May 31, 2005

Mr. Bruce Wolfe, Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA. 94612

Subject: 2004 Annual Self-Monitoring Report For South San Francisco Bay Low Salinity Salt Ponds (July 2004 – December 2004) Order No. R2-2004-0018, WDID No. 2 019438001.

Dear Mr. Wolfe:

This letter is in response to your March 25, 2005, file No. 2199.9438 (RS), Notice of Noncompliance with Order No. R2-2004-0018 Effluent Limits and Monitoring & Reporting Requirements, Review of Operations Plans and Annual Self-Monitoring Report, and Revisions to Self-Monitoring Program; South San Francisco Bay Low Salinity Salt Ponds, Alameda, Santa Clara, and San Mateo Counties.

Your letter requested that the USFWS resubmit its Operations Plans and Annual Self-Monitoring Report (ASMR) to address specific issues communicated in a March 3, 2005, meeting. This report provides revisions to our Operations Plan and ASMR to optimize operations for protection of water quality and evaluate the effectiveness of best management practices. For these reasons we will provide clearer cross-referencing between the two documents.

We would be pleased to discuss with your staff whether information in this report would be better presented or described in a different manner.

Please contact me or Eric Mruz of my staff at (510) 792-0222 if you have questions regarding this report.

Sincerely yours,

Clyde Morris, Manager
Don Edwards San Francisco
Bay National Wildlife Refuge

Enclosures

1. Explanation of Revisions to Operation Plans and ASMR
2. Revised Operations Plans
3. Revised Self Monitoring Report

cc: Carl Wilcox, CDFG
Steve Richie, CCC

Explanation of Revisions to Operation Plans and ASMR

As stated in the March 25, 2005, revisions letter:

For the revised Operation Plans, we request that USFWS (a) analyze the effectiveness of proposed corrective measures in minimizing dissolved oxygen violations (i.e., use 2004 data to show the effect of ceasing nighttime discharges), (b) implement corrective measures based on dissolved oxygen levels at the discharge instead of receiving water, (c) indicate metals monitoring will be conducted at the discharge point instead of in the receiving water, and (d) document measures it will implement to minimize the downtime of continuous monitoring devices.

Revisions to Operating Plans:

a) Effectiveness of proposed measures:

1. Increase the flows in the system by opening the A1 inlet further. If increased flows are not possible, fully open both the A1 and A2W gates to allow the ponds to become muted tidal systems until pond DO levels revert to levels at or above conditions in the Creek. *This was implemented in 2004 when the discharge monitoring showed low DO levels but the increased flow seems to have little to no effect on the DO levels within the ponds.*

2. Set in a series of flow diversion baffles at the pond discharge for directing the water from more suitable DO water levels to achieve maximum oxygen uptake. *Adding baffles to the ponds is an option if there are sections of the pond that have higher DO levels then what is being released. This BMP has been implemented at Pond A3W and at least at this point has prevented last year's uniquely low DO discharges.*

3. Cease nighttime discharges due to diurnal pattern. *Shutting the discharge outlets each afternoon and re-opening them in the morning would be very labor intensive, requiring the USFWS to hire another person for which currently there is no funding.*

4. Close discharge gates completely until DO levels meet standards. *If this BMP is implemented, FWS will need to monitor pond salinity closely and will notify the Water Board if the salinity increase to near the 44 ppt limit.*

5. Close discharge gates completely for a period of time each month when low tides occur primarily at night. *Based on a review of the 2004 DO levels in pond waters being discharged, this BMP does show that it would have some effect on reducing low DO discharges at certain times of the year. (**See Table 7- Closing of Discharge gates in ASMP**)*

6. Mechanically harvest dead algae. *The Refuge discussed this option with Cargill which had also considered this in their pond management and with the manager of the Sunnyvale Green Waste Program. The Refuge also attempted a small algae removal project at Pond A3W in 2004. The Refuge discovered that* m*echanically harvesting algae would be very difficult and expensive considering how large the ponds are. It would also be difficult to dry, and then dispose of large quantities of harvested algae in an urban environment. The Sunnyvale "green waste' facility has indicated that they were not interesting in receiving the dried algae from the ponds because the salinity would lower the acceptability of the use of their product as garden mulch.*

7. Install solar aeration circulators. *A pilot study will be implemented on Pond A7 with 4 SolarBee units to determine the effectiveness of this BMP.*

b) Implement corrective measures: additional corrective measures have been added to this year's Operation Plan and are stated under the heading of ***Dissolved oxygen and pH Control*.**

c) Metals monitoring: stated under the heading of ***Mobilization of Inorganics / and or the Methylation of Mercury Control.***

d) Minimize downtime: stated under the heading of ***Dissolved oxygen and pH Control***.

For the revised ASMR, we request that USFWS (a) address improvement of communication of discharge noncompliance, and document internal changes to show that data will be evaluated in the most timely manner possible (e.g., investigate the use of telemetry and protocol for evaluating data and reporting violations to Water Board staff), (b) interpret the benthic data provided, and document the condition of the benthic community during sample collection, (c) provide the detection limit for recent metals monitoring (Table 6 of ASMR), and (d) indicate that it will collect future sediment samples for methyl and total mercury at similar locations within ponds because of heterogeneous distribution of this pollutant in sediments.

Revisions to Annual Self- Monitoring Report:

a) Address improvement of communication of discharge noncompliance: stated in **5.0 Future Monitoring Plans,** *Communications.*
A pilot study will start in the summer of 2005 at Pond A3W. In which a telemetry system will be installed to see Real Time data that the Datasonde is collecting, which will be available for view on the internet for all Agencies involved.

b) Interpret benthic data: The results of the 2004 benthic invertebrate sampling did not detect impacts from the Alviso Salt Pond discharges. Some trends were observed during sampling; however, the results of the sampling could have been more definitive if more data was obtained and the pre-release samples were taken closer to the post-release samples. It is possible that the results were confounded by the difference in the sampling seasons rather than the difference in the water quality coming from the ponds. To improve on the 2004 benthic invertebrate sampling, in 2005 we have included pre-release samples taken just 7 days before the first release from the Phase 2 ponds. The results from the 2005 sampling should provide us with a more appropriate comparison between pre-release and post-release benthic populations. *(**see Appendix E**).*

c) Detection limits for recent metals: located in **Table 6**.

d) Indication of collecting future sediment samples for methyl and total mercury: FWS asked Keith Miles from USGS to revise last year's Hg monitoring plan based on the results from the 1st year Hg monitoring. He submitted his proposed plan which we have forwarded to the Water Board for comment. Because the purpose of the Hg monitoring in the ponds is to help us better design the long-term restoration project

(South Bay Salt Pond Restoration Project), with your permission, FWS asked the SBSP science team to review the Miles revised Hg monitoring plan. They will review the plan in light of the existing Hg studies in the north and south San Francisco Bay as well as the recently proposed Hg study centered on Pond A8 and Alviso Slough. Once FWS receives these review comments (1 or 2 months), FWS will work with the California Department of Fish and Game, USGS and the Water Board to finalize a fundable Hg monitoring plan to add to the ASMR.

2004 Annual Self Monitoring Program for Alviso Ponds within South San Francisco Bay Low Salinity Salt Ponds Alameda, Santa Clara, and San Mateo Counties

Order No. R2-2004-0018

WDID No. 2 019438001

Prepared for:

California Regional Water Quality Control Board
San Francisco Bay Region
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Self-Monitoring Report

1.0. Introduction:

This annual report summarizes the results of the 2004 water quality sampling conducted at the Alviso Salt Ponds in Santa Clara County, which are part of the South San Francisco Bay Low Salinity Salt Ponds. Operations occurred from July through December 2004. Sampling was performed on a continuous, weekly, monthly or bi-monthly schedule as required by the Final Order (No. R2-2004-0018). Sampling was performed by U.S. Geological Survey (USGS) on behalf of the U.S. Fish and Wildlife Service (FWS) in accordance with the waste discharge requirements.

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 only covers Alviso Pond Systems A2W, A3W and A7 operated by the Don Edwards San Francisco Bay National Wildlife Refuge in Santa Clara County. Other ponds in Santa Clara County and the ponds in San Mateo County were not opened to the Bay in 2004 and hence are not covered in the 2004 Annual Report. The California Department of Fish and Game will be submitting a report for the Eden Landing (Baumberg) Ponds under a separate cover.

The ponds are generally being operated as flow-through systems with Bay waters entering an intake pond at high tides through a tide gate, passing through one or more ponds, and exiting the discharge pond to a tidal slough or the bay at low tides. The ponds only discharge at low tides, generally about 6 or 8 hours per day. Two ponds in the Alviso system (Ponds A3N and A8) were operated as seasonal ponds during 2004 and were not connected to the flow-through system.

The Final Order recognized two periods of discharges from the ponds: the Initial Release Period when salinity levels would decrease from the initial levels in the ponds and a Continuous Circulation period after salinities reached the 44 ppt salinity discharge limit. Different monitoring plans were identified in the Final Order for each specific period.

2.0. 2004 Annual Summary

This section summarizes the activities performed during the 2004 calendar year at the Alviso Pond Complex to comply with RWQCB Final Order.

2.1 Water Quality Monitoring Summary

The site location is shown in Figure 1 and sampling locations are shown in Figures 2a and 2b. Initial Release Period monitoring parameters are shown on Table 1a; Continuous Circulation Period monitoring parameters are shown on Table 1b.

Pond Systems A2W and A3W were opened to the Bay on July 19, 2004 and Pond System A7 was opened to the Bay on July 26, 2004. Pond Systems A2W and A3W met the 44 ppt salinity discharge limit and hence the requirements for the Continuous Circulation Period monitoring on

July 19. However, in addition to Pond System A7, we monitored Pond System A3W in accordance with the Initial Release Monitoring Plan in order to gather additional information for future releases. Because of miscommunications at the early stages of release as to which monitoring plan would be followed for each pond system, invertebrate data was not collected before beginning discharge at A3W and A7, though subsequent samples were immediately collected.

The data for this sampling period are presented in several ways. Tables 2 and 3a-c present data for receiving waters and discharges as daily averages. Figures 3 through 14 show daily average discharge data plotted with actual site specific data for receiving waters. Appendix D presents all receiving water data as well as all continuous monitoring data on the computer disk attached to this report. Other water quality data collected are shown in various tables, including benthic sampling (Tables 4a - b), chlorophyll-a (Table 5) and metals in the water column (Table 6). The results of required "management sampling" are shown in Appendix B.

The results of the 2004 sampling events indicate:

Salinity

- Pond System A7 was the only one of the three pond systems initially above the 44 ppt salinity required for Continuous Circulation. Salinities behaved as predicted. When opened on July 26, salinities discharging from A7 were at 51 ppt, rose to almost 54 ppt on July 28 and then fell to below 44 ppt by August 10, 2004. The salinities fell below 35 ppt by September 1. (See Figure 11).

- The salinity levels for all ponds now remain well below 44 ppt and generally reflect slightly higher salinities than the intake waters from the bay and sloughs. (See Figures 3, 7 and 11).

*Temperatur*e

- Temperature levels in the ponds generally matched the temperature levels in the intake and receiving waters and therefore met the discharge limits of not exceeding natural temperatures of the receiving waters by 20^{o}F. (See Figures 5, 9 and 13).

pH

- Levels of pH varied differently in each Pond System, but were generally greater than 8.5. In A2W, pH increased to above 9.0 within a month after the initial start of operations and then fell below 9.0 and leveled off until mid October when rains began and pH levels fell. Pond System A3W followed a similar pattern although it stayed above 9.0 for a longer period than A2W. Pond System A7 stayed generally between 8.5 and 9.0 throughout the initial release period but increased above 9.0 in mid-November after heavy rains. (See Figures 4, 8 and 12).

- Levels of pH in receiving waters remained below the 8.5 discharge limits on all but two occasions. On July 28, one sample at the mouth of Guadalupe Slough was recorded at 8.7, though other samples throughout the slough and closer to the discharge point were below 8.5. (See Figure 8 and Appendix C). This sample was taken on an incoming tide close to the Bay and pH level is assumed not to be a result of this discharge. On August 23, the most upstream sample point in Alviso Slough showed a pH level of 8.9 though other samples through the slough and closer to the discharge point were below 8.5. (See Figure 12 and Appendix D). This sample was taken at the ebb of the daily higher low tide and it is presumed that the waters at this upstream sample point should have contained mostly flows coming from the Guadalupe River to Alviso Slough. Hence the high pH level at that point is presumed to be more influenced by Guadalupe flows than the A7 discharge.

Dissolved Oxygen

- Based on daily averages of our continuous monitoring for dissolved oxygen, discharges were below the 5.0 mg/L compliance limit as follows: Pond System A2W: 109 total recorded days with 39 days below 5.0 mg/L; Pond System A3W**:** 99 total recorded days, with 91 days below 5.0 mg/L; and Pond System A7**:** 118 total recorded days with 77 days with a daily average dissolved oxygen below 5.0 mg/L.

- Based on the number of days when dissolved oxygen levels fell below 5.0 mg/L during any 15-minute increment during the 6-8 hour low tide period when discharges occurred, discharges were below 5.0 mg/L as follows: Pond System A2W: 109 total recorded days with 82 days below 5.0 mg/L; Pond System A3W: 99 total recorded days with 95 below 5.0 mg/L; and Pond System A7: 118 total recorded days with 106 days with actual days dissolved oxygen below 5.0 mg/L.

- Monitoring efforts showed that dissolved oxygen levels in Ponds A2W and A7 exhibited a strong diurnal pattern (low dissolved oxygen near dawn and higher levels at mid-day), but that receiving water monitoring in the Bay and Alviso Slough did not detect reductions in dissolved oxygen levels from these discharges. The discharge from Pond A3W showed consistently low dissolved oxygen levels, and monitoring of Guadalupe Slough indicates that Pond A3W may have caused dissolved oxygen depressions in certain areas. For that reason, the discharge gates for Pond A3W were closed from September 9 through October 16, when heavy rains were predicted, and subsequently fell.

- To evaluate why dissolved oxygen levels in Pond A3W were severely depressed on a consistent basis (i.e., below 1 mg/L), the Discharger performed two surveys and determined the low dissolved oxygen levels in the Pond A3W discharge were the result of a large mat of decaying algae in one area of the pond, and were not representative of the general state of the pond. Since the discharge point for Pond A3W was located near the edge of this algal mat, water currents caused discharge waters to flow through the area of algae buildup which resulted in consistently depressed dissolved oxygen levels.

- The ROWD and the Final Order recognized that the ponds would likely exhibit a diurnal dissolved oxygen pattern, with saturated conditions during the day, and low levels during the night and predawn hours. This was not expected to cause significant dissolved oxygen depression in sloughs, and the monitoring indicates that it did not cause problems under these normal diurnal conditions. However, in situations where the discharge point is near accumulating dead algae, the discharge could produce a significant DO sag in receiving waters and actions should be taken. FWS will install flow diversion baffles in the pond next year to move the flow of water away from algae buildup and to increase oxygen uptake in Pond A3W. However, further discussions need to be pursued with the RWQCB concerning alternatives to achieving the discharge limits for dissolved oxygen in natural diurnal situations such as at A2W and A7.

Metals

- Annual water column sampling data indicated that levels of metals in discharge waters for all Alviso ponds met water quality objectives for San Francisco Bay receiving waters. (See Table 6).

Invertebrates

- Analysis of preliminary data from Alviso and Guadalupe Sloughs indicates more diverse populations of invertebrates than expected. Seventeen taxa were found in Guadalupe Slough and fourteen taxa were found in Alviso Slough. (See Tables 4a-b). Although pre-discharge samples were not collected, no linear patterns could be detected to indicate any immediate potential effects from the discharge. Identification of benthos at additional sample points and QA/QC remain to be completed.

2.2. Water Quality Monitoring Methodology

Continuous Pond Discharge Sampling (Initial Release and Continuous Circulation): USGS installed continuous monitoring Datasondes (Hydrolab-Hach Company, Loveland, CO) in Alviso ponds A2W, A3W, and A7, , prior to their initial release dates and through October (A2W) or November (A3W and A7) 2004. Datasondes were installed on the inside of the water control structures at the discharge into the slough and/or San Francisco Bay using a PVC holder attached to a ground-mounted pole 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.

Salinity, pH, temperature, and dissolved oxygen were collected at 15-minute intervals with a sensor and circulator warm-up period of 2 minutes. Data were downloaded weekly and sondes 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. Any problems detected with the Datasonde were corrected through calibration or replacement of parts or instruments. The sensors on the Datasonde were calibrated prior to deployment into the salt pond and were calibrated and cleaned on a biweekly schedule unless otherwise noted in service records. 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.

Receiving Water Sampling (Initial Release and Continuous Circulation): 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 Guadalupe Slough adjacent to Alviso pond A3W (8 sites) and Alviso Slough adjacent to Alviso pond A7 (7 sites) from July 2004 through November 2004. Additionally, water quality measurements were collected after initial discharge and then monthly in San Francisco Bay outside the water control structure in pond A2W (3 sites) from July 2004 until October 2004.

Sampling locations were marked using a GPS waypoint. USGS 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, CO) was used to measure salinity, pH, turbidity, temperature, and dissolved oxygen at each location.

From July 2004 through September 2004, readings were collected only from the near-surface at a depth of approximately 25 cm. From October 2004 through November 2004, 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. Alviso pond A2W receiving water sites could only be accessed during high tides over 6.0 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, fisher people 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 twice monthly in Alviso salt ponds A2E, AB2, A2W, A3W, and A7 salt ponds from May through July 2004 (i.e., two months prior to the initial release of ponds A2W, A3W, and A7). Management sampling in ponds A2E, AB2, and A3N were continued monthly following the initial release of the ponds, according to the schedule for

Continuous Circulation Monitoring. One sampling location was established for each salt pond and samples were collected between 0800 and 1000 hours (Appendix A). A Hydrolab Minisonde (Hydrolab-Hach Company, Loveland, CO) 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 (Ertco, West Paterson, New Jersey) to a precision of 0.0005. At hypersaline ponds (>70 ppt), only hydrometers were used to measure salinity.

***Chlorophyll-a sampling (for Continuous Circulation Monitoring*)**: USGS collected chlorophyll samples monthly in Alviso salt ponds A2E, AB2, and A3N in September and October 2004. Two to three sampling locations were established for each salt pond and water quality measurements were collected between 0800 and 1000 hours of the same day or within one day of chlorophyll sample collection. A recently calibrated Hydrolab Minisonde (Hydrolab-Hach Company, Loveland, CO) was used to measure salinity, pH, turbidity, temperature, and dissolved oxygen at each location. Readings were collected from the near-surface at a depth of approximately 25cm.

USGS determined Chlorophyll-a levels using a TD700 fluorometer. Water samples were collected at 2-3 established sampling locations per pond using a water collection pole and 500ml dark Nalgene bottles. Samples were packed in ice for transport, and filtered by USGS staff in within 24 hours of collection. Samples were filtered with 25 mm Whatman GF/F (glass fiber filters) (Whatman International, Maidstone, England) and filters were frozen at least 24 hours. Extraction solvent (90% acetone) was then added to the filters at least 48 hours after filtration. Absorbance of the extracts was read using a TD700 fluorometer. Chlorophyll concentration was calculated using the Fluorometric equations for extracted chlorophyll-a and pheopigments (Holm-Hansen et al.1965).

Annual Water Column Sampling for Metals: Water column samples were collected on 23 September 2004, 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 ToxScan, Inc. Samples from ponds A2W and A3W were collected approximately 30 meters west of each pond's water control structure, whereas pond A7 was sampled 30 meters north of its water control structure. Salinity, temperature, pH, and dissolved oxygen were measured concurrently with water column sample collection using a Hydrolab Minisonde (Hach Hydrolab, Loveland, CO). Collected samples were immediately stored on ice in a cooler and shipped overnight to ToxScan, Inc. (Watsonville, CA).
Dissolved mercury samples were immediately filtered by ToxScan, Inc., and all mercury samples were shipped to Columbia Analytical Services, Inc. (Kelso, WA), where the samples were analyzed using EPA method 1631. ToxScan, Inc. analyzed total and dissolved chromium, nickel, copper, zinc, silver, cadmium, and lead using EPA method 200.8; total and dissolved selenium (EPA 270.3) and arsenic (EPA 206.3) were determined with more sensitive analyses recommended for those metals. Total Suspended Solids (TSS) samples were forwarded to Soil Control Lab (Watsonville, CA) for analysis. All labs reported that the samples arrