2005 Self-Monitoring Report
Baumberg Complex - Hayward, California
Eden Landing Ecological Reserve

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Table of Contents

Introduction

This annual self-monitoring report summarizes the results of the water quality monitoring and sediment sampling conducted at the Baumberg Complex, also known as the Eden Landing Ecological Reserve (ELER), in Hayward, California, April through November 2005. Data was collected by the U.S. Geological Survey (USGS) on behalf of the Department of Fish and Game (Department) in accordance with the waste discharge requirements. Water quality monitoring was performed using continuous data recorders at the locations described in the Self-Monitoring Program outlined in the Final Order, except Pond B10. B10 had discrete monthly "grab" samples, as requested by the Department and approved by the Regional Water Quality Control Board (RWQCB) staff in June 2005, as described in its letter to the Department dated October 5, 2005. Water column sampling for metals was performed using following Environmental Protection Agency (EPA) method 1669 (Sampling ambient water for trace metals at EPA water quality criteria levels), and dissolved mercury samples were analyzed using EPA method 1631. Analysis of the 2005 sediment samples will be forwarded to the RWQCB staff under separate cover, after completion of analysis since paired sampling seasons will include data collected in the 2005/2006 winter season.

The Final Order for the South San Francisco Bay Low Salinity Salt Ponds covered 15,100 acres of ponds in Alameda, Santa Clara and San Mateo counties. This report covers ELER (Baumberg Complex) pond systems described in the ISP, including Systems B11 (Pond B10), B2, B2C and B8A, operated by the Department in 2005. System B6A was not operated during the 2005 monitoring period due to construction of the water control structure in pond 6A. This structure was completed in November and the system began winter operations in December 2005. The U.S. Fish and Wildlife Service (USFWS) will be submitting a report for the Alviso Ponds under separate cover.

The ponds are generally being operated as muted tidal systems, as described in the 2005 operations plans, augmenting flow-through systems described in the Initial Stewardship Plan (ISP). Bay water entered ponds via the bay and sloughs at high tides, flowed to one or more ponds, and discharged to sloughs and the bay at low tides. The ponds generally discharge at lower tides, for about 8 hours per day. Pond systems B8A and B2 also have additional intake structures as described in the ISP. In 2005, intake and discharge in Ponds B10, B1, B2c and B8A occurred at the same water control structure (WCS).

The Final Order recognized two periods of discharges from the ponds: the Initial Release Period (IRP) when salinity levels in ponds were above 44 parts per thousand (ppt) and would decrease from the initial levels in the ponds, to a Continuous Circulation Period (CCP) thereafter, with salinities at or below the 44 ppt, which is the continuous discharge limit described in the Final Order. Different monitoring plans were identified in the Final Order for each specific period. In 2005, we began operation of Systems B2C and B8A, both of which required IRP monitoring, as more fully described later. Pond B2C had an initial salinity only slightly above CCP levels, and had initial pH levels above 8.5 which were corrected via operation in a short period and no adverse effects were observed in receiving waters. Pond B8A operation began after the restoration of tidal action to North Creek, and breached North Creek waters were treated like an initial release from B8A.

On March 3, 2005, a meeting was held with the Department, USFWS, USGS, and RWQCB staff to discuss the Annual Self Monitoring Report (ASMR) and Operations Plans for 2004. At our March 3, 2005, meeting, it was agreed that triggering of reporting and best management practice (BMP) implementation should occur when dissolved oxygen concentrations are observed in the discharge outside of the natural range of variation in functional slough and lagoon environments of the South San Francisco Bay. This is especially the case during extended periods of high air and water temperature. Evaluation of summertime, benthic dissolved oxygen levels in a number of locations was completed recently based on continuous monitoring devices in Artesian Slough and Coyote Creek. A dissolved oxygen trigger was described, based on levels found in Artesian Slough near the heron rookery in July 1997, during an extended period of high air temperatures, and appears to be the most relevant representation of natural dissolved oxygen variations in sloughs or lagoon systems currently available. This data and analysis were used in the issuance of Order No. R2-2005-0003, adopted by the Board on February 16, 2005, which permits Cargill Incorporated to discharge saline waters from Pond A18 to Artesian Slough. The established trigger in the Cargill Pond A18 Order is when the dissolved oxygen levels at the point of discharge fall below a 10^{th} percentile of 3.3 mg/L (calculated on a calendar weekly basis). When such a trigger event occurs, the Discharger shall make a timely report to the Board, and implement BMPs described in its Operations Plan. Therefore, in evaluating compliance with the dissolved oxygen limit contained in Order No. R2-2004-0018, the Department will consider it a trigger for reporting and action if, at the point of discharge, the 10^{th} percentile falls below 3.3 mg/L (calculated on a calendar weekly basis).

The RWQCB requested that additional information be provided in all ASMR, as described in a letter dated March 25, 2005. The 2004 SMR was revised and submitted in June, 2005. In accordance with a letter from the Board, dated October 5, 2005, additional revisions were made and the Final 2004 SMR was submitted in December, 2005. This SMR also incorporates those and subsequent suggested changes and requests for additional information, except as noted (i.e. discharge volumes, slough invertebrate analysis). The Department has prepared this report as the Draft 2005 Self-Monitoring Report for the Eden Landing Ecological Reserve (Baumberg Complex).

2005 Annual Summary

This section discusses the activities performed during the 2005 monitoring season at the ELER ponds (Baumberg Complex) to comply with RWQCB Final Order and subsequent requirements and/or modifications. The site location is shown on Figure 1; sampling locations are shown on Figures 2a, 2b and 2c.

The water quality monitoring performed according to the Final Order for operation of the pond systems revealed periods of low Dissolved Oxygen (DO). In 2004, low DO levels were observed in a number of the South Bay Salt Ponds (SBSP), including ELER ponds, in the late-summer/early-fall when seasonal temperatures, winds and evaporation were expected to be highest. However, in 2005, low DO levels were observed throughout the monitoring period, not just during the latter part of the season as was anticipated based on

2004 monitoring data. The low DO levels were more pronounced in some pond systems than others, and a definitive explanation for such differences is not yet apparent. There appears to be some correlation with abiotic factors, such as spring and neap tide periods, weather conditions and seasonal variations, and there may also be biotic factors that affect DO levels, such as algal growth and growth and/or usage by pond invertebrates or larger animals, including fish.

System B11:
In 2004, a single existing 48" flap gate in Pond B10 that was used to operate this pond deteriorated and thereafter B10 began operation as a continuous discharge muted tidal pond. Pond 11 was generally operated as a seasonal pond with rainwater input. These conditions continued in 2005. The new intake/discharge culverts described in the ISP are not yet constructed. This construction is scheduled to be completed in 2006 as part of the final phase of the existing 835-acre Eden Landing restoration project, formerly known as the Baumberg Tract, and now as part of the larger ELER.

System B8A:
Due to high construction costs, the new discharge structure described in the ISP at Pond B8A was not built. A supplemental intake gate in the northeast corner of Pond B8A was retrofitted to operate as an intake/discharge structure. The change is not expected to materially affect operations or potential impacts described in the ISP or Report of Waste Discharge. Pond System B8A was opened to discharge to Old Alameda Creek on May 12, 2005, following initial release of North Creek waters via the levee breach on April 27. North Creek provides the tidal circulation connection to Old Alameda Creek and the bay.

As background for the start of operations in the Pond B8A system, the following explains the rationale for treating the breach of North Creek to Old Alameda Creek as an initial release from the B8A system. Delays in construction for the Eden Landing restoration project, and allowing time for treatment of non-native *Spartina alternaflora* and its hybrids, may have led to an unanticipated rise in salinity in the North Creek channel. Leaching of salts from the new levees may have contributed to the elevated salinity in the channel. North Creek was scheduled to be breached to Old Alameda Creek in 2004 as part of the Eden Landing restoration project; however, the breach was completed April 29, 2005.

North Creek was constructed by the *Mallard*, Cargill's floating dredge, along its historic alignment by developing a new levee between Ponds B8A and B8 and topping an existing levee between the ponds. Therefore, the original source of North Creek water was from previous salt making operations in Ponds B8 and B8A and since then had only rainfall added. It should be noted that all of the ponds in the B8A and B6A systems were operated as batch ponds for the previously existing salt making operations. In 2001 and 2002, during levee construction for North Creek as part of the Eden Landing restoration project, salinity levels in the B8A and B8 systems were higher than in previous years. It was expected that the water in North Creek would be diluted by rainfall.

The North Creek channel had an approximate salinity of 60 ppt in April 2005 while the salinity of Pond B8A was approximately 40 ppt. Pond B8A salinity was likely lower than the waters in North Creek because the transfer standard for Pond B8A provided for the pond being transferred "dry" with only residual salts remaining. Contrarily, North Creek was received "wet." Generally, rainfall was the source of the majority of water in Pond B8A prior to tidal action being restored to North Creek, although limited intake had occurred via flows from Pond B9 during spring tides entering the intake structure (B8A-1) during the previous winter, and a small amount of North Creek water was allowed into B8A. B8A has a large surface area and high pond bottom (which limited intake).

After discussion with RWQCB staff, we treated the breach of North Creek to Old Alameda Creek as an initial release from Pond B8A and followed the monitoring requirements of the Final Order for this breach. The volume of water from this release was less than 10% of the B8A system waters described in the ISP, although since it was an uncontrolled release in a 150-foot breach rather than via water control structure discharge, the water was released in a shorter period of time, and residence time in Old Alameda Creek receiving waters was expected to be much shorter duration. Once the "breach" initial release was completed, operation of the 8A system began with supplemental intake at Pond B8A, which reduced salinity levels to within CCP levels. Pond B8A had fairly low salinity generally well below 44 ppt, except for a brief period at the beginning of the discharge period. Higher salinity conditions observed in Pond B9 in the summer appear to have been well mixed by the supplemental intake in B8A at the discharge location, since it was operated in a muted tidal condition.

System B2C:

Pond B2C was opened with initial release discharge to Alameda Creek on April 12, 2005. This system generally performed as expected, except as noted below, and provided good habitat conditions for waterbirds. This muted tidal system had the greatest difficulty in attaining the DO standard described in the Basin Plan and frequently resulted in 10th percentile values below the reporting trigger set by the RWQCB at 3.3 mg/L, although median values generally ranged near the Basin Plan value of 5 mg/L.

System B2:

Pond System B2 was not operated for the majority of the season due to levee maintenance work, performed under contract by Cargill from February through August, using the floating dredge known as the *Mallard*. The *Mallard* required water levels be maintained as high as possible and therefore the ponds were not discharged in the previous winter. The B2 system was maintained at approximately 5-feet NGVD and was not lowered to ISP summer water levels until the *Mallard* had exited the system. Deeper water conditions provided good foraging habitat, particularly for piscivores.

By the time the levee maintenance work was completed in August, the salinity in Pond B2 was above the continuous circulation limits. As described in the ISP, discharge was initiated alternatively from Pond B1, the main intake pond, which was below 44ppt. The system was operated as muted tidal, discharging to Old Alameda Creek from August 31 to September 6, when discharge from B1 was closed to prevent exceeding continuous circulation values. Upon inspection of the B2 system thereafter, it was noted that the mud dam that sealed the dredge lock used by the *Mallard* to exit the system had slumped and continued operation of the pond and lowering water levels could result in more slumping. Furthermore, a sinkhole was discovered in the B2-1 WCS and would require construction to repair. The B2 system was not operated again until November 14, when muted tidal discharge operation resumed in B1 until November 21.

To address low DO levels and to maintain summer operation water levels in the ponds, in Systems B2C and B8A, the outlets were adjusted, closed and opened throughout the season. Management activity for the B2C system was relatively high, as adjustments were made frequently based on pond discharge and receiving water data, current or anticipated weather and predicted tidal conditions, to minimize discharge of pond waters below 10^{th} percentile trigger values. A summary of discharge events is shown on Table 1.

Table 1. Summary of Discharge Events.

Complete notes of pond (system) conditions and management activities are available for review upon request. Continuous meter data (Datasondes) was provided to RWQCB staff during the season and are not included in the report due to large file size; Final Datasonde files are available upon request.
NOTE: Table 1 salinity values displayed are generally from field measurements using hand-held refractometer, except in rare cases where not collected and Datasonde values are substituted; Datasonde values differ slightly and are generally 2-4 ppt lower than refractometer values. Datasonde values should be considered more accurate and are used for all graphs listed as Figures in this SMR.

Pond	Location	Date	Time	Salinity	Activity and notes
2c	B2c-14	4/12/2005	13:45	46	BEGAN DISCHARGE (1x48” 100%)
2c	B2c-14	4/13/2005	08:10	47	CLOSED DISCHARGE (pH reading high in receiving water)
2c	B2c-14	4/18/2005	15:30	*50*	RESUMED DISCHARGE (1x48” 100%)
2c	B2c-14	5/16/2005	12:30	*55*	CLOSED DISCHARGE
2c	B2c-14	5/17/2005	16:30	*50*	CLOSED INTAKES (for USGS in-pond DO investigation)
2c	B2c-14	5/24/2005	11:45	*66*	Opened intakes 2x48" 100%
2c	B2c-14	5/25/2005	09:30	39	OPENED DISCHARGE 1x48"(25%)
2C	B2c-14	6/16/2005	15:00	43	CLOSED DISCHARGE
2C	B2c-14	6/22/2005	12:15	28	OPENED DISCHARGE 1x48" 50%
2C	B2c-14	6/28/2005	14:50	36	Reduced discharge 1x48” gate setting to 25%
2C	B2c-14	6/30/2005	14:25	35	Reduced Discharge 1x48" to 20%
2C	B2c-14	7/7/2005	12:55	32	Reduced discharge 1x48" to 10% (neap tides)
2C	B2c-14	7/11/2005	14:30	34	CLOSED DISCHARGE (meter exposed)
2C	B2c-14	7/12/2005	12:00	36	OPENED DISCHARGE 1x48" to 10%
2C	B2c-14	7/20/2005	12:20	30	Increased 1x48"discharge gate to 90%.
2C	B2c-14	7/21/2005	12:05	34	Reduced discharge 1x48" to 20%
2C	B2c-14	8/1/2005	11:15	37	Opened discharge 1x48" to 40%
2C	B2c-14	8/4/2005	11:20	35	Reduced Discharge 1x48" to 25%
2C	B2c-14	8/9/2005	9:45	39	CLOSED DISCHARGE
2C	B2c-14	8/12/2005	10:40	33	OPENED DISCHARGE 1x48" 10%

2C	B2c-14	8/15/2005	10:15	33	Increased 1x48"discharge gate to 20%.
2C	B2c-14	8/22/2005	10:00	35	Increased 1x48"discharge gate to 35%.
2C	B2c-14	8/23/2005	15:30	33	Increased 1x48"discharge gate to 50%.
2C	B2c-14	8/26/2005	12:15	40	CLOSED DISCHARGE
2C	B2c-14	8/29/2005	9:30	33	OPENED DISCHARGE 1x48" to 20%
2C	B2c-14	9/2/2005	17:45	37	CLOSED DISCHARGE
2C	B2c-14	9/6/2005	15:20	34	OPENED DISCHARGE 1x48" to 15%
2C	B2c-14	9/12/2005	10:15	40	CLOSED DISCHARGE
2C	B2c-14	9/15/2005	15:45	34	OPENED DISCHARGE 1x48" 10%
2C	B2c-14	9/18/2005	12:00	34	Increased 1x48"discharge gate to 20%.
2C	B2c-14	9/27/2005	16:15	43	CLOSED DISCHARGE
2C	B2c-14	10/3/2005	10:15	35	OPENED DISCHARGE 1x48" 10%
2C	B2c-14	10/11/2005	10:45	43	CLOSED DISCHARGE
2C	B2c-14	10/17/2005	10:45	34	OPENED DISCHARGE 1x48" to 20%
2C	B2c-14	10/21/2005	10:25	40	Reduced discharge to 10%
2C	B2c-14	10/24/2005	09:15	41	CLOSED DISCHARGE
2C	B2c-14	11/14/2005	10:45	33	OPENED DISCHARGE 1x48" 10%
2C	B2c-14	11/21/2005	11:15	41	CLOSED DISCHARGE
2C	B2c-14	11/22/2005	12:50	40	OPENED DISCHARGE 1x48" to 5%
2C	B2c-14	11/29/2005	9:30	30	Increased 1x48"discharge to 20%.
8A	*B8A-NC*	*5/2/2005*	*12:45*	*70*	*Opened intake gate 1x48" 100%*
8A	*B8A-NC*	*5/10/2005*	*11:00*	*17*	*BEGAN DISCHARGE, opened 1x48” 25%*
8A	*B8A-NC*	*5/24/2005*	*09:10*	*25*	*CLOSED DISCHARGE*
8A	*B8A-NC*	*7/7/2005*	*15:15*	*28*	*OPENED DISCHARGE 1x48" to 10%*
8A	*B8A-NC*	*8/1/2005*	*09:30*	*33*	*Reduced discharge to 5%*
8A	*B8A-NC*	*8/9/2005*	*11:45*	*33*	*CLOSED DISCHARGE*
8A	*B8A-NC*	8/15/2005	*12:20*	*32*	*OPENED DISCHARGE 1x48" to 10%*
8A	*B8A-NC*	*9/8/2005*	*10:30*	*42*	*CLOSED DISCHARGE*
8A	*B8A-NC*	*10/3/2005*	*11:30*	*34*	*OPENED DISCHARGE 1x48" to 10%*
8A	*B8A-NC*	*10/12/05*	*12:00*	*49*	*CLOSED DISCHARGE*
8A	*B8A-NC*	*11/18/2005*	*09:30*	*39*	*OPENED DISCHARGE 1x48" to 10%*
8A	*B8A-NC*	*11/21/2005*	*09:00*	*42*	*CLOSED DISCHARGE*
8A	*B8A-NC*	*11/22/2005*	*13:20*	*40*	*OPENED DISCHARGE 1x48" to 5%*
1	B2-1	8/31/2005	10:15	40	OPENED DISCHARGE (1x48” 100%)
1	B2-1	9/6/2005	13:00	45	CLOSED DISCHARGE(elevated salinity, dredge loch crack due to lower water)
1	B2-1	11/14/2005	11:15	34	OPENED DISCHARGE 1x48" to 10%
1	B2-1	11/21/2005	10:45	40	CLOSED DISCHARGE
1	B2-1	11/22/2005	13:00	40	OPENED DISCHARGE 1x48" to 5%

Water Quality Monitoring Requirements

Water quality monitoring was performed at the sampling stations shown in Figures 2a and 2b (Baumberg Complex). The water quality parameters are provided in the Final Order and are summarized below for reference:

Table 2. Initial Discharge Salinity Limits.

For the initial discharge, ponds shall not discharge waters that exceed the following limits:

Pond System	Salinity (ppt) Instantaneous Maximum
B2	65
B2C	100
B6A	65[1]
B8A	65[1]
B11	65

[1] Pond Systems B8A and B6A were transferred "dry." In modeling the initial release, the Discharger only considered discharges from Pond System B8A. Since both of these pond systems will discharge to Old Alameda Creek, the Discharger must either (a) stagger the initial releases so that the different time periods of initial release do not overlap, or (b) meter the flow to ensure that Old Alameda Creek contains at least 60% bay water (the percentage of bay water assumed in the Discharger's EIR for an initial release from Pond System B8A) during the initial release.

Table 3. Continuous Discharge Limits.

All pond waters discharging to the Bay or Sloughs shall meet the following limits:

Constituent	Instantaneous Maximum	Instantaneous Minimum	Units
Continuous circulation salinity	44		ppt
Dissolved Oxygen[1]		5.0	mg/L
pH[2]	8.5	6.5	

[1] = Limitation applies when receiving waters contain ≥ 5.0 mg/L of dissolved oxygen (DO). When receiving waters don't meet the Basin Plan objective, pond discharges must be ≥ DO receiving water level.

[2] = The Discharger may determine pH compliance at the discharge or in the receiving water.

3. Pond waters discharging to the Bay or Sloughs shall not exceed receiving waters temperature by 20°F, or more.

4. Dissolved Oxygen (DO) Trigger. Within each pond, once at Continuous Circulation (≤44 ppt), if the DO concentration is < 1.0 mg/L, the Discharger shall implement corrective measures to increase DO concentrations to >1.0 mg/L in that system, and revise Operation Plans to minimize reoccurrence.

Table 4. Proposed Maximum Salinities and Metals for Initial Discharge

Pond System	Modeled Salinity	Cr	Ni	Cu	Zn	As	Se	Ag	Cd	Hg	Pb
B2, B11	65	2.36	15.7	2.15	3.07	15.7	0.27	0.03	0.063	*32*	0.84
B2C	100	2.36	*18.1*	2.15	3.38	20.1	0.27	0.15	0.063	*44.5*	0.84
B8A	135	2.36	*21.8*	3.39	4.49	*56.2*	0.31	0.15	0.119	*49.7*	1.37
WQO[1]		11.4	16.3	4.6	58	36	5.0	2.3	0.27	25	3.2

[1] The water quality objectives north of Dumbarton Bridge apply to discharges from the Baumberg Ponds. The water quality objectives for chromium, cadmium, and lead are freshwater driven and based on a hardness of 100 mg/L. As the Discharger performed site-specific translators for copper and nickel, the values shown in Table 4 represent site-specific water quality objectives. The initial release of highly saline waters from Baumberg Ponds will cause some receiving waters to contain salinity, nickel, arsenic, and mercury in excess of water quality objectives for a short duration.

Water Quality Monitoring Methodology

Continuous Pond Discharge Sampling:

USGS installed continuous monitoring devices (Hydrolab-Hach Company, Loveland, CO) called Datasondes in ponds B8A, B2C and B2 prior to discharge. Datasondes were installed in ponds B10, B2C and B8A on April 29, March 30 and May 2, 2005, respectively. Beginning August 2005, discrete water samples were collected concurrent with some meter calibrations to perform Winkler titration samples. Samples were fixed in the field and analyzed at the USGS Menlo Park facility. Results were compared to direct meter readouts of DO to check for meter accuracy.

Ponds B2C and B8A were monitored under initial release protocol through November 2005. The B2 meter was moved from B2-10 once it was established that salinity in B2 was consistently higher than 44ppt, and was placed at B2-1 for discharge operations initiated from B1. Pond B10 was generally sampled weekly using discrete “grab” samples at two locations in the pond, as approved by RWQCB staff. The change in the monitoring protocol for B10 was determined to be sufficient for monitoring water quality because of the uncontrolled muted tidal management regime which began in 2004. Pond B10 did not provide continuous ponding conditions and operated like a mudflat. Datasondes collected values for the following parameters: salinity, pH, temperature, and dissolved oxygen, which were collected at 15-minute intervals with a sensor and circulator warm-up period of 2 minutes. The discrete “grab” samples collected the same parameters. Data were downloaded weekly from Datasondes and the devices were serviced to check battery voltage and data consistency. A recently calibrated Hydrolab Minisonde was placed next to the Datasonde in the pond at the same depth, and readings of the two instruments were compared. Datasondes were calibrated pre-deployment and maintained on a biweekly cleaning and calibration schedule unless they required additional maintenance.

During the 2005 monitoring season, short data gaps resulted even with two meters in place, generally due to unknown malfunctions of meters, as opposed to greater-than-expected water level fluctuations. This was less of an issue than in 2004 when there were fairly long periods when data wasn’t logged for either reason. Communication protocols have been improved and monitoring devices have been re-installed in more appropriate locations and water depths. Spare data recorders were deployed to replace devices during servicing periods.

Datasondes were installed on the pond side of the WCS that discharged waters to the San Francisco Bay receiving waters using a PVC holder attached to a pole mounted to the structure to allow for free water circulation around the sensors. The devices were installed at a depth of at least 25cm to ensure that all sensors were submerged, and these depths were monitored and adjusted to maintain constant submersion as the pond water levels fluctuated. During periods of neap tides coinciding with discharge periods, the Datasondes were occasionally exposed for short periods (hours). These episodes were corrected as soon as possible after being observed in the field or during review of data. There were some periods when meters malfunctioned and did not log data, for uncertain reasons, which resulted in data gaps on the order of days. Two Datasondes were deployed in most ponds for most of the season, to provide secondary data to address malfunctions and to ensure accuracy of reporting data. In the latter part of the season, the original meters were removed because of continued malfunctions and questionable data accuracy concerns resulting from corrosion, exposure, biofouling and other reasons, and thereafter only the secondary Datasonde was deployed. The Datasondes were serviced biweekly to recalibrate and de-foul the units. It is apparent that the meters suffered significant bio-fouling and the data from the week between cleanings was affected by the fouling.

Discharge Time-Period and Volume Estimates:

In a letter dated March 25, 2005, RWQCB required that the Department document in each ASMR the time-period each day that ponds discharge, and an estimate of the quantity discharged, starting in the 2005 monitoring period. Based on subsequent conversations with RWQCB staff, it is understood that this information would be provided for particular periods of interest, rather than be provided in the form of a summary table for each actual discharge day. Estimates of discharge volume could provide useful information, which would be used for activities such as modifications to operations, and for evaluation and analysis, particularly for determining what effects, if any, discharges had on receiving waters, and determination of effectiveness of BMPs. RWQCB modified ASMR requirements similarly for the ponds operated by USFWS, which is working collaboratively with the Department on the ISP and long-term restoration project for the SBSP. In response to this requirement, USFWS requested assistance from USGS in developing a methodology to estimate discharge volumes. USGS is developing a 'calculator' to estimate discharge from five Alviso Complex ponds for USFWS. According to the project's lead Hydrologist Greg Shellenbarger, inputs currently include the pond water surface elevation, the number of discharge culverts (48"), and the range of dates for discharge. Output would be the estimated volume of discharge over the data range. Tidal height is predicted in the calculator. Generalized use of this calculator for other ponds, including those managed by the Department, likely would be appropriate. However, USGS must go through an internal review process before they can publicly release the calculator (for use outside the federal agencies). USFWS has received a version for review purposes to ensure it will meet the goals of the new requirements. USGS is currently finishing their report on the calculator and hope to complete the formal review process in the near future. Once the calculator is available for use by the Department, we intend to provide this information in future reports to the RWQCB to assist in evaluation and analysis of particular periods of interest. This 2005 SMR would be revised accordingly.

Discharge time period information is summarized in Table 1: Summary of Discharge Events. The time-period each day that pond discharge was made is not specifically provided in this report. This information has limited usefulness without context provided by additional information, such as the discharge quantity estimates, which are not available. Furthermore, the daily discharge time-period information would be based on predicted tidal elevations, not actual time periods because there is currently no instrumentation to record actual discharge time-periods. Discharge periods in the ISP were assumed to be approximately 8 hours a day.

Receiving Water Sampling (Initial Release and Continuous Circulation):

Receiving quality measurements were collected after initial discharge and then weekly in sloughs that drain into San Francisco Bay including locations immediately outside the WCS in ponds B1, B2C and B8A from April 2005 until November 2005. Receiving waters were measured outside pond discharge locations one week prior to discharge, one, three and seven days after initial discharge, and then weekly by USGS at sites along Alameda Flood Control Channel adjacent to Eden Landing pond B2C (6 sites) and along Alameda Creek adjacent to Eden Landing Pond 8A at the confluence of North Creek (5 sites) and adjacent to Pond 1 (5 sites). Pond 10 was not discharging because most water drained from the pond on the tidal cycle, but point samples were taken inside the pond when the pond contained enough water.

Receiving water samples were collected weekly when water quality objectives in discharge samples were not met. Sampling locations were marked using a GPS waypoint. We accessed slough sampling sites via boat from San Francisco Bay and used a GPS to navigate to sampling locations. When the boat was approximately 50-25 meters from the site, the engine would be cut or reduced to allow for drifting caused by current and wind to the site location. Every effort was made to ensure that the sample reading was collected from the center of the slough. A recently calibrated Hydrolab Minisonde (Hydrolab-Hach Company, Loveland, Colorado) was used to measure salinity, pH, turbidity, temperature, and dissolved oxygen at each location. Samples were collected from the near-bottom of the water column in addition to the near-surface at each sampling location. Depth readings of sample locations were collected at the completion of each Minisonde measurement to account for drift during the reading equilibration period. The specific gravity of each site was additionally measured with a hydrometer (Ertco, West Paterson, New Jersey) scaled for the appropriate range. This sample was collected concurrently with the near-surface Minisonde measurement. The majority of the samples were collected on the rising or high tide in order to gain access to the sampling sites, which were not accessible at tides less than 3.5 ft MLLW. Standard observations were collected at each site. These were:

A) Observance of floating and suspended materials of waste origin.

B) Description of water condition including discoloration and turbidity.

C) Odor – presence or absence, characterization, source and wind direction.

D) Evidence of beneficial use, presence of wildlife, anglers and other recreational activities

E) Hydrographic conditions – time and height of tides, and depth of water column and sampling depths.

F) Weather conditions – air temp, wind direction and velocity, and precipitation.

Sections A, B, C, D and E were recorded at each sampling location. Section F was recorded at the beginning and ending of each slough, unless it had changed significantly.

Pond Management Sampling (for Initial Release and Continuous Circulation):

USGS conducted water quality measurements bi-monthly in Ponds B4, B6A, B6B, B8A, B10, B11, B2C and B3C from January through May 2005. USGS conducted water quality measurements bi-monthly in Ponds B6A, B6B and B8 from July through October 2005. One sampling location was established for each salt pond (Figure 2a) and samples were collected between 0800 and 1000 hours. A Minisonde was calibrated prior to use and measured salinity, pH, turbidity, temperature, and dissolved oxygen. Readings were collected from the near-surface at a depth of approximately 25cm. Because sondes may not measure salinity accurately at concentrations greater than 40 ppt, an additional method was used. USGS measured specific gravity of each pond (corrected for temperature and converted to salinity) with an appropriately-scaled hydrometer to a precision of 0.0005. The salinity of hypersaline ponds (>70 ppt), was measured using hydrometers only.

Chlorophyll-a Sampling (for Continuous Circulation Monitoring):

As approved by RWQCB, the Department discontinued collecting in-pond chlorophyll samples monthly in ELER salt ponds due to limited analysis and applicability. With limited funding available for the ISP, this helped ensure discharge and receiving water quality monitoring could continue throughout the season.

Metals- Annual Water Column Sampling:

Water column samples were collected on September 30, 2005, following EPA method 1669 (Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels). Pre-cleaned sample containers conforming to EPA protocols were provided by Frontier GeoSciences, Inc. Samples from ponds B2, B2C, B8A, and B10 were sampled approximately 30 meters from the water control structure to minimize the influence of the structure on water column metals concentrations. Salinity, pH, temperature, and dissolved oxygen were measured concurrently with water column sample collection using a Hydrolab Minisonde (Hach Hydrolab, Loveland, Colorado). Collected samples were immediately stored on ice in a cooler and shipped overnight to Frontier GeoSciences (Seattle, Washington).

Upon receipt, bottles submitted for dissolved metals analysis were immediately filtered through an acid-rinsed 0.45um disposable filtration unit. Total and dissolved Hg was determined by cold vapor atomic fluorescence spectrometry; total and dissolved Cr, Ni, Cu, Zn, Ag, Cd, and Pb were determined by reductive precipitation preparation and inductively coupled plasma mass spectrometry; and total and dissolved As and Se were determined by hybride generation atomic fluorescence spectrometry. Total Suspended Solids (TSS) samples were sent separately to the University of California, Davis Department of Agriculture and Natural Resources laboratory (DANR) for analysis. All labs reported that the samples arrived intact and were handled with proper chain-of-custody procedures, and that appropriate QA/QC guidelines were employed during the analysis on a minimum 5% basis.

Calibration and Maintenance:

All the instruments used for sampling as part SMP were calibrated and maintained according to the USGS standard procedures. Datasondes were calibrated pre-deployment and maintained on a biweekly cleaning and calibration schedule unless they required additional maintenance. During the cleaning and calibration procedure, simultaneous readings were collected with a recently calibrated Hydrolab Minisonde to confirm data consistency throughout the procedure (initial, de-fouled, post cleaned, and post calibration). The initial and de-fouled readings were also used to detect shifts in the data due to accumulation of biomaterials and sediment on the sensors. The problem of algae and other substances interfering with the moving parts such as on the self-cleaning brush and circulator was improved with the use of nylon stockings. This allowed for maximum water flow past the sensor but stopped algae from wrapping around and binding the moving parts. Copper mesh and wire was used to inhibit growth in ponds with high concentrations of barnacles and hard algae, which could interfere with sensor function. USGS performed a biweekly fouling check to detect shifts in data due to the accumulation of biomaterial and sediment on the sensors. A calibration and maintenance log was maintained for each pond.

Additionally, Winkler titration samples were collected during and after August 2005 to check accuracy of DO readings. The Minisonde, used for receiving water sample measurements, read on average 0.4 mg/L (SD 0.5 mg/L) lower than the Winkler samples (n=159). Despite some variability in readings, the data fit a regression line well (R^2 = 0.9396, y = 0.9304x + 0.7933, $F_{1,157}$ = 2441.51, $P < 0.000$), suggesting that Minisonde DO readings are slightly lower than actual, but very consistent.

Clarke Cell Datasondes overall read DO on average 0.1 mg/L (SD 1.1 mg/L) lower than the Winkler samples (n=58). Despite a relatively high degree of variability in readings, the data fit a regression line reasonably well (R^2 = 0.9074, y = 0.7925x + 1.6551, $F_{1,56}$ = 548.82, $P < 0.000$), suggesting that Clarke Cell DO readings are slightly lower than actual, and consistent overall, but subject to some variability.

Dissolved oxygen sensors were particularly problematic due to the addition of self-cleaning brush attachments on the equipment which tended to damage the surface of the membrane more frequently. The secondary meters that were deployed, Luminescent DO (LDO) sensors, are improved in that they did not have the same brush mechanism and were less problematic, though were not problem free. Luminescent DO (LDO) sensors were not accurate prior to mid-August 2005 because the associated software did not compensate for pond salinity. After the software was corrected, LDO meters overall read on average 0.4 mg/L (SD 0.4 mg/L) higher than the Winkler samples (n=41). Some initial variability was due to inconsistent meter calibration, but adjustments to the calibration method have resulted in better consistency. Overall data fit a regression line well (R^2 = 0.9686, y = 0.924x + 0.1615, $F_{1,39}$ = 1201.39, $P < 0.000$).

The salt pond environment results in corrosion and fouling and will continue to pose challenges to successful deployment of continuous monitoring devices.

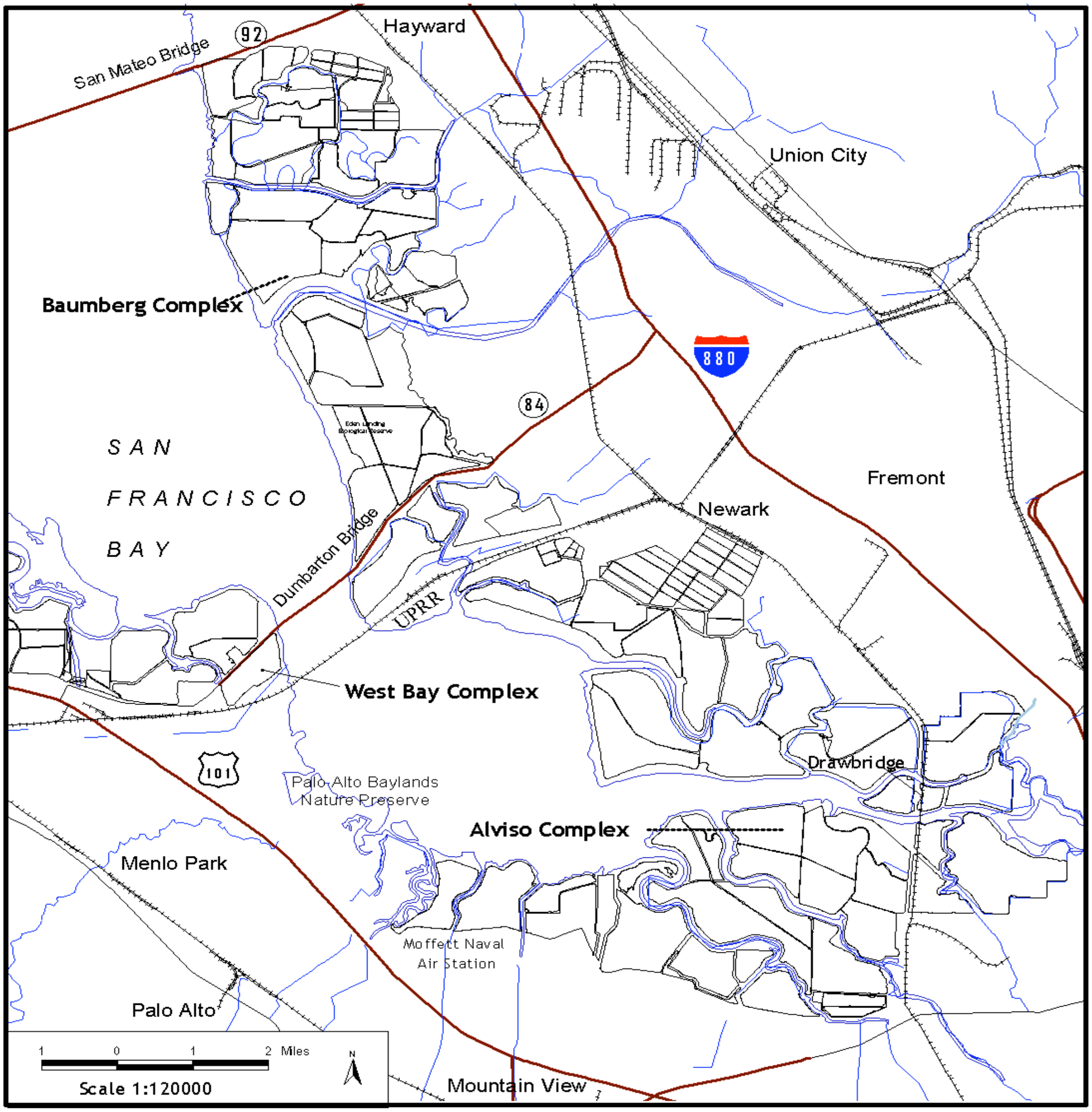

Figure 1. Vicinity Map of the Eden Landing Ecological Reserve (Baumberg Complex) Ponds

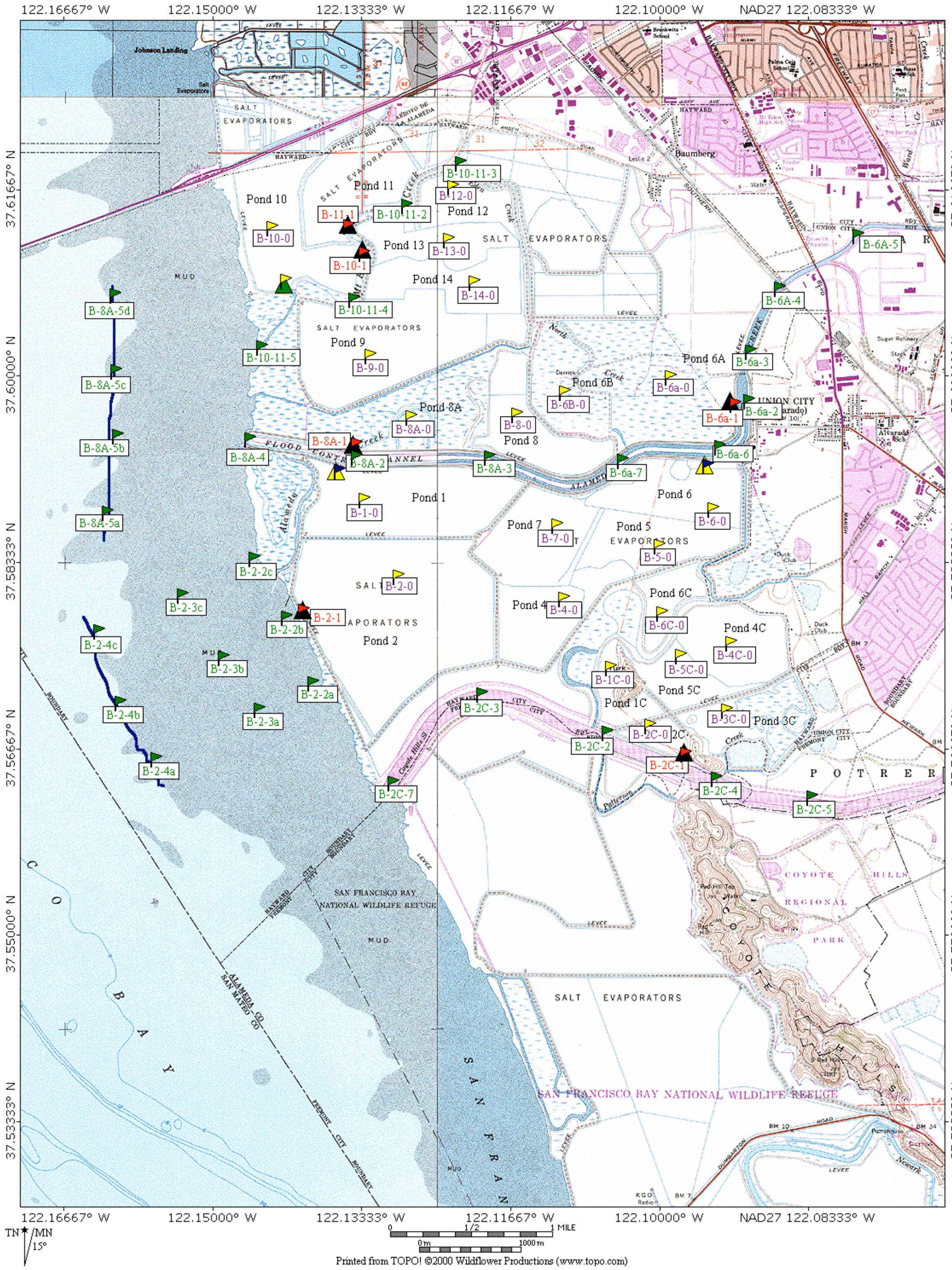

Figure 2a. Eden Landing Ecological Reserve (Baumberg Complex) Water Quality Sampling Locations- Pond Management

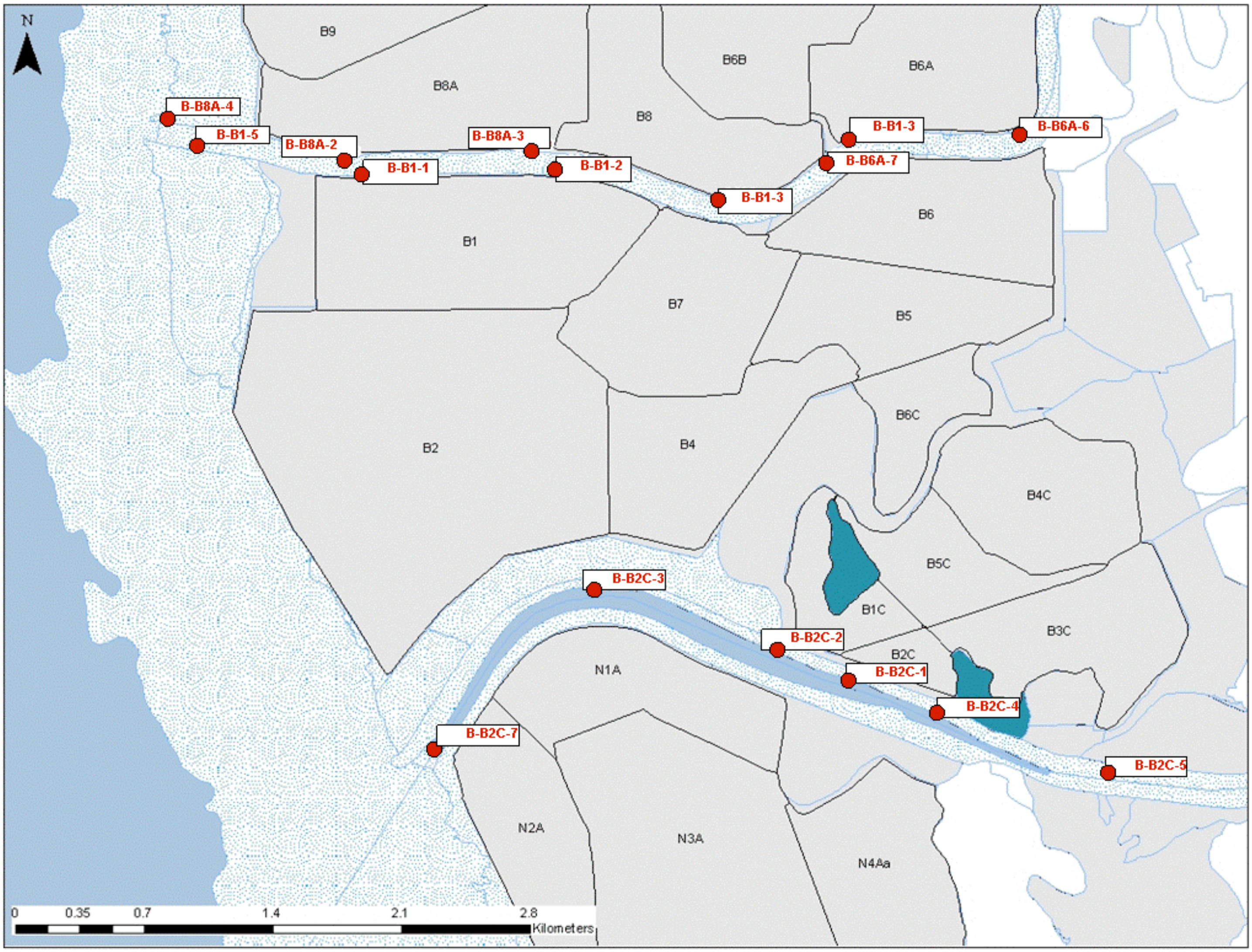

Figure 2b. Eden Landing Ecological Reserve (Baumberg Complex) Water Quality Sampling Locations- Receiving Waters

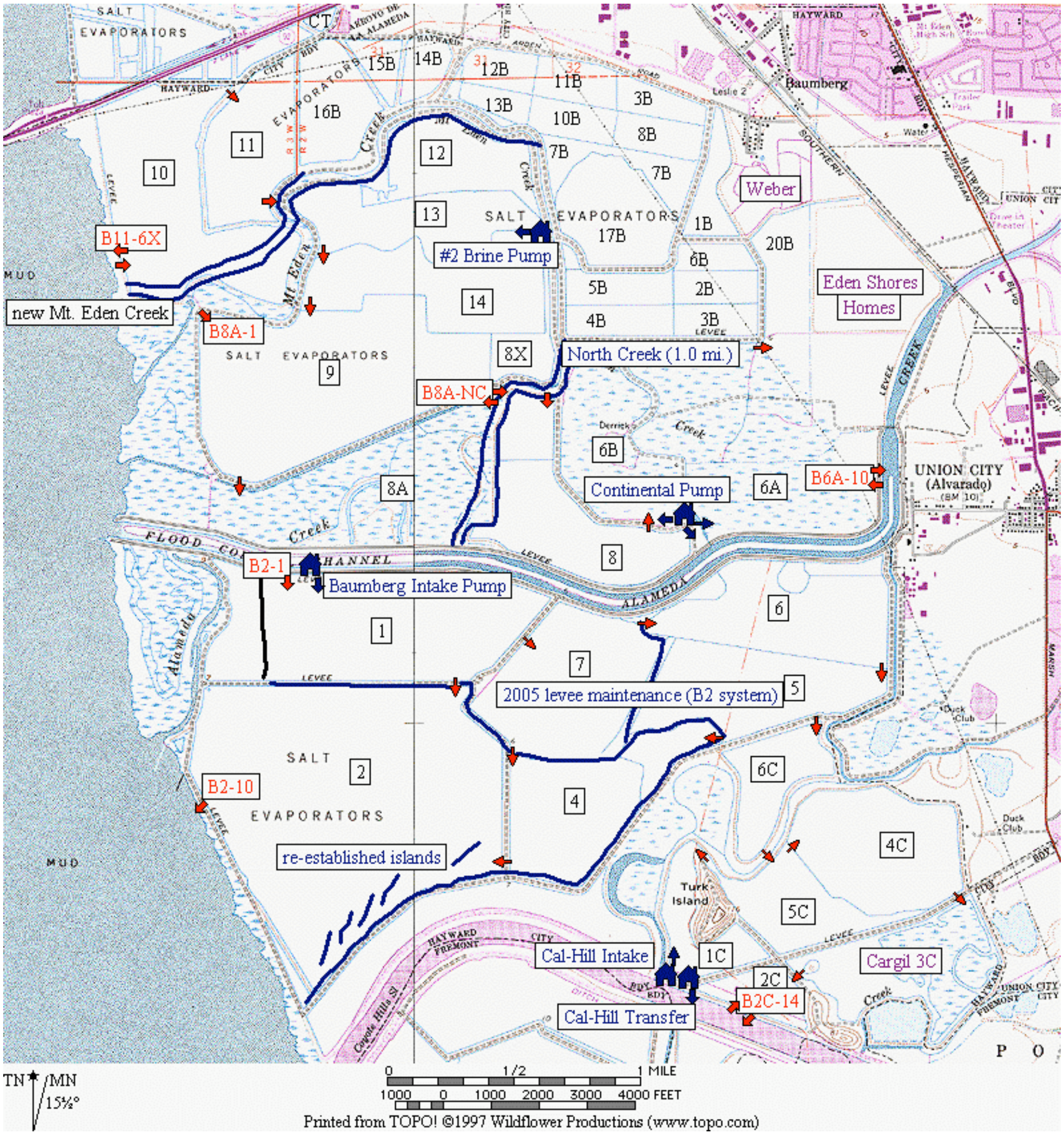

Figure 2c. Eden Landing Ecological Reserve (Baumberg Complex) Water Quality Sampling Locations- Discharge (red text boxes)

Water Quality Monitoring Results

Discharge and Receiving Waters

Results from the monitoring of pond discharge locations and receiving waters are summarized below by parameter. It should be noted that, where the continuous data collection meter files show values below Basin Plan objectives and Final Order requirements, it does not necessarily indicate or reflect actual violations. Pond discharges did not occur continuously. Pond discharge data should be reviewed considering tidal variation and operational activities which resulted in ceasing or modifying discharges.

Figures 3-6 show the daily means for salinity, temperature, pH and DO for the discharge and receiving water at B2C, Figures 7-10 for B8A and Figures 11-14 for B1 (System B2 discharge from B1), and values of those parameters recorded by continuous collection for B10 are shown in Figures 15-17. Figures 18-26 illustrate the typical diurnal pattern exhibited for DO, plotting daily DO fluctuation, and patterns for other recorded parameters over one week periods at the discharge point for ponds B1, B2C and B8A. The graphs shown in Figures 18-26 represent three individual weeks spread through the monitoring season to display seasonal variations. The 2005 surface water analytical results and field observations are large files and are not included in this SMR. Please contact the Department to request this information.

The results of the 2005 sampling events indicate:

Salinity

Pond salinities generally behaved as expected. After initial releases and during subsequent operations, salinities were generally not above the 44 ppt salinity required for Continuous Circulation, except for rare, very brief periods during neap tide intervals. Only a portion of those daily mean periods were during actual discharge events, and values were only a few points above 44 ppt. Refer to Figures 3, 7 and 11 for daily means in B2C, B8A and B1, respectively. The operating salinities for all system ponds are expected to remain under Continuous Circulation in future years, and will continue to chiefly function as low-salinity systems, reflecting only relatively higher salinities than the intake waters from the Bay and sloughs. Differences in mean salinity between pond and bay waters are more apparent during neap tide periods. It is anticipated that seasonal or batch pond operations, where a limited number of ponds are allowed to reach moderate salinities, will not prevent continued management of these primarily low salinity ponds.

<u>B2C:</u>
System B2C is operated as a muted tidal system, with intake and discharge at the same location, and salinity therefore varied depending on periods of spring and neap tides. After initial release from System B2C, daily mean salinities were not above 44ppt (Continuous Circulation limit), except on four recorded dates. Instantaneous salinity values ranged from a low of 2 ppt to a high of 63 ppt. Pond B2C started out discharging at 46 ppt in April 2005, and operated at values ranging from approximately 25-40 between late-April to mid-May, and from June through November, except for a brief

period in mid-June. Daily mean salinity in B2C was consistently below 44 ppt by mid-June and below 40 ppt from late June through November. A prolonged period of elevated salinity was noted in the latter half of May. Conditions observed in the field on May 16 showed low pond water-levels had briefly exposed the Datasonde, during which time discharge was almost negligible. The discharge was closed because a field salinity reading indicated elevated salinity and to ensure that the Datasonde would be sufficiently submerged. After May 16, no pond waters entered the receiving waters, and daily mean graphs show discharge during the elevated salinity period was largely avoided. The highest recorded daily mean value was 63 ppt (May 24, 2005). This coincided with a period during which the intakes were closed, and higher salinity brines from other ponds in the B2C system had accumulated in B2C. This period was during the earlier part of the season when evaporation was not yet at its highest.

B8A:

System B8A is also operated as a muted tidal system, with intake and discharge at the same location. Salinity correspondingly varied depending on spring and neap tide periods. As discussed previously, the salinity of North Creek waters were approximately 65ppt in April, while B8A waters were approximately 40ppt. Intake of the higher salinity waters from North Creek to B8A was allowed during April to reduce the volume of higher salinity water released from North Creek during the "initial release" breach. B8A salinity was therefore approximately 65ppt at the start of May 2005; with tidal action restored to North Creek at the end of April, full tidal intake to B8A resulted in salinity quickly being reduced. We began discharging B8A when the pond daily mean salinity was at 16 ppt on May 10, 2005. Daily mean salinities were not above 44ppt, except on two dates during the first week of operation, therefore the initial release period transitioned quickly to Continuous Circulation conditions.

Instantaneous salinity values ranged from lows of 16ppt to peaks as high as 50ppt, while daily mean salinity typically ranged from 25-40ppt from late-May through November. Daily mean salinities did not exceed 44ppt after the initial release. Discharge salinity was actively managed and was generally limited by operations to avoid instantaneous discharge values above 44ppt. For very brief periods during warmer weather and extended periods of neap tides when salinities were elevated, discharge operations were temporarily suspended until spring tides reduced salinities to the typical operation range. Higher salinity waters originating in Pond B9 appear to have been well mixed by the supplemental intake in B8A at the discharge location, since it was operated in a muted tidal condition. The B8A highest daily mean salinity value was below 46 ppt (May 15, 2005).

B2 (B1):

Salinity in Pond B2 was observed to be approximately 46 at the end of August at the B2-10 discharge location when dredge operations were completed and discharge was to begin for this system in 2005; therefore discharge operations were initiated in Pond B1 at the B2-1 location. B1 salinity at the end of August was approximately 39ppt and once discharge began, B1 daily mean salinities ranged from 34-47 ppt. Instantaneous salinity values ranged from low of 28 ppt to a high 45 ppt. Discharge only occurred from

August 31 to September 6, 2005 during which time daily mean salinity ranged from 39-42. Thereafter, from mid-September through early-November 2005, Pond 1 was not discharged chiefly due to concerns about the newly dredged levees and repairs required at the B2-1 structure. Daily mean salinities remained below 44 ppt, except on one day (9/10/05), which occurred during a prolonged neap tide period. Discharge was not resumed until mid-November, by which time the daily mean was steadily below 40 ppt. Discharge was resumed November 14, 2005 and daily mean salinity was 34 ppt.

Temperature

Temperature levels in the ponds generally matched the temperature levels in the intake and receiving waters and therefore easily met the discharge limits of not exceeding natural temperatures of the receiving waters by 20^{o}F. Refer to Figures 4, 8 and 12 for daily means in B2C, B8A and B1, respectively.

pH

Levels of pH varied in each Pond System and were different comparing between systems, but were generally less than 8.5 during discharge periods. Refer to Figures 5, 9 and 13 for daily means in B2C, B8A and B1, respectively. Compliance for pH levels was allowed in the Final Order to be measured in either the pond or receiving waters, as determined by the discharger. While pH levels were above 8.5 for some periods within the ponds, the receiving waters generally did not appear to be elevated, except in a few instances immediately outside the B2C discharge during the initial discharge, and additional monitoring (grab samples for ammonia) did not show an adverse effect.

Mean pH in the Pond System B10 remained around 8.0 and ranged from 7.4 (summer) to 8.7 (spring).

In B8A, daily mean pH was above 8.5 during discharge only during the initial release for a period of one week. Other periods exceeding pH 8.5 were avoided by ceased discharge periods and therefore limited by operations.

In B2C, daily mean pH varied extensively, ranging from approximately 8.0 to 9.4 values. There was no readily identifiable pattern in B2C pH values as related to discharge operations, and may be more correlated to DO values, as might be expected. B2C receiving waters only reflected elevated pH levels on the first day of discharge (8.7 and 8.8, surface and bottom, respectively), and B2C receiving waters were well below 8.5 thereafter, ranging from approximately 8.3 to 7.7 during the season. Follow up investigation of B2C receiving water pH values, including sampling for toxic ammonia levels, indicated that receiving waters were not adversely affected by elevated pond discharge pH values.

In B1, daily mean pH during the beginning of the season (August 31 –September 6 discharge period) was approximately 8.3 and 8.2 during the mid-November discharge period. All daily mean values after the start of discharge were below pH 8.5, ranging from approximately 7.9 to just below 8.5 and instantaneous values were in the 7.9 to 9.7 range.

Dissolved Oxygen (DO)

Monitoring efforts showed that DO levels in Ponds B1, B2C, B8A and B10 (during continuous monitoring period) exhibited a strong diurnal pattern where lower DO is observed near dawn and higher DO is observed at mid-day. Continuous monitoring DO values are discussed below by pond system, and evaluations are based on daily mean values recorded at the discharge locations and on calendar-weekly 10th percentiles. Values are referenced with the Basin Plan water quality objectives (compliance limit of 5.0 mg/L) and reporting "trigger" values established by RWQCB (below 3.3 mg/L), as discussed herein. Refer to Figures 6, 10 and 14 for daily means in B2C, B8A and B1, respectively.

Pond System B2C: Monitoring data for B2C was collected from March 30 through November 21, 2005, representing 224 total recorded days, not including 13 days when meters did not record data due to malfunctions or other reasons. For B2C daily mean DO was below 5.0 mg/L on 94days, and of those days, daily mean salinity was below 3.3 mg/L on 34days; there were 24 weeks, of 34 weeks, where calendar-weekly tenth percentile "trigger" values were below 3.3 mg/L, which required notification of RWQCB staff. It should be noted that this summary does not necessarily indicate or reflect actual violations. Pond discharges did not occur continuously nor in all of these periods, as Best Management Practices (BMPs) were implemented, such as temporarily ceasing discharge, or reducing gate settings to limit discharge. Monitoring indicated that Receiving Waters were below 5.0 mg/L only on three dates, none of which were below 4.5 mg/L. Two of the dates where those receiving water values were observed corresponded to discharge periods, however, one date does not coincide with discharge, as discharge was ceased one day prior . It is unclear whether the lower DO values in the receiving waters can be attributed solely to pond discharge affects, or whether the lower DO values can be attributed to natural variation in slough and bay conditions or other factors, or a combination thereof.

Pond System B8A: Monitoring data for B8A was collected from May 2 through November 21, 2005, representing 181 total recorded days, not including 14 days when meters did not record data due to unknown malfunctions. For B8A, daily mean DO was below 5.0 mg/L on 28 days, and of those days, daily mean salinity was below 3.3 mg/L on only one day (6/30/05, 3.1 mg/L); there were 10 weeks, of 28 weeks, where calendar-weekly tenth percentile "trigger" values were below 3.3 mg/L, which required notification of RWQCB if discharging. It should be noted that this summary does not necessarily indicate or reflect actual violations. Pond discharges did not occur continuously, and discharge only occurred during one corresponding trigger value. Best Management Practices (BMPs) were implemented and appeared to effectively avoid discharge during trigger periods. Monitoring indicated that Receiving Waters were not observed below 5.0 mg/L, except on one date (April 30, 2005) which was prior to initial discharge of Pond B8A and was not below 4.6 mg/L anytime. As discussed previously, the breach of North Creek to Old Alameda Creek occurred on April 27, 2005, which was considered similar to discharge of System B8A, and monitored as if the breach event was an Initial Release from the B8A system. On April 28, 2005, the day after the initial breach release, the receiving waters had an observed value of 8.0 mg/L and 7.9mg/L, bottom and surface sampling, respectively. It appears that DO values in Old Alameda Creek receiving waters were not affected by the breach release, as minor variation in DO values can be attributed to natural variation in slough and bay conditions and other factors. Furthermore, as mentioned above, only one discharge period coincided with a tenth-percentile trigger event (10/5/05, 0.8 mg/L), and receiving waters did not reflect any adverse effect (both bottom and surface values were 7.1 mg/L).

Pond System B2 (B1):
As discussed previously, at the end of August when dredge operations for levee maintenance was completed and discharge of System B2 was planned to begin, salinity at the B2-10 discharge location in Pond B2 was observed to be above CCP levels; therefore discharge operations were initiated in Pond B1 at the B2-1 location. Discharge only occurred from August 31 to September 6, 2005 chiefly due to concerns about the stability of the restored levees and repairs required at the B2-1 structure. Discharge was not resumed until November 14, 2005.

Monitoring data B1 was collected from August 25 through November 15, 2005, representing 80 total recorded days, not including 3 days when meters did not record data due to unknown malfunctions. For B1, daily mean DO was below 5.0 mg/L on 37 days, and of those days, daily mean salinity was below 3.3 mg/L on seven days; there were 7 weeks, of 12 weeks, where calendar-weekly tenth percentile "trigger" values were below 3.3 mg/L, which required notification of RWQCB if discharging. It should be noted that this summary does not necessarily indicate or reflect actual violations. Pond discharges did not occur continuously, and discharge only occurred during one week during which time no trigger value is observed. Best Management Practices (BMPs) were implemented and appeared to effectively avoid discharge during trigger periods. Monitoring indicated that Receiving Waters were observed below 5.0 mg/L on two dates not coinciding with the discharge period, but rather following the discharge (9/7/05 and 9/14/05). Daily mean DO values during the discharge week ranged from 5.2-6.4 mg/L.

On September 7, 2005, after the discharge was closed, one receiving water location had an observed low DO value of 2.2 mg/L; however, this sample site was furthest from the discharge location and the sample sites near to the discharge had values of 4.0-6.0mg/L. At that site, salinity was also observed to be substantially lower than all other site nearer to the discharge. Based on observations by USGS during collection of receiving water data, including tidal conditions, and conversations Department staff had with Alameda County staff in the field, the low DO and salinity values in Old Alameda Creek appeared to be localized and may have been caused by municipal (freshwater) discharge from Alvarado Pump Station during maintenance activities. The rest of the sampling sites track well with what would be expected in the pond/slough environment near the mouth of Old Alameda Creek It is not clear that low DO values in Old Alameda Creek receiving waters were affected by or could be attributed in whole or in part to the week of B1 discharge, or whether the lower DO values can be attributed to natural variation in slough and bay conditions or other factors. The municipal discharge operated by Alameda County from the Alvarado Pump Station located upstream may have confounded data evaluation for B1 this season. Coordination with Alameda County will occur in future years to help discern pond discharge effects from municipal discharge affects.

Pond System B11 (B10):
For Pond B10, a continuous meter was deployed from April 29 – May 11, 2005, representing continuous meter data for 13 days, thereafter approximately weekly grab samples (14 weekly events). Note that Pond 10 operates as an uncontrolled muted tidal pond since the structure failed in August, 2004 and water has very little residence time so may be generally reflective of bay water conditions. Weekly tenth percentile values for the 13 day continuous monitoring period were at 5.5 mg/L and above. Weekly grab samples showed a DO value range from 4.6 - 7.7 mg/L, with only 1 day below 5.0 mg/L (7/14/05, 12:20pm, 4.6 mg/L), therefore there were no days where pond DO values were below the trigger of 3.3 mg/L. Refer to Figures 15-17 for continuous meter values.

Effectiveness of Dissolved Oxygen BMPs

As it is recognized that, without the installation of mechanical aerators, it will not be feasible for a well-operated lagoon system to continuously meet an instantaneous dissolved oxygen limitation of 5.0 mg/L as specified in the Basin Plan, which is based on the national criteria published by the U.S. Environmental Protection Agency (USEPA). It is understood that that a stringent interpretation of this limit is not necessary to protect water quality, based on review of probe monitoring data in the Bay and recent site-specific standards work in the Everglades and Virginian Province (Cape Cod, MA to Cape Hatteras, NC). This is based on analysis showing that levels lower than 5.0 mg/l naturally occur in estuaries. The March 25, 2005 letter from the RWQCB required a trigger for reporting and action if, at the point of discharge, the 10th percentile falls below 3.3 mg/L (calculated on a calendar weekly basis), as described more fully above. In the October 5, 2005 letter which requested the revisions/corrections incorporated herein, RWQCB stated that the Department should implement a DO corrective measure (BMP) that ceases nighttime discharges if the weekly 10th percentile value of pond discharge shows the trigger value of 3.3 mg/L, unless a more effective alternative can be implemented.

To address the excursions from the DO limit, several operational strategies or Best Management Practices (BMPs) were proposed in the individual system operations plans. Several of these BMPs used the closing of the discharge during periods of time when the diurnal pattern suggests that DO would be below the limit (3.3 mg/L). Ceasing discharge from 10 pm to 10 am, as suggested in the 2004 SMR, would avoid most of the excursions from the limit since there is a strong diurnal pattern to DO levels.

Daily discharge timing is not practicable due to staff and budget constraints. However, a similarly effective alternative can be implemented during periods when the weekly 10th percentile is at or below the trigger value. The alternative to daily discharge timing implemented by the Department was weekly discharge timing. This BMP may be particularly useful when trigger values are expected or observed to correspond with periods when overnight tides are low and would result in the majority of discharge volume, and/or with weak (neap) tide periods when intake is more limited. Closing the discharge for a period of days when overnight DO levels in the pond are known to be or are expected to be low would generally provide equivalent protection of receiving waters as would daily closure of the outlet gates. By adjusting discharge gates on an approximately weekly basis (with the number of days being depending on duration of the neap tide cycle), such management activities allow for periods when no discharge would occur, or discharge would occur only during periods when discharge is mostly during the day, when pond DO levels are higher.

A possible consequence of ceasing discharge, while not resulting in discharge of low DO pond waters to receiving waters, is prolonged periods of depressed DO levels due to more limited intake, since without discharge pond water levels are higher and thereby duration and volume of intake is reduced. It appears that reducing residence time of water in the ponds improves overall DO levels. Therefore, allowing discharge, even at reduced volumes, would provide for some increased volume of intake. A discharge gate can be set to allow reduced discharge volumes versus discharge volumes that would be expected for normal operations. For example, a gate would be set at approximately 10 percent open (versus normally 20% open) during strong (spring) tide periods, when the weekly 10^{th} percentile is at or below the trigger value. Reduced discharge settings would reduce the volume of discharge water entering the receiving waters, and correspondingly minimize the extent to which low DO discharges could potentially affect receiving water quality. These reduced discharge volumes would allow for greater exchange of intake waters, since pond water levels would be lower than if no discharge occurred, which may also help to raise DO values.

In May 2005, DO values began to decrease to values below the 10^{th} percentile trigger. Department staff requested USGS begin in-pond investigation to collect data on B2C conditions for analysis of potential causes. In-pond investigation showed relatively high DO values (7.5-9.6 mg/L) which is now understood to relate to diurnal trends, but did not reveal information helpful in determining potential causes for DO levels decreasing to below trigger values. Data collected during routine pond operations monitoring was reviewed and it appears that potentially stagnant brines from ponds in System B2C farthest from the discharge may have begun to reach the discharge. This period also coincides with a particularly weak and prolonged neap tide period.

Closing pond intake is not suggested during periods of low DO. For B2C, during the low DO period in May, intakes were closed for one week (5/17/05-5/24/05), during which the in-pond DO investigation performed by USGS (5/18/05). Intakes were closed in an attempt to discern pond water quality values from slough intake conditions. DO levels quickly deteriorated during the period there was no intake, and salinity levels were substantially elevated (see Figure 27). Once intakes were reopened, pond water quality recovered and discharge resumed once salinity normalized. After normal intake/discharge operations resumed, DO values were above trigger values through late-June. Refer to Table 1 for a full summary of discharge events.

It appears that the placement of the data recorders may not be accurately recording actual DO levels that enter into the receiving waters, based on information was obtained by USFWS to investigate potential differences in DO levels. Preliminary data, collected in late May 2005 at the Alviso Complex, suggest that turbulence related to discharge from the culvert leads to an increase in DO. Data recorders were placed at both the pond side of the discharge (position from 2004) and on the trash-rack on the outside of the gate. More data has been collected to evaluate the impact of discharge through the culvert and trash rack on DO levels. If these preliminary results are confirmed, we will contact RWQCB staff to discuss whether data recorders may be placed in locations other than inside the pond at the discharge location, to more accurately reflect discharge DO levels for pond discharges entering the receiving waters.

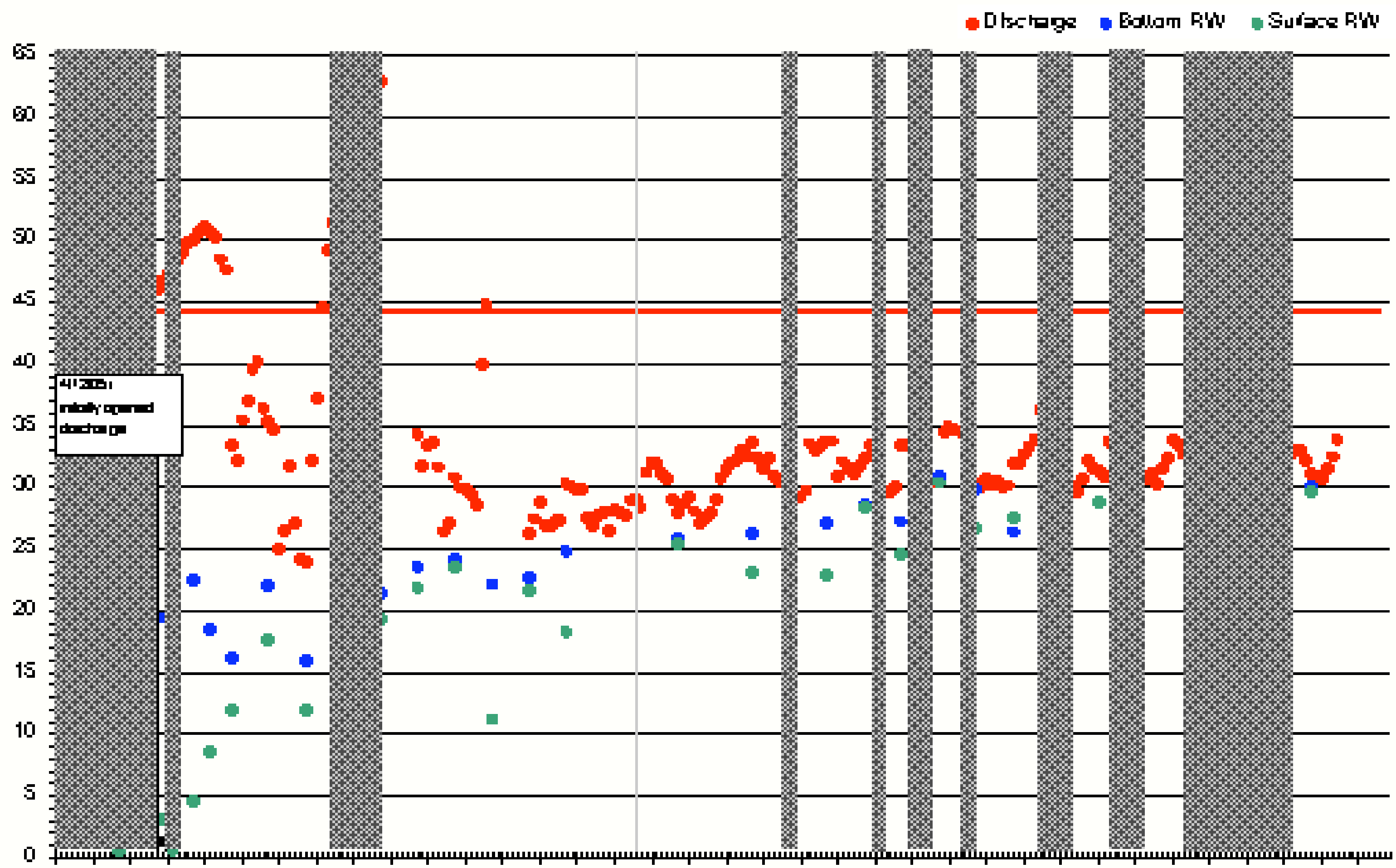

Figure 3. Pond B2C- Daily Mean Salinity for Discharge and Receiving Water

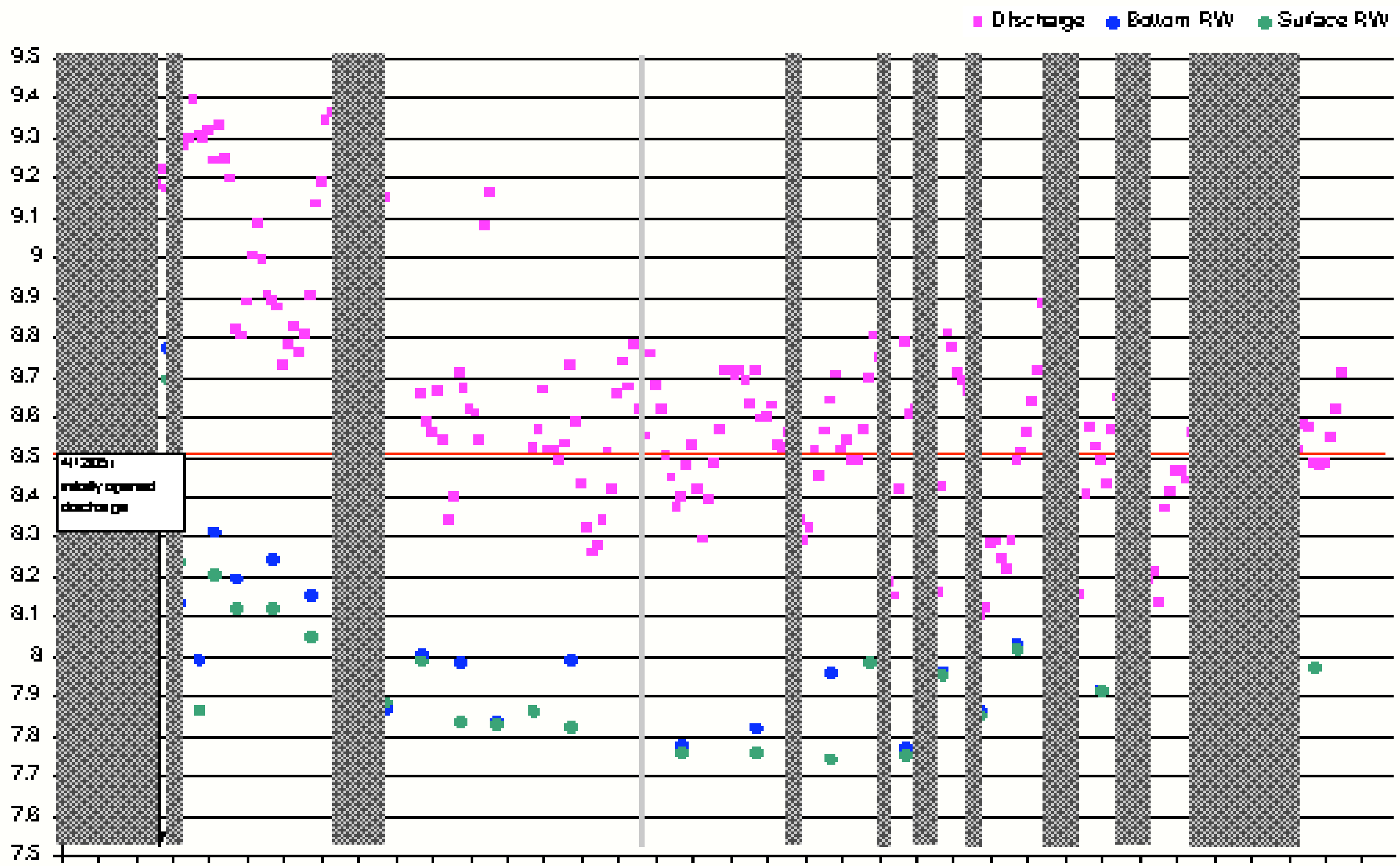

Figure 4. Pond B2C- Daily Mean pH for Discharge and Receiving Water

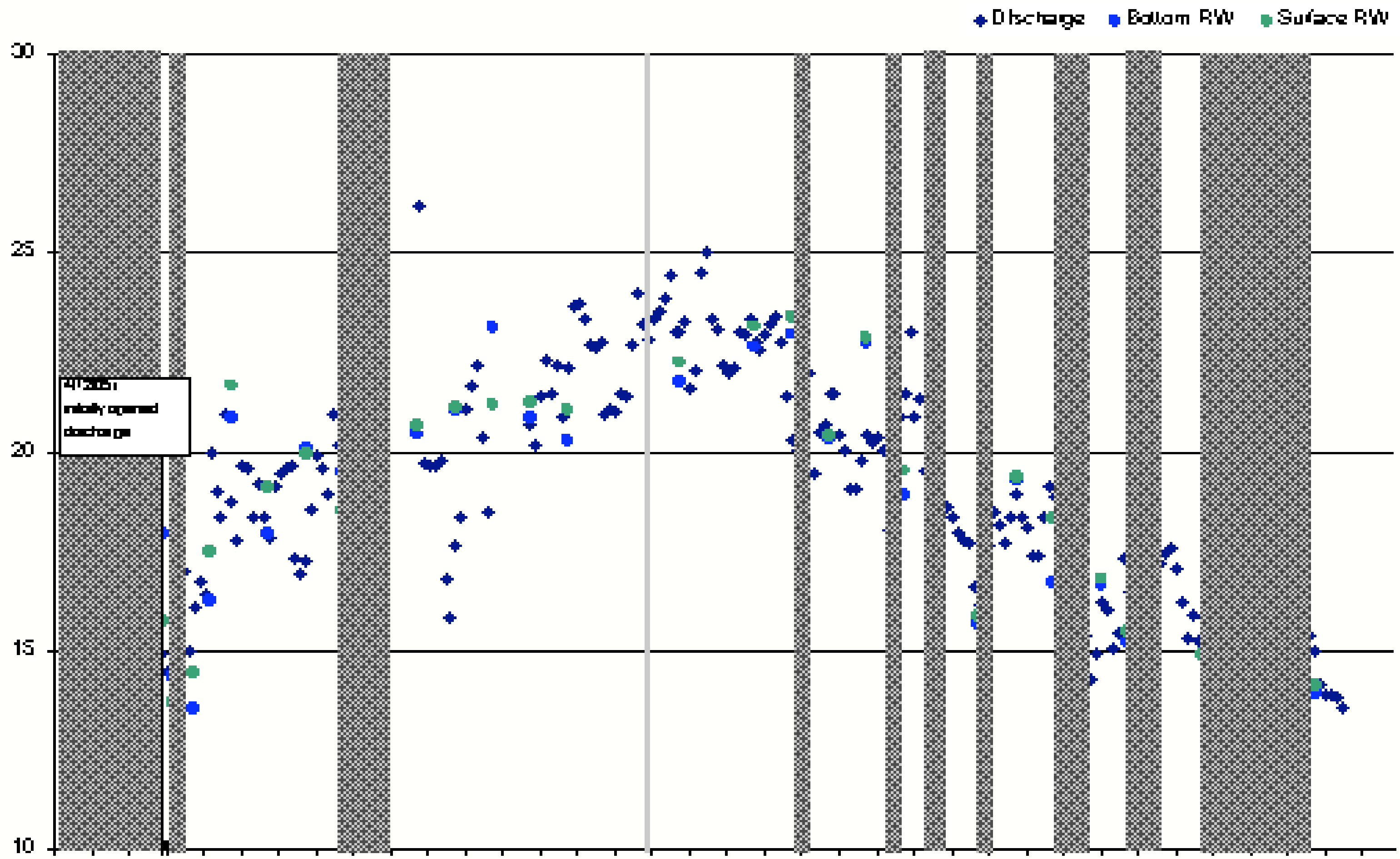

Figure 5. Pond B2C- Daily Mean Temperature for Discharge and Receiving Water

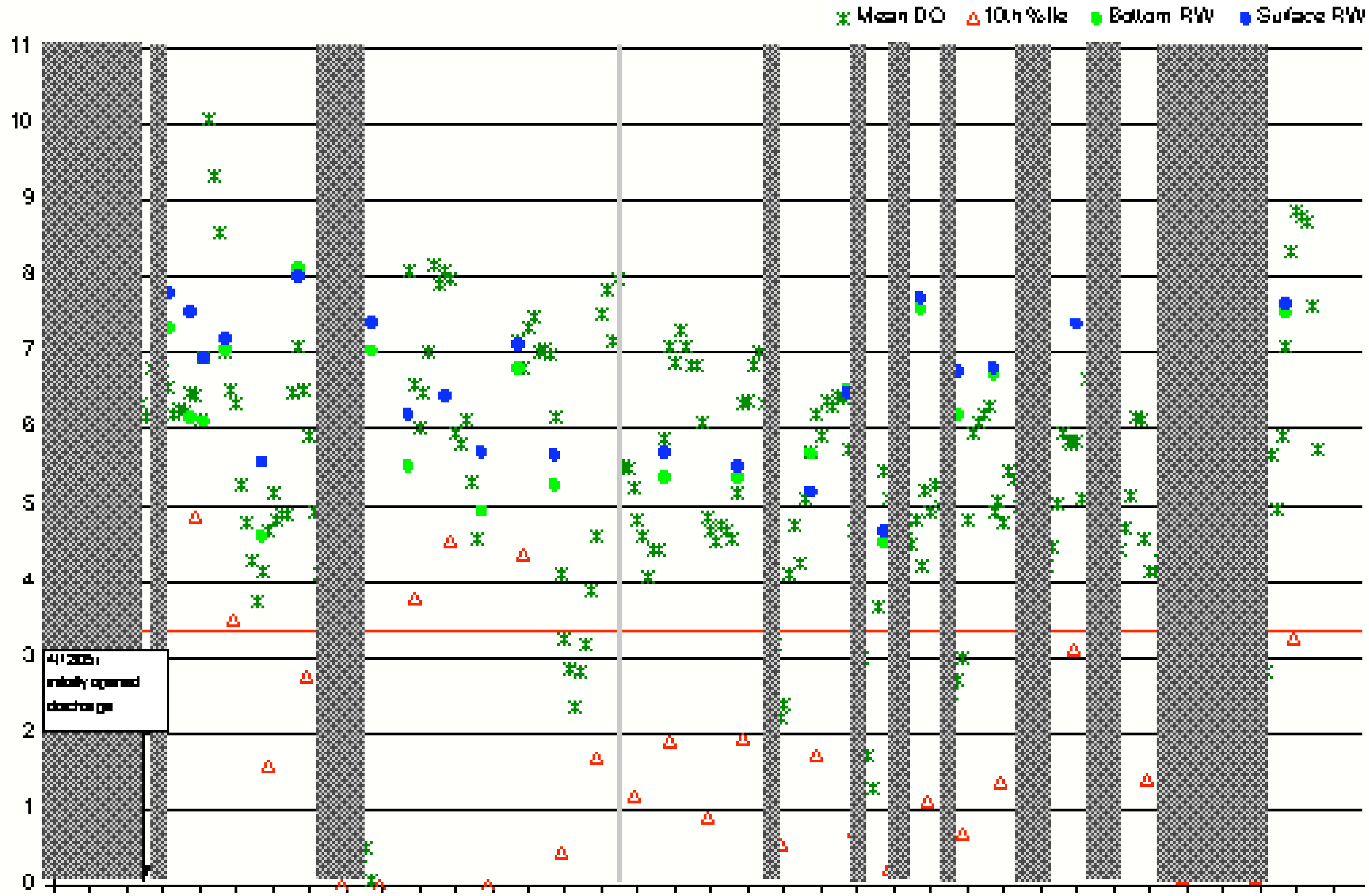

Figure 6. Pond B2C- Daily Mean DO for Discharge and Receiving Water

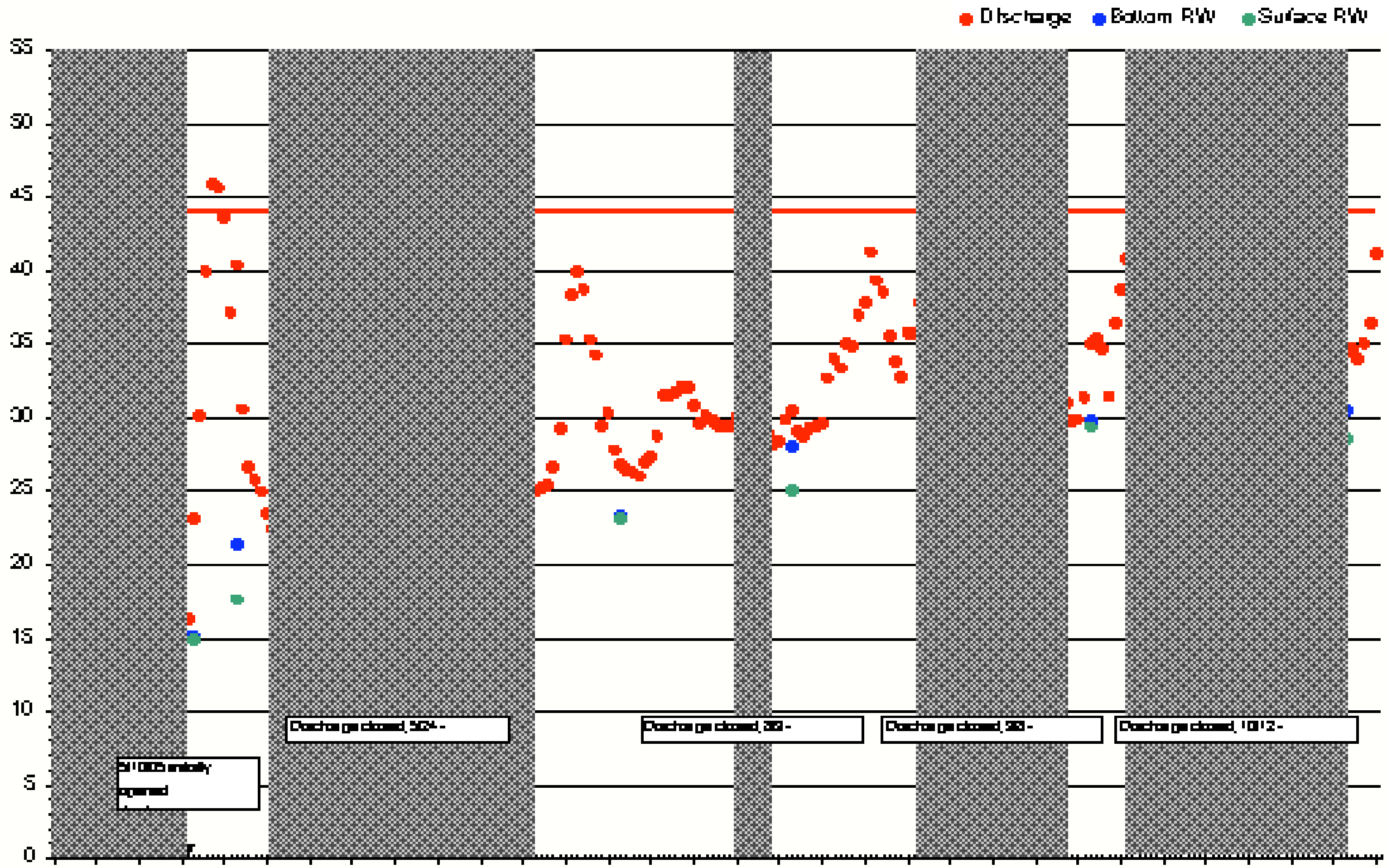

Figure 7. Pond B8A- Daily Mean Salinity for Discharge and Receiving Water

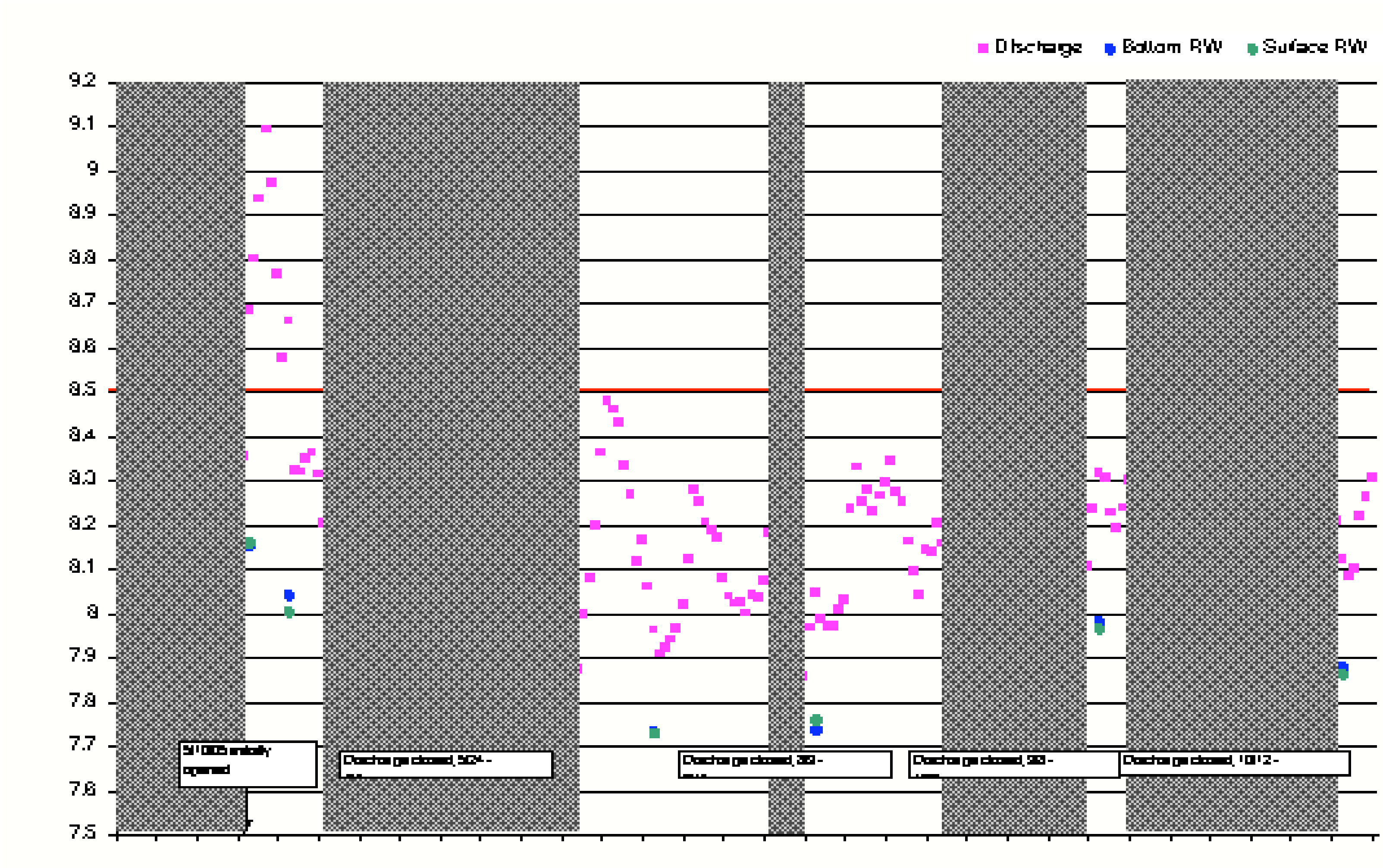

Figure 8. Pond B8A- Daily Mean pH for Discharge and Receiving Water

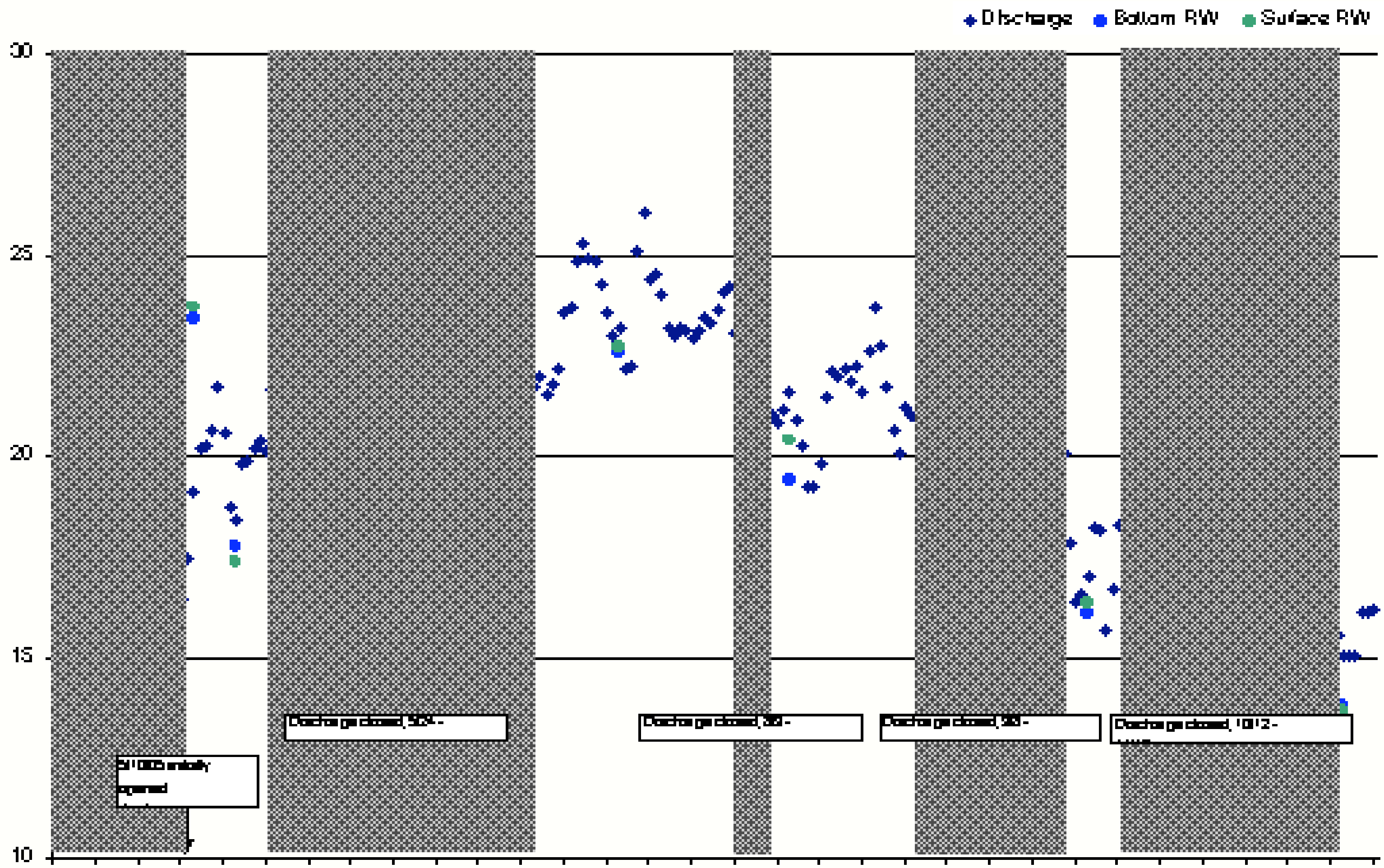

Figure 9. Pond B8A- Daily Mean Temperature for Discharge and Receiving Water

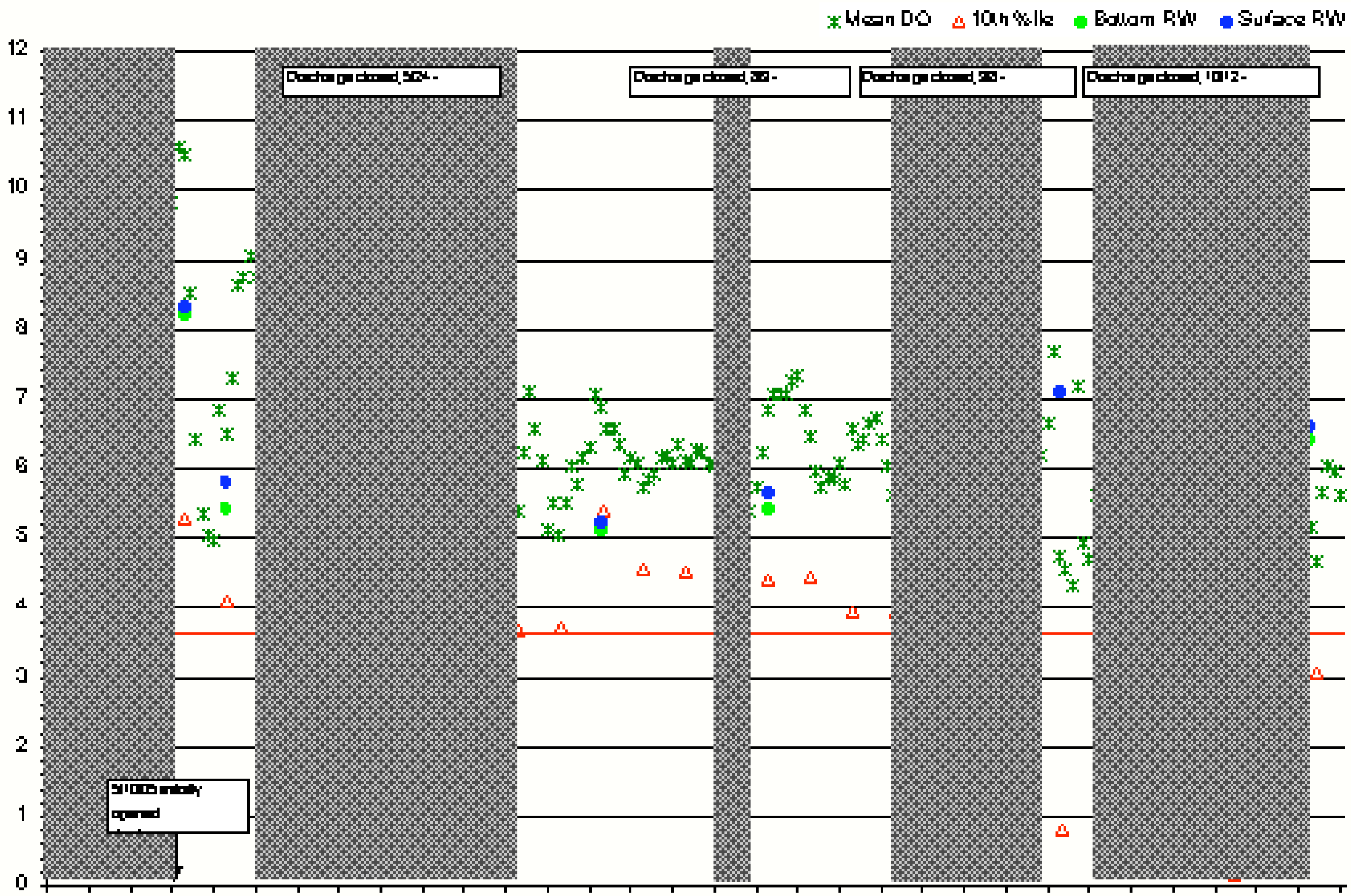

Figure 10. Pond B8A- Daily Mean DO for Discharge and Receiving Water

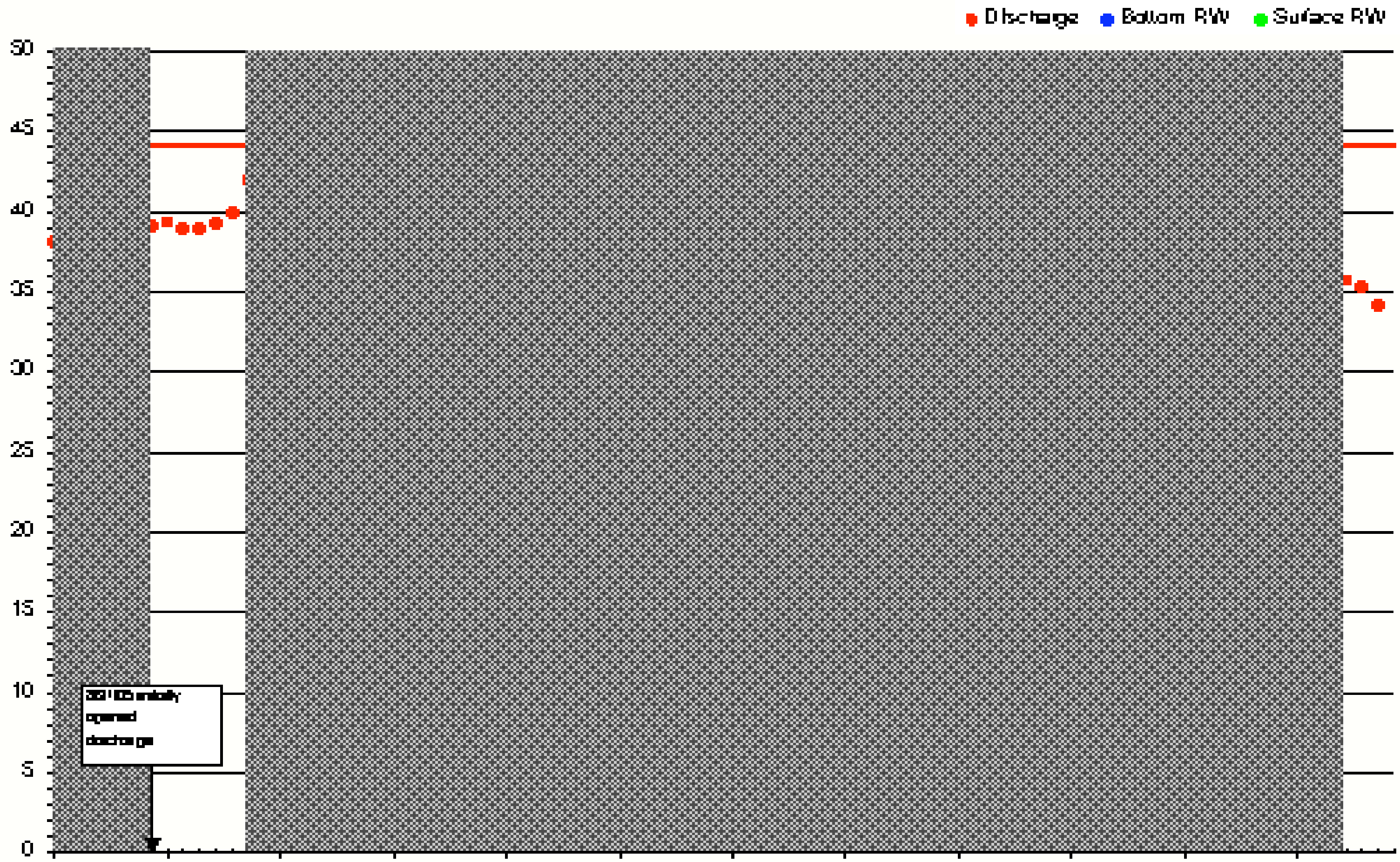

Figure 11. Pond B1- Daily Mean Salinity for Discharge and Receiving Water

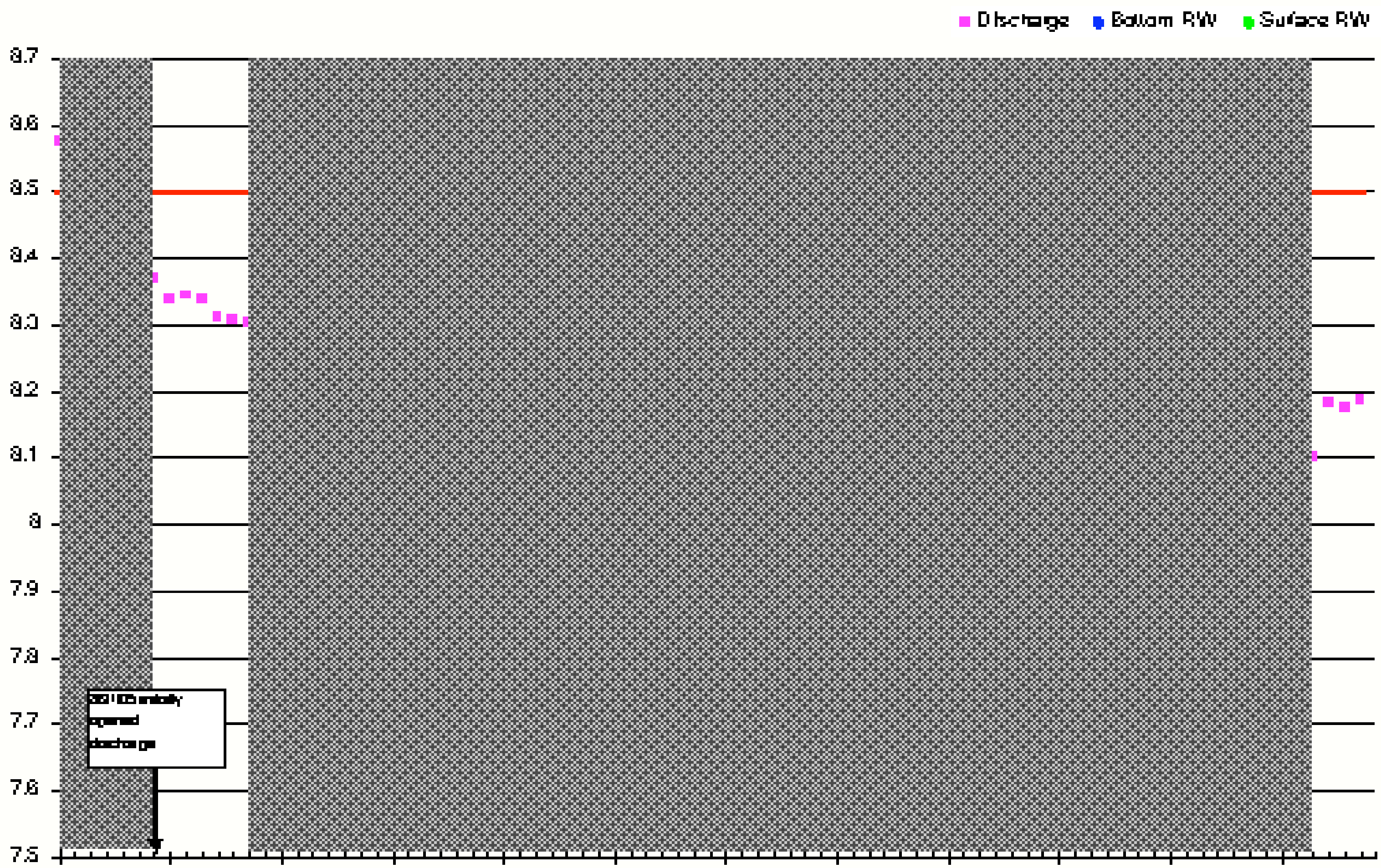

Figure 12. Pond B1- Daily Mean pH for Discharge and Receiving Water

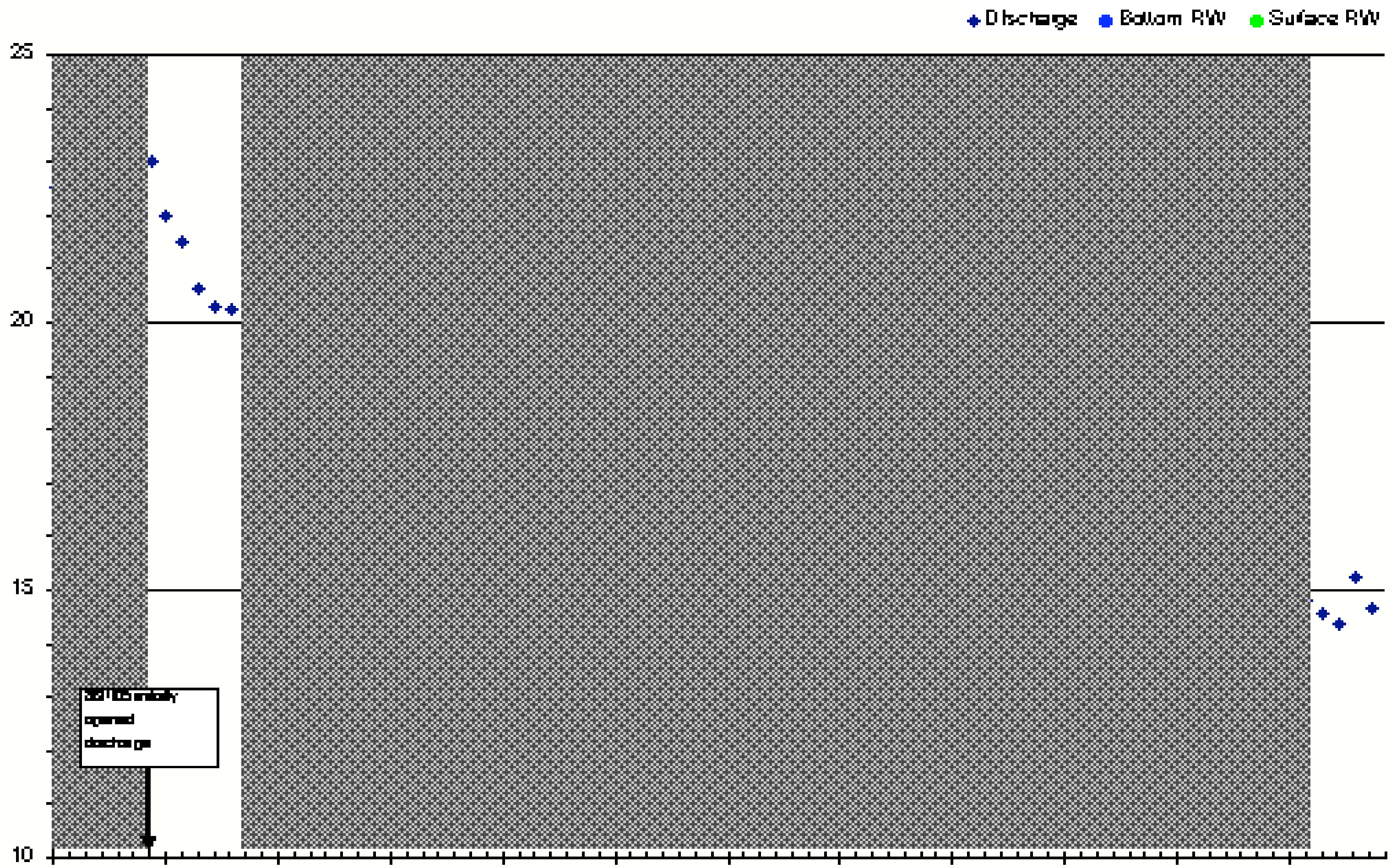

Figure 13. Pond B1- Daily Mean Temperature for Discharge and Receiving Water

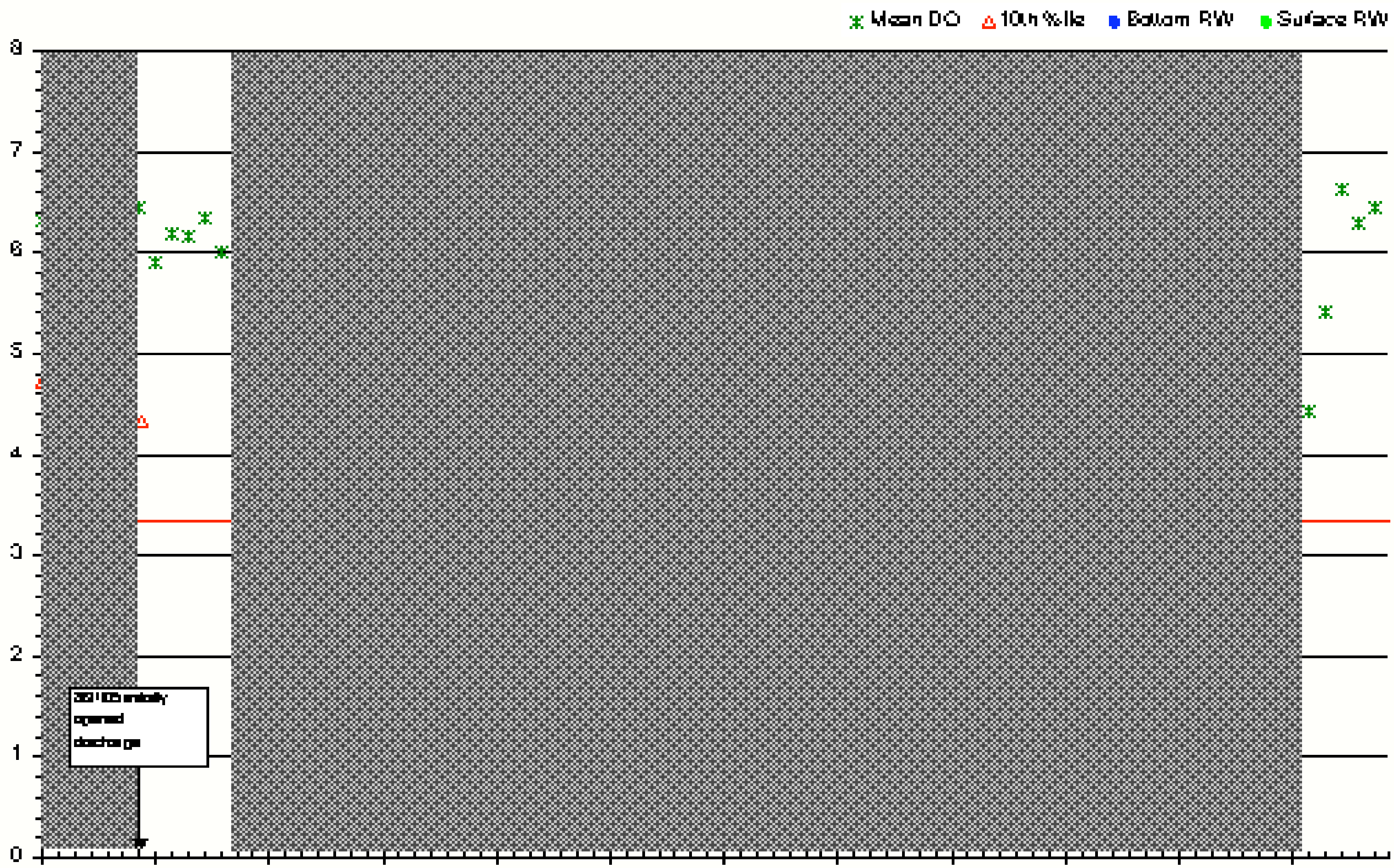

Figure 14. Pond B1- Daily Mean DO for Discharge and Receiving Water

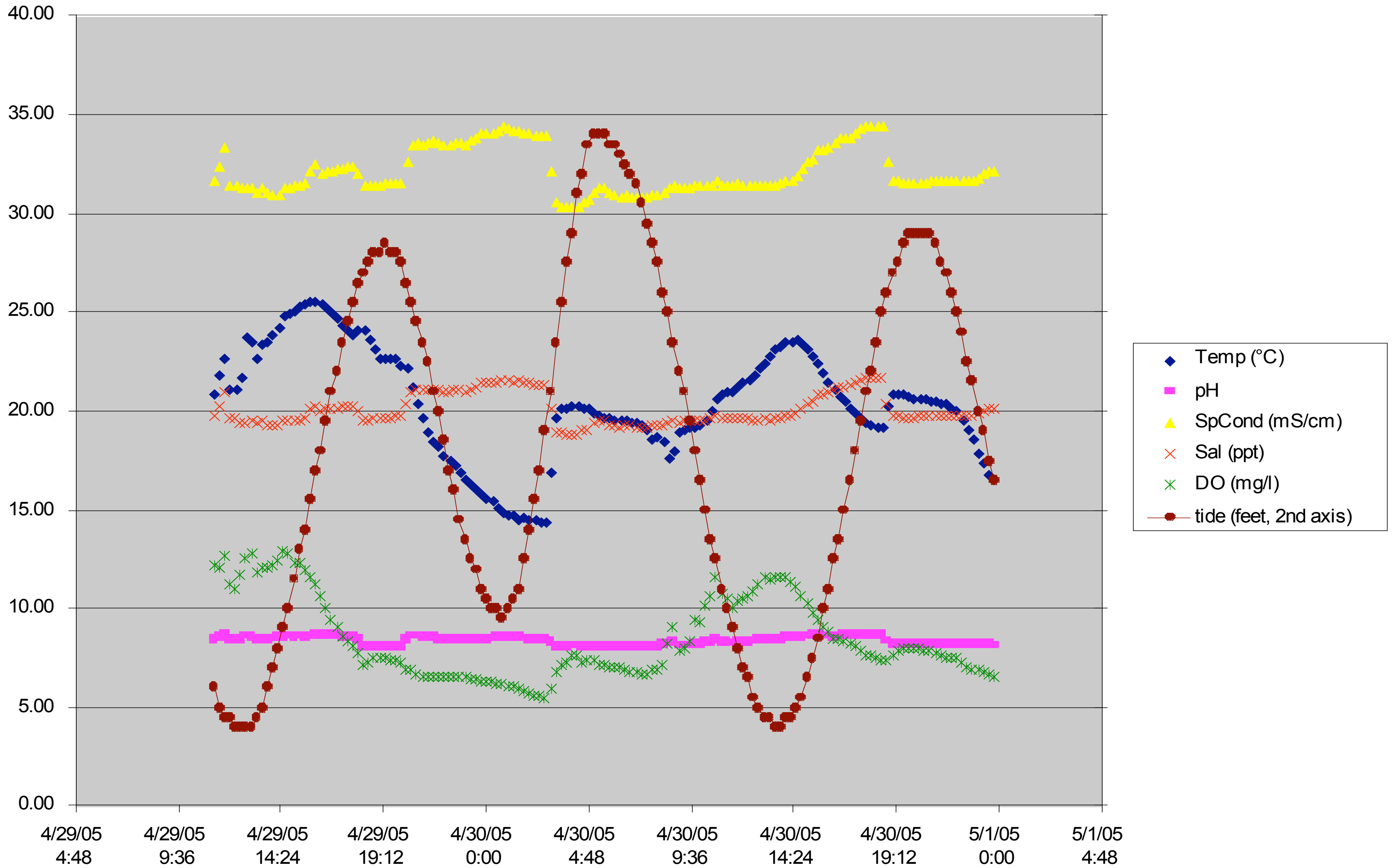

Figure 15 Pond B10- values for 4/29/05 – 4/30/05

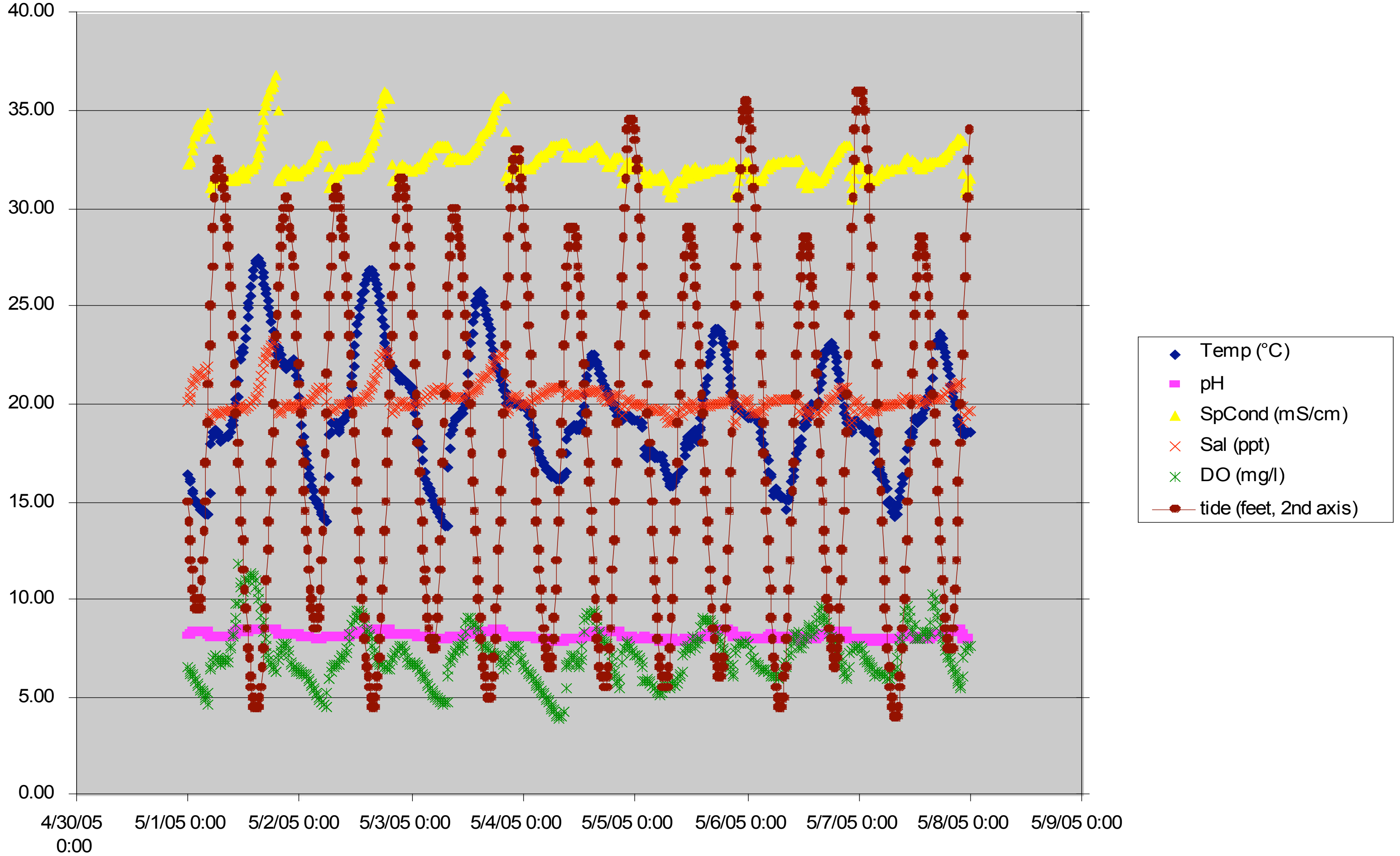

Figure 16. Pond B10- values for 5/1/05 – 5/7/05

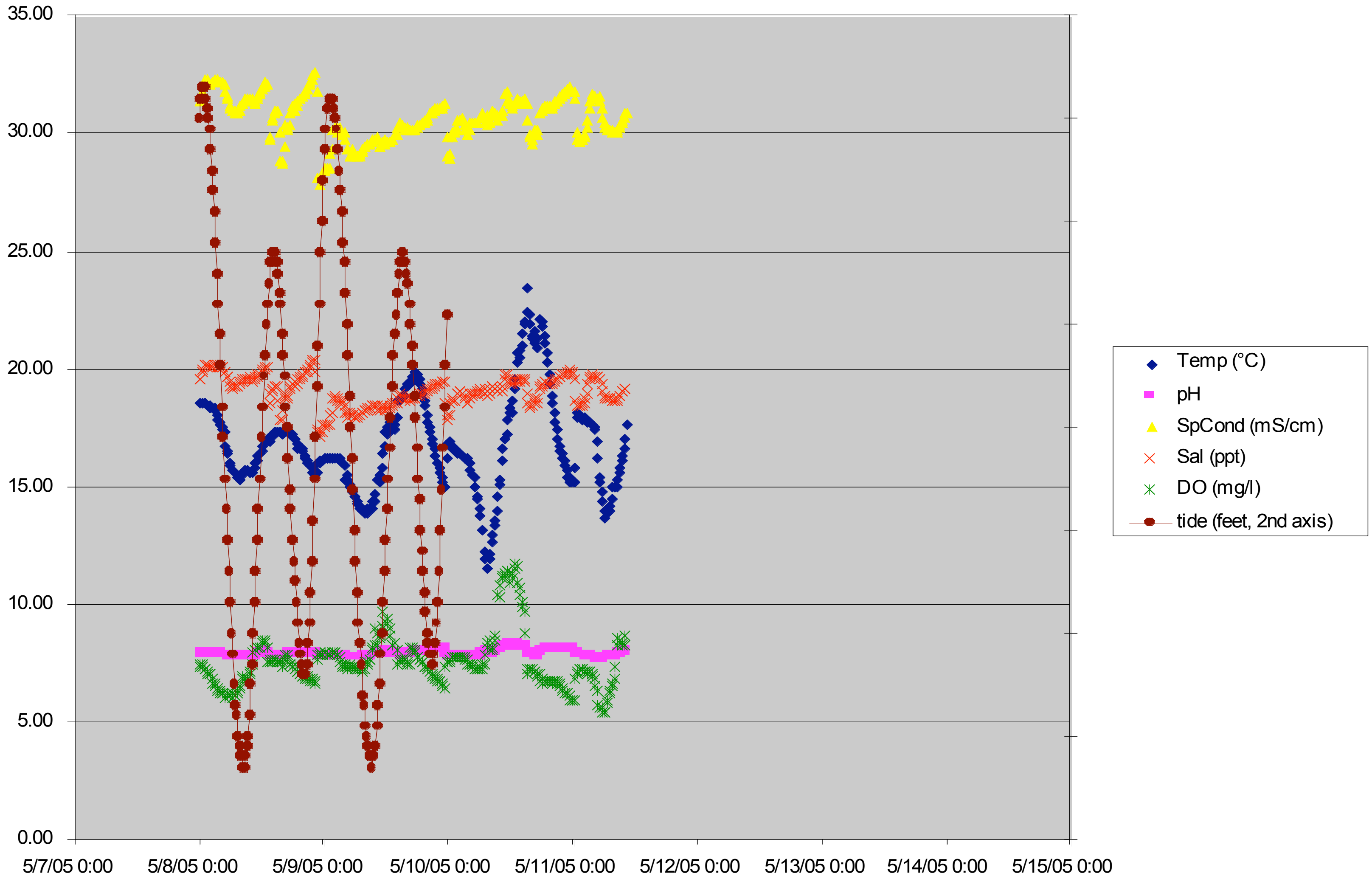

Figure 17. Pond B10- values for 5/8/05 – 5/11/05

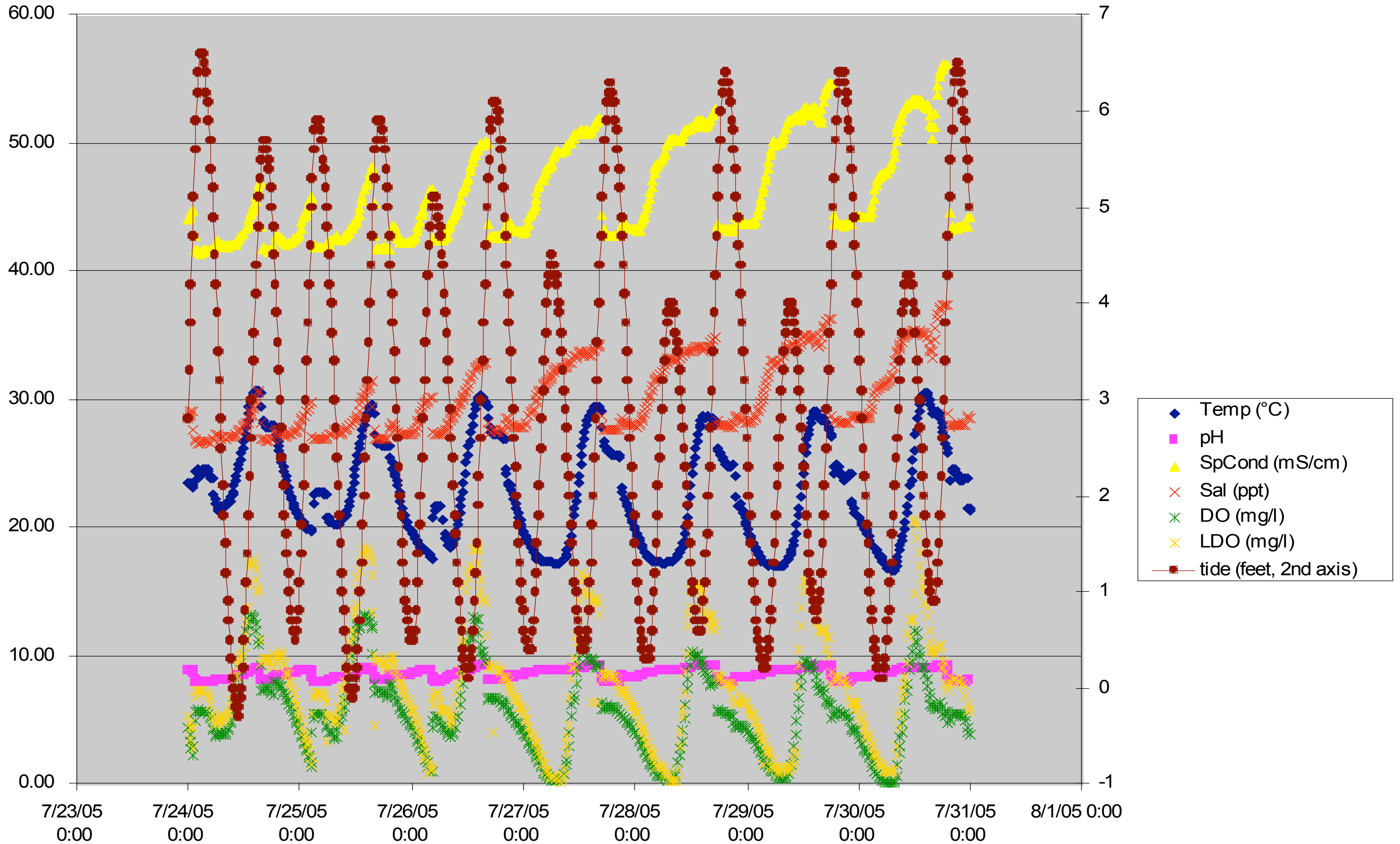

Figure 18. Pond B2C- values for 7/24/05 – 7/31/05

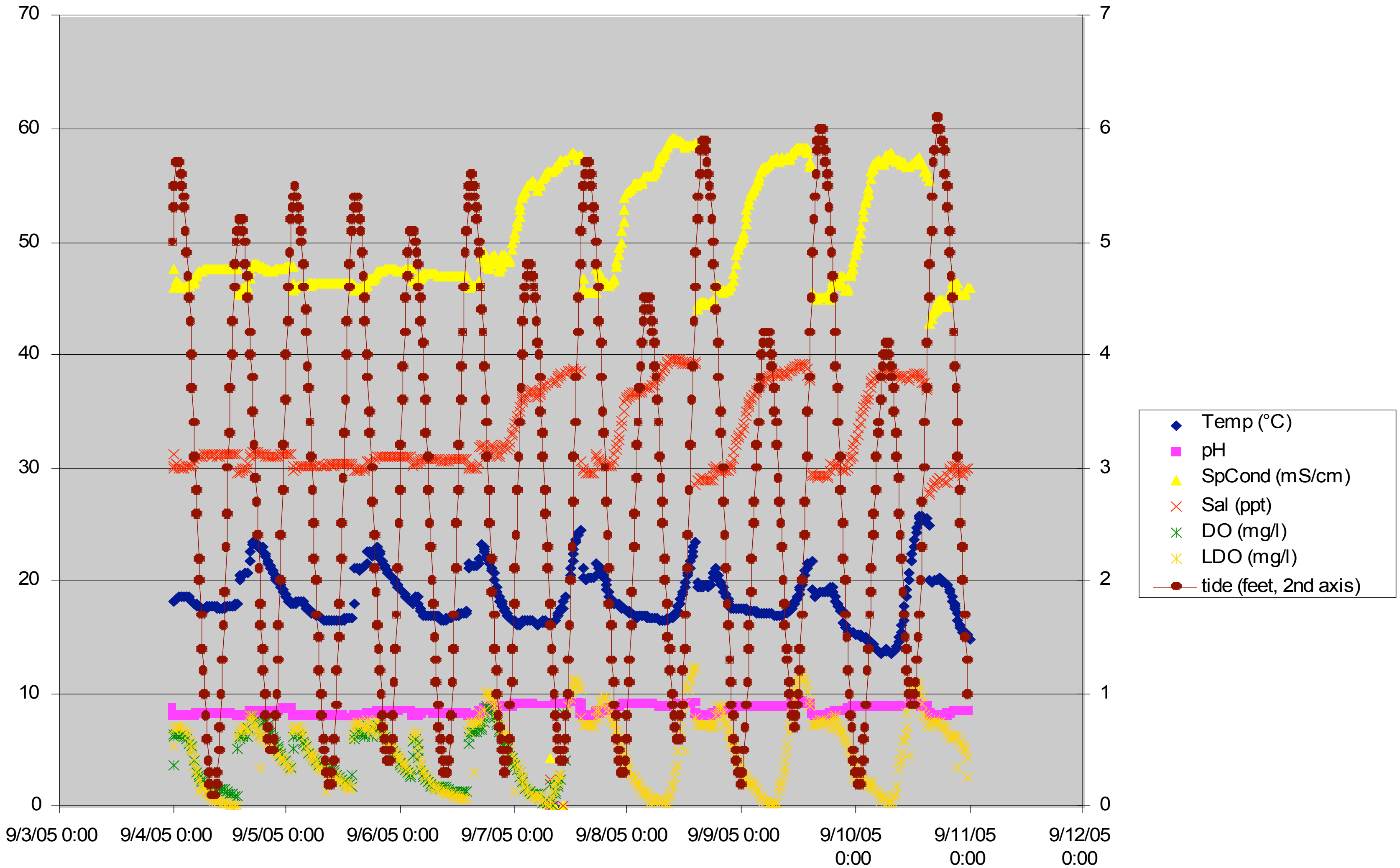

Figure 19. Pond B2C- values for 9/4/05 – 9/10/05

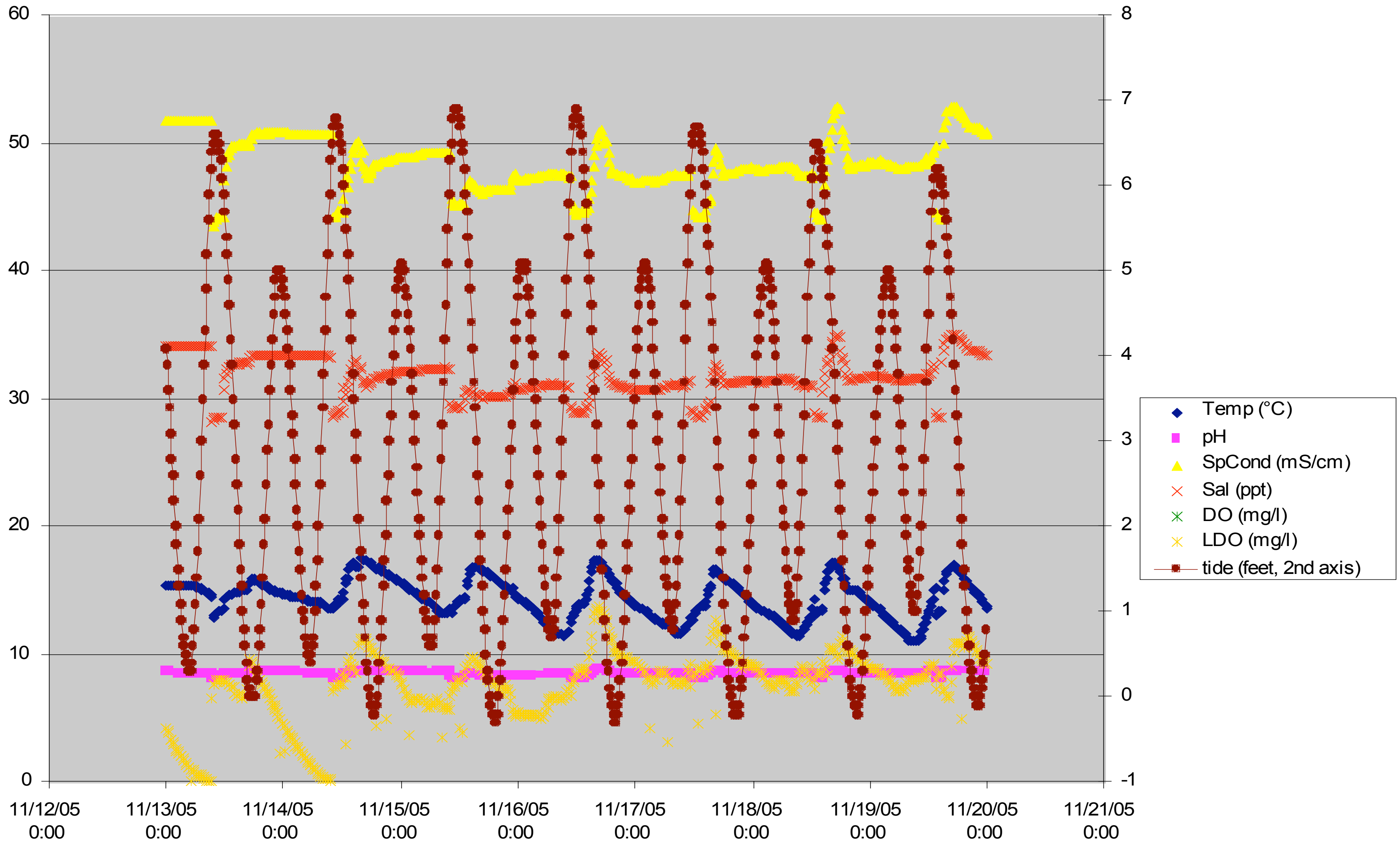

Figure 20. Pond B2C- values for 11/13/05 – 11/19/05

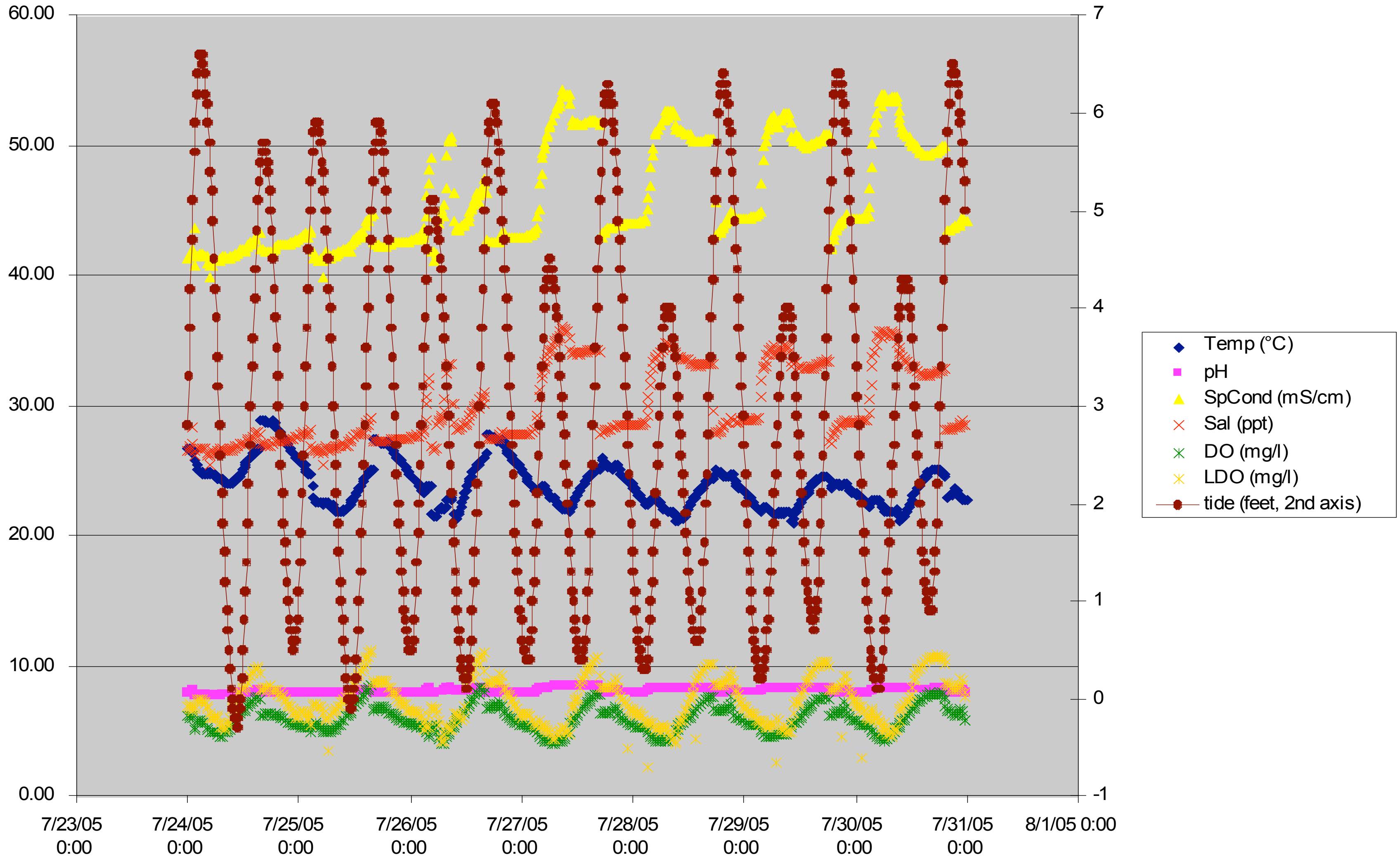

Figure 21. Pond B8A- values for 7/24/05 – 7/31/05

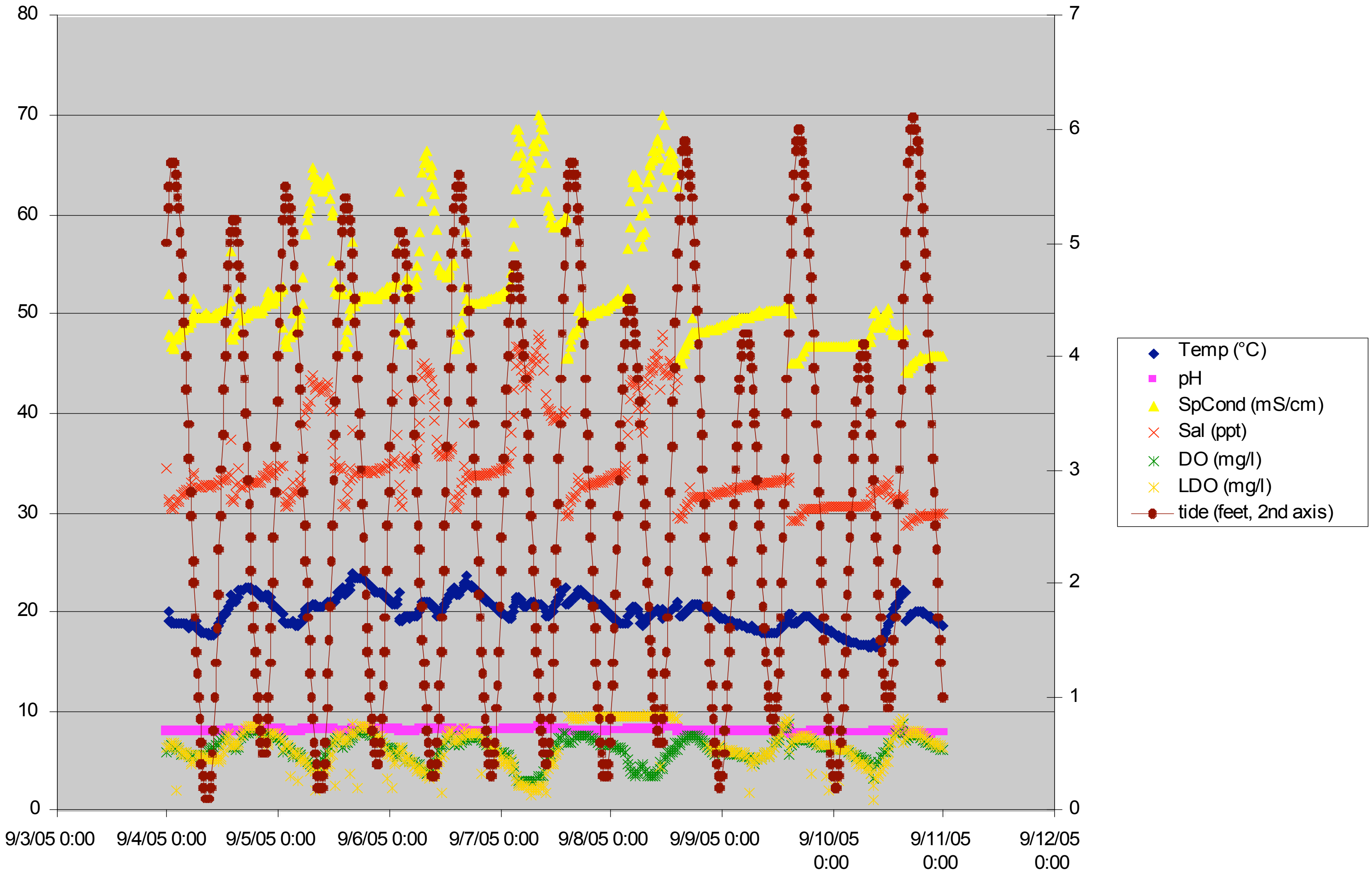

Figure 22. Pond B8A- values for 9/4/05 – 9/10/05

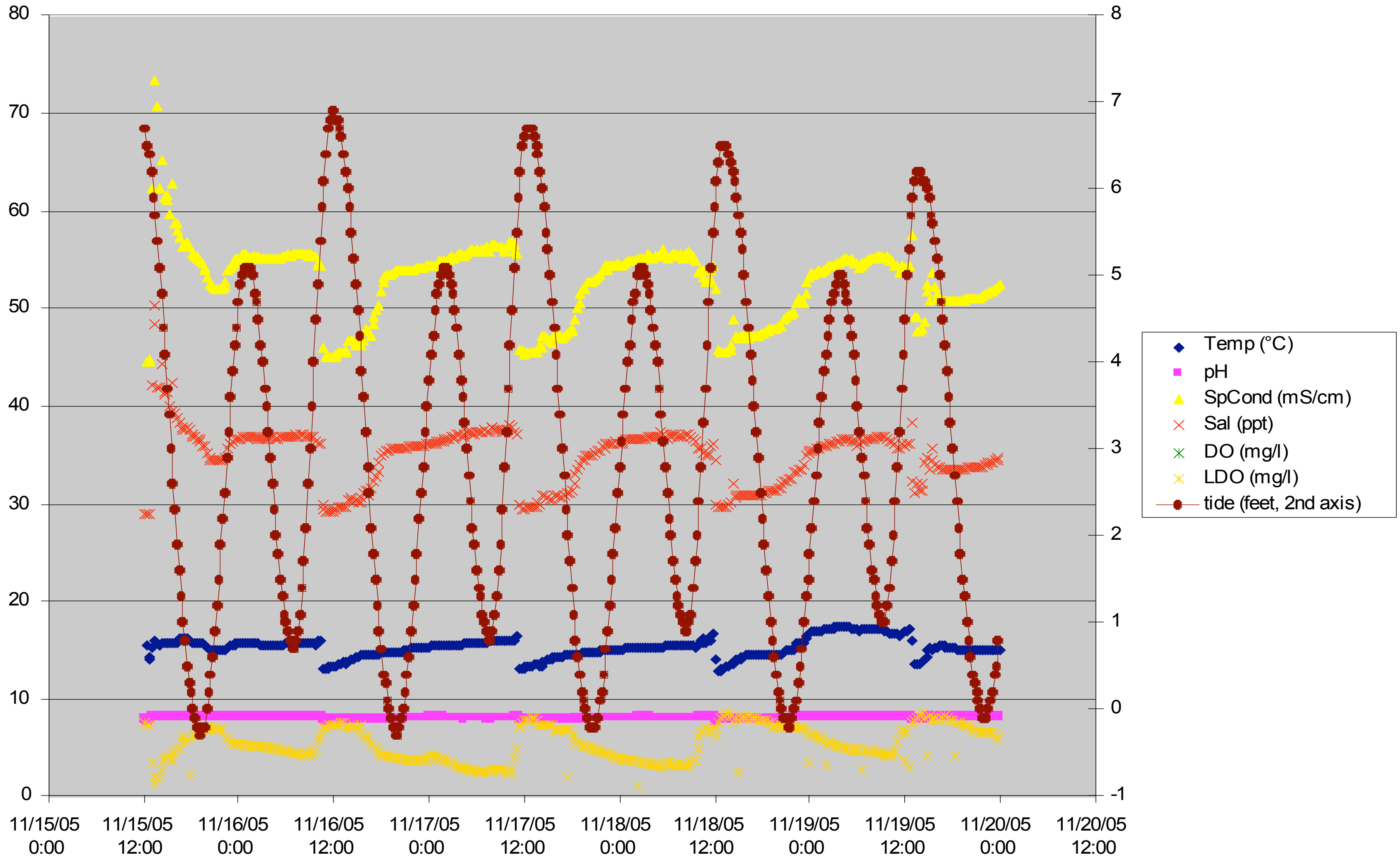

Figure 23. Pond B8A- values for 11/15/05 – 11/19/05

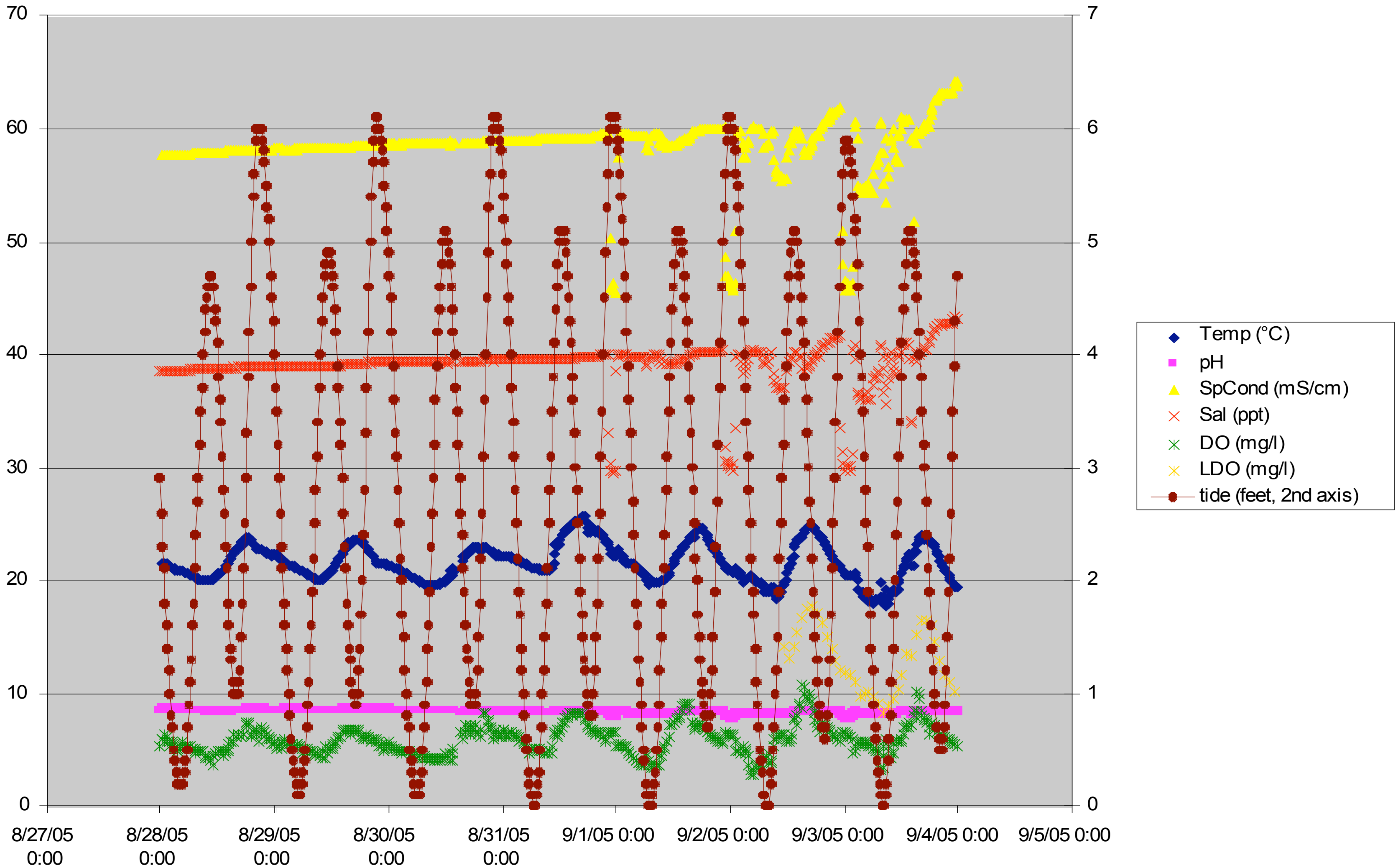

Figure 24. Pond B1- values for 8/28/05 - 9/3/05

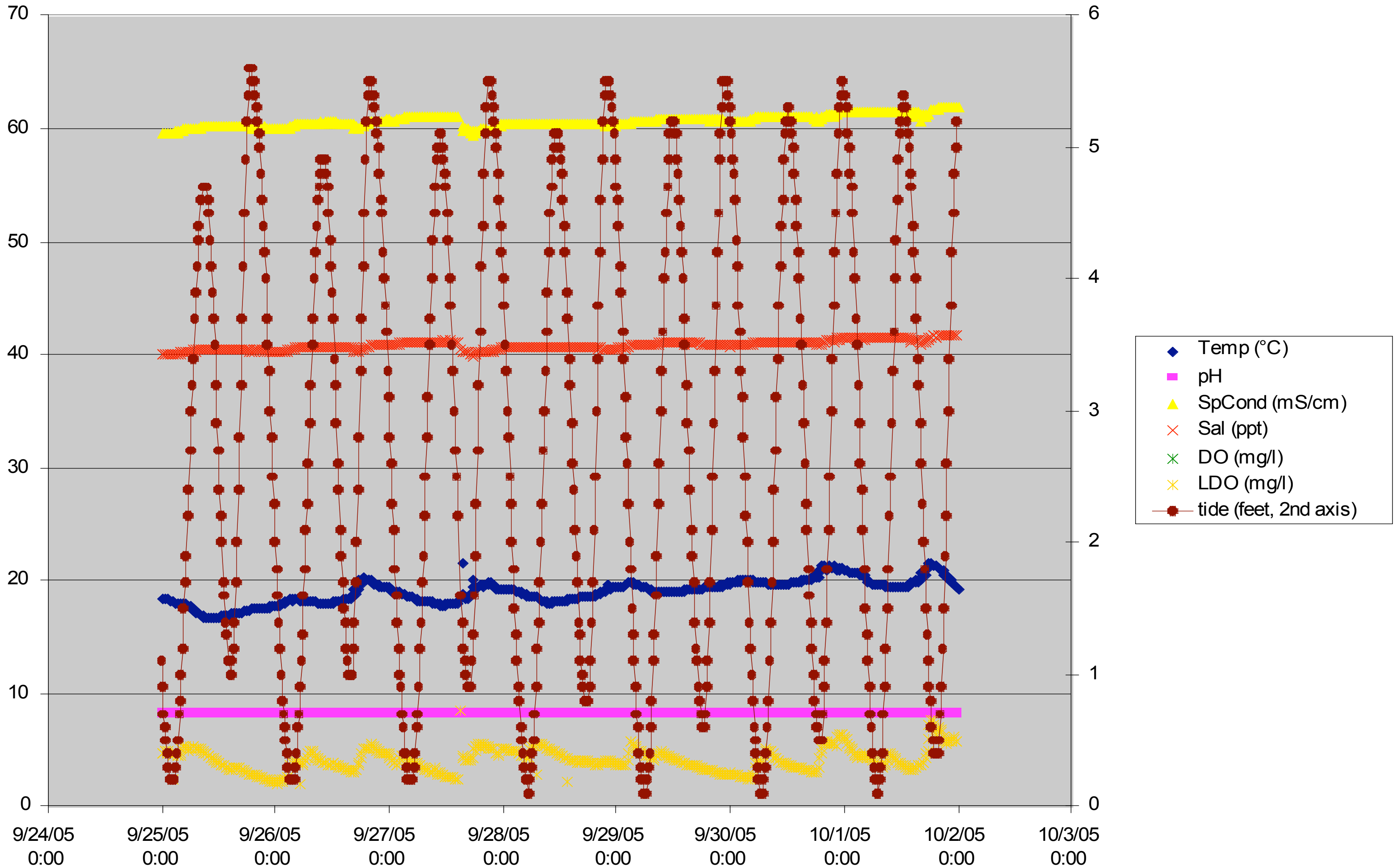

Figure 25. Pond B1- values for 9/25/05 – 10/1\/05

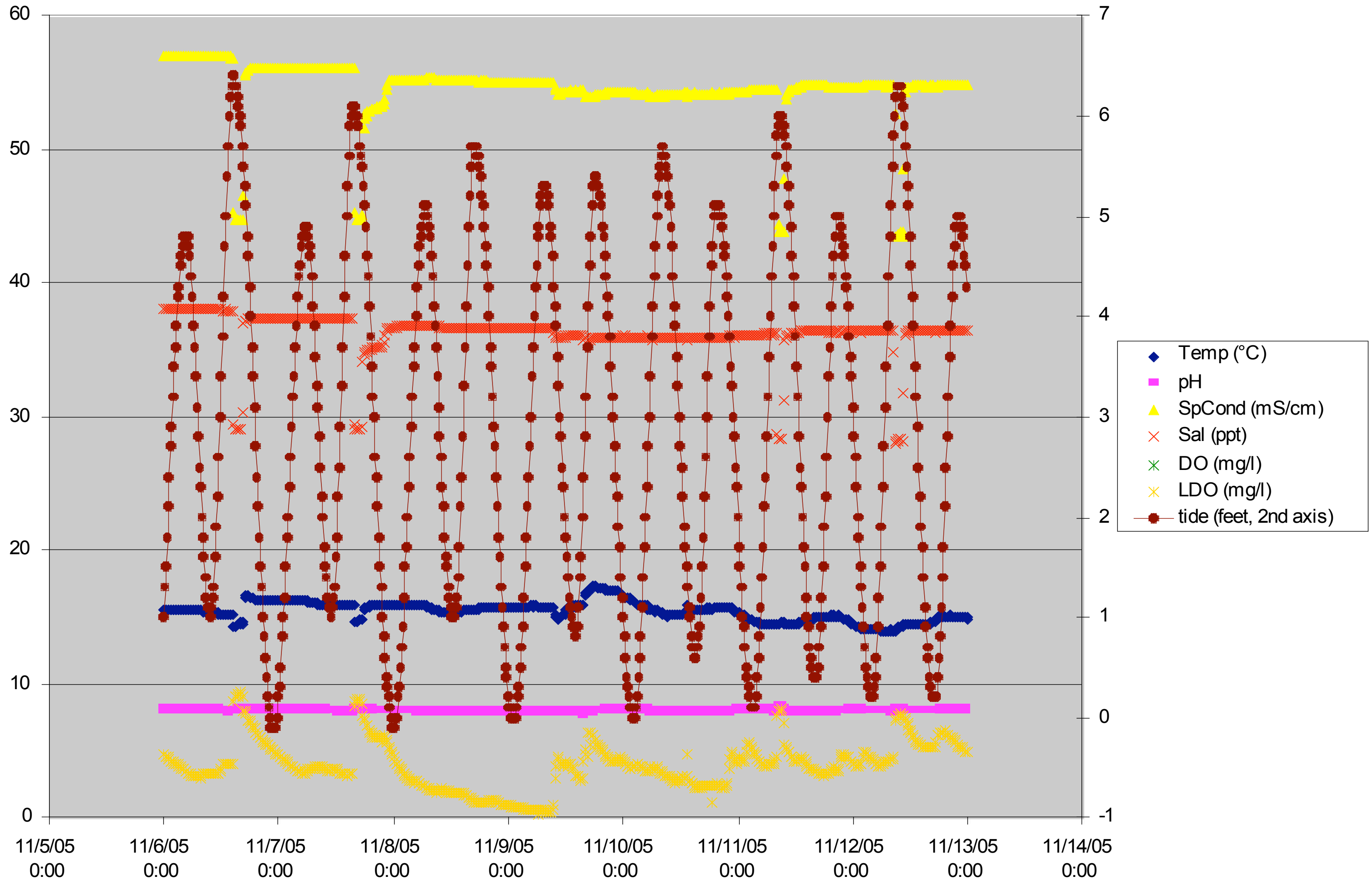

Figure 26. Pond B1- values for 11/6/05 – 11/12/05

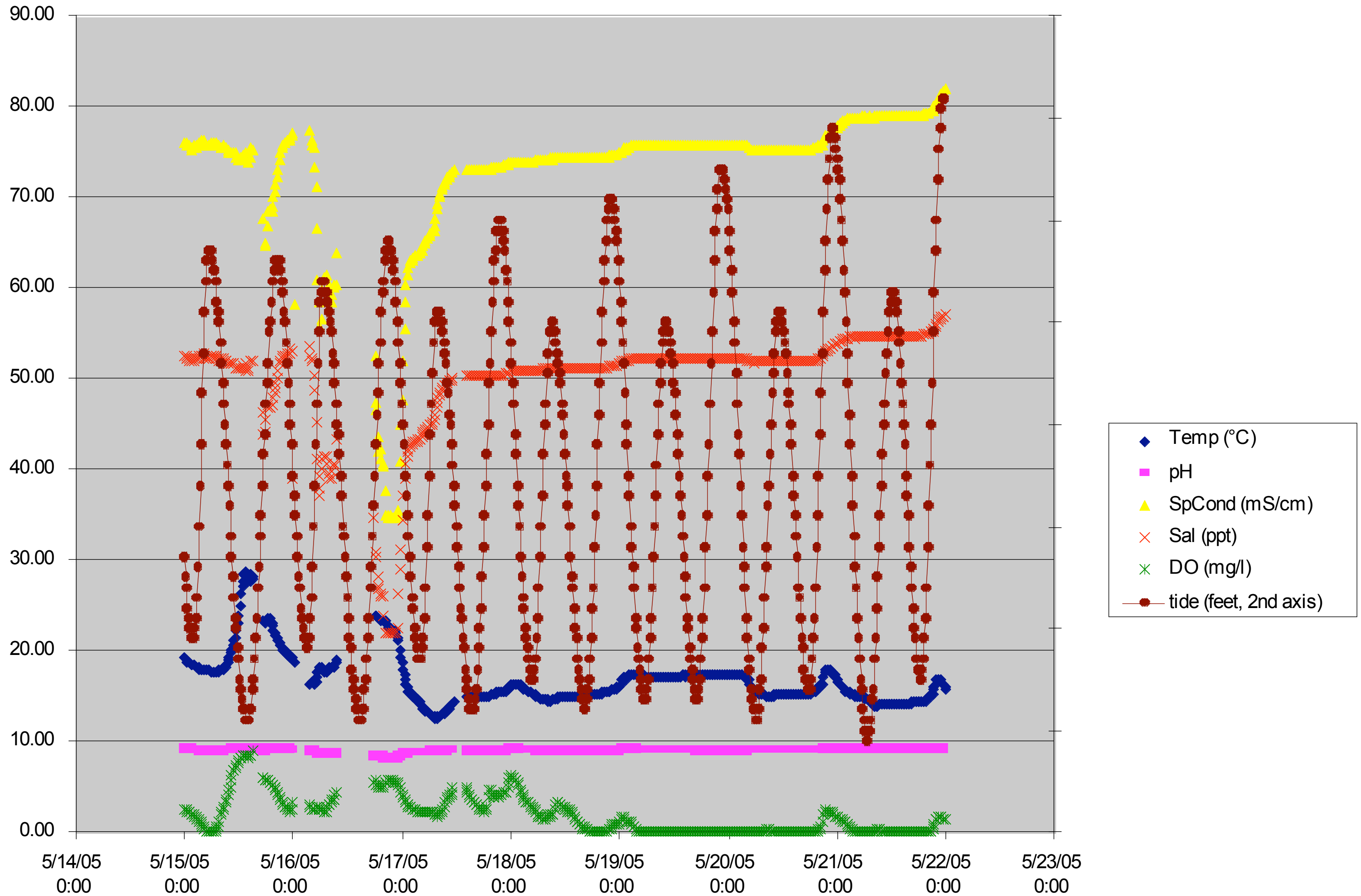

Figure 27. Pond B2C- values for 5/15/05 – 5/2/05 (Closed Discharge 5/16, Closed Intakes 5/17)

Invertebrate Monitoring

Waste discharge requirements did not require invertebrate monitoring for bay discharges, but did for slough discharges. Invertebrate collection was completed during slough water quality monitoring conducted for 2005; however, the analysis and discussion was not completed for this draft of the 2005 SRM. The Department does not have sufficient funds for USGS to continue with sorting, identifying and analyzing invertebrate data, and therefore to discuss the results. This is due largely because of the funding redirection to compensate for the unanticipated increase in slough monitoring required in 2005 as a result of weekly discharge values of concern. It was necessary for the USGS scope of work to be modified, particularly, the weekly receiving water monitoring, since some of the pond systems had greater than expected DO excursions.

The Department is developing alternatives to address this issue. We have been attempting to get assistance from developing internships, recruiting students from universities as well as reviewing seasonal aide and other staff availability, and may consider diverting some of the 2006 monitoring season funds to continue funding USGS staff to complete the identification, analysis and discussion. However, budget and staffing constraints must balance workload with usefulness and application of monitoring specified in the SMP.

Department staff consulted with USGS staff regarding the usefulness and applicability of the invertebrate monitoring efforts. An alternative to completing the invertebrate monitoring would be to postpone this work indefinitely.

For the B2C system, ISP initial release period salinity limits were set at 100ppt, and if salinity actually was that high or at least relatively elevated, the invertebrate monitoring might have been able to show effects of elevated salinity and residence time. Actual B2C salinity at the initial discharge was generally less than 50ppt, which was half of what was considered possible for initial release. Thus, salinity values were only slightly elevated above Continuous Circulation levels and those values were observed for only a very brief period. B2C values were always below 50ppt, including only 5 non-consecutive days of discharge above 44 ppt, which occurred in the first month after discharge, and generally values were between about 25-40 ppt. Considering these conditions, it appears that the invertebrate monitoring, intended to help determine effects, is unlikely to not provide any insight.

For initial release period conditions, if pond salinity levels had been substantially greater than the slough/bay ambient conditions, as was modeled in the ISP, the invertebrate monitoring may have been useful in determining what effects, if any, discharges had on slough invertebrates. ISP modeling predicted elevated salinity and longer residence times in sloughs than were observed. As none of the ELER ponds had daily mean salinities greater than CCP levels, except B2C, which was only 2ppt above CCP levels, effects of elevated salinity and longer residence times would not be expected to be apparent. Furthermore, receiving water monitoring prior to, immediately following and weeks after the initial release of the higher salinity (65 ppt) waters from North Creek did not indicate discernable affects of salinity or residence time. There appeared to be little indication that salinity values, residence time or stratification had any more effect than perhaps an acute exposure to higher salinity waters, which was limited to less than one day since the receiving water monitoring the day after the breach discharge began did not reflect values other than ambient conditions.

Considering that there is a seasonal difference in invertebrates, being short-lived organisms, the lack of conclusive data about water quality effects is additionally complicated. Furthermore, affects in the receiving waters were not readily observed in other water quality parameters except in few instances (generally only for DO, and only at or in the immediate vicinity of the discharge location), and in some of those limited instances, ELER pond systems weren't actually discharging. Therefore, fluctuations in the receiving waters, independent of discharge, would make too many variables to tease out any real info.

The Department proposes that the invertebrate analysis be deleted from SMR requirements altogether, as the time and cost associated with doing the tedious invertebrate sorting, identification and evaluation is not likely to provide much, if any, information relative to discharge effects on receiving water invertebrates. The invertebrate collections that was done won't be discarded, rather they can be stored and if at a later date there is a need to continue invertebrate studies, the collections might be at least useful as reference conditions in that local area. Limited monitoring funding may be better spent on other analysis efforts, such as synthesizing and further analyzing the collected pond and receiving water data to identify trends, patterns or relationships between pond and receiving water conditions, particularly for DO.

Metals- Water Column Sampling Results:

The results of the metals and total dissolved solids analyses are shown in Table 5. These data show that levels were not in excess of the Water Quality Objectives for trace metals.

Table 5. ELER Pond (Baumberg Complex) Metals and and Water Quality Objectives (WQOs).

	Cr (ug/L)		Ni (ug/L)		Cu (ug/L)		Zn (ug/L)		Ag (ug/L)		Cd (ug/L)		Pb (ug/L)		Se (ug/L)		As (ug/L)		Hg (ng/L)	
	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
B2C	0.4	<0.2	1.93	1.62	1.65	1.33	2.49	2.87	<0.2	<0.2	0.051	0.041	0.132	<0.10	0.114	0.103	2.23	2.12	3.16	0.55
B2	0.9	<0.2	4.56	4.28	3.06	2.59	4.71	1.26	<0.2	<0.2	0.037	0.035	0.430	0.116	0.267	0.252	13.6	12.7	3.43	1.33
B8A	1.1	<0.2	3.70	2.40	2.31	1.49	3.35	0.79	<0.2	<0.2	0.092	0.080	0.399	<0.10	0.209	0.170	3.08	2.53	10.1	0.79
B10	2.5	<0.2	5.69	2.40	2.14	1.03	3.87	0.42	<0.2	<0.2	0.055	0.045	0.785	<0.10	0.166	0.128	2.29	2.01	5.26	0.73
WQOs	**11.4**		**16.3**		**4.6**		**58**		**2.3**		**0.27**		**3.2**		**5.0**		**36**		**25**	

Note: Sample Methodology

Metal	EPA Method
Arsenic(Dis.)	206.3D
Arsenic (Tot.)	206.3TR
Mercury(Dis &Tot)	1631.00
Metals(Tot&Dis)	200.80
Selenium(Tot&Dis)	270.30

Note: All results are in micrograms/L

Sediment Monitoring

Upon completion of analysis for the 2005/2006 sediment samples, the report will be forwarded to RWQCB under separate cover. A preliminary summary of the 2005 USGS sediment sampling and analysis from late-September to mid-October, 2005 is provided in Appendix B.

USGS collected 21 surface (top 0-5 cm) sediment samples from ELER ponds (ED) from September 29 – October 13, 2005. Sediment sampling followed protocols from previous sampling efforts with slight modifications for site selection to allow for statistical comparisons within and among ponds. Sampling was stratified into 4 interconnected pond complexes comprised of ED-1/2/4, ED-6A/6B, ED-10/11, and ED-9/12/13/14. Sites were sampled using a 2 cm diameter corer made of PVC pipe. GPS coordinates and discrete water quality measurements (e.g. pH, temperature, salinity, Redox potential, dissolved oxygen) were recorded.

Battelle Marine Sciences Lab (Sequim, WA) conducted all Hg analyses. Total mercury (THg) analyses followed EPA guidelines (1996; Method 1631, Appendix A, digestion and cold vapor) and methyl mercury (meHg) analyses followed Bloom, et al. 1989 and 1997. Limits of detection averaged 0.005 mg/g for THg and 0.012 ng/g for meHg. Quality Assurance/Quality Control results were within accepted criteria and approved by Battelle. Relative percent difference for duplicate samples averaged 5% and 7% and recovery of matrix spikes averaged 87% and 95%. All concentrations were expressed on a dry weight basis.

Compliance Evaluation Summary

In the 2004 SMR, evaluation of DO data indicated that ceasing discharge from 10 pm to 10 am would avoid most of the excursions from the DO limit, as there is a strong diurnal pattern to DO levels. Daily discharge timing, however, is not practicable due to staff and budget constraints and was not implemented in 2005. We instead implemented a similarly effective alternative; during periods when the weekly 10th percentile is at or below the trigger value, that Department staff performed weekly discharge timing. This BMP may be particularly useful when trigger values are expected or observed to correspond with periods when overnight tides are low and would result in the majority of discharge volume, and/or with weak (neap) tide periods, when intake is more limited. Closing the discharge for a period of days when overnight DO levels in the pond are known to be or are expected to be low generally provides equivalent protection of receiving waters as would daily closure of the outlet gates. By adjusting discharge gates on an approximately weekly basis (with the number of days being depending on duration of the neap tide cycle), such management activities allow for periods when no discharge would occur, or when discharge would occur only during periods when releases from the pond mostly occur during the day, when pond DO levels are higher.

Discharge gates were also set to allow reduced discharge volumes versus discharge volumes that would be expected for normal operations described in the operations plans. For example, a gate would be set at approximately 10 percent open (versus normally 20%

open) during strong (spring) tide periods, when the weekly 10th percentile was at or below the trigger value. Reduced discharge settings reduce the volume of discharge water entering the receiving waters, and correspondingly minimize the extent to which low DO discharges could potentially affect receiving water quality. These reduced discharge volumes still allow for exchange of intake waters, since pond water levels would be lower than if no discharge occurred, which may also help to raise DO values by reducing overall residence time.

RWQCB previously indicated that the BMP providing installation of baffles should be implemented to help improve DO values at the discharge. For Systems B2C and B8A, the installation of baffles is not practicable and would not be expected to improve DO levels. In B2C, this is because there is no deep borrow ditch at the discharge, which is presumably where especially low DO water would be located, since this pond is generally more uniformly shallow and levee maintenance in this system has not historically required construction of borrow ditches. Instead weekly discharge timing and reduced discharge gate setting operations were implemented; however, patterns are not apparent to determine whether this operational BMP will be sufficient to prevent discharge of waters not meeting water quality standards. In Pond B8A, because of the high pond bottom, the only water in the pond is in the borrow ditch. Therefore, installation of baffles across the borrow ditch would not result in diversion of waters from other portions of the pond. Additionally, the B8A system performs substantially differently than other systems and low DO does not appear to be a chronic problem. Weekly discharge timing operations appear to be sufficient to prevent discharge of waters not meeting water quality standards. System B2 was not operated for most of the season due to levee maintenance, and therefore water quality values were presumably different than when the system is operated under Continuous Circulation. Weekly discharge timing operations appear to be sufficient to prevent discharge of waters not meeting water quality standards and low DO values were generally not observed.

Data, Collection, Evaluation, and Communication

A few gaps in the data sets were caused by malfunctioning meters, and few occasions were observed that showed the recorders were temporarily out of the water. While malfunctioning meters resulted in a few days of data gaps, there were no days when low water conditions resulted in full day data gaps. It should be noted that pond operations were monitored as much as possible, given staff limitations, and the down-time of the continuous data recorders was significantly reduced compared to 2004. Since meters have been adjusted more appropriately and pond operations are now better understood, in the future we expect that there will be few, if any, data gaps that result from management operations. Spare data recorders have been provided to address replacement during device servicing. These efforts are expected to ensure data is adequately recorded.

In 2005, USGS collected data and provided raw data to the Department on the same day it was downloaded from the meters. The Department was therefore able to review data as soon after it is collected to make effective operational and management decisions. Raw data was evaluated by USGS for accuracy and erroneous readings, and then typically provided the reviewed, calendar-weekly data set to the Department within one week of collection. This procedure led to improved flow and use of information. The Department reviewed the raw data set for potential problems and violations and immediately contacted RWQCB regarding potential violations. Once the Department had evaluated the reviewed calendar-weekly data, we either confirmed the possibility of a violation or explained that the data was faulty. Communications were typically made via telephone and/or email. Additionally, we provided the data to RWQCB by posting to its ftp site.

Regarding communication of compliance with Final Order requirements to the RWQCB, for 2005, the Department followed Standard Provisions and Reporting Requirements, which required that we report potential noncompliance events to RWQCB staff by phone within 24 hours, and follow-up with a written report within 5 business days. This effort was very helpful in addressing concerns and conversations and other written communications between the Department and RWQCB staff were very helpful.

Requests for Revisions to SMP:

As described previously, the Department proposes that the invertebrate analysis for ELER ponds be deleted from SMR requirements, as the time and cost associated with invertebrate sorting, identification and evaluation is not likely to provide much, if any, information relative to discharge effects on benthic invertebrates. Limited monitoring funding may be better spent on other analysis efforts, such as synthesizing and further analyzing the collected pond and receiving water data to identify trends, patterns or relationships between pond and receiving water conditions, particularly for DO.

We previously requested SMR requirements be modified for B10 discharge monitoring, which was approved by RWQCB. The change in the monitoring protocol for B10 was determined to be sufficient for monitoring water quality because of the uncontrolled muted tidal conditions which began in 2004 as a result of deterioration of the B10 WCS. B10 did not generally provide continuous ponding conditions and operated like a mudflat. Pond B10 was generally sampled weekly using discrete “grab” samples at two locations in the pond, and values were consistently within acceptable ranges for water quality objectives. The Department proposes that monitoring of receiving waters for bay discharges, including for Pond System B2 and Pond System B11 (for Pond B10 discharge operations), be deleted from SMR requirements.

Receiving water monitoring in the open bay for Pond B2 and B10 discharges is not likely to provide useful information. For Bay discharges, which occur at low tide, receiving waters cannot be sampled by boat since water depth is not sufficient. Monitoring cannot be conducted on the mudflat due to insufficient water depths, while suitable water depths for sampling may be as much as one mile or more from discharge locations. Such monitoring is not practicable, and is not particularly informative, since effects of discharge are expected to only be apparent locally, if at all, as demonstrated by slough discharge and receiving water monitoring. Furthermore, because the ponds discharge only at low tide, even when there is some depth in the receiving water, the discharge waters are immediately diluted over a large area. Generally, there are no actual receiving waters covering the mudflat and discharge waters disperse by sheet flow.

Appendix A: Metals- Water Column Sampling Report

Appendix B: Sediment Monitoring- Preliminary Results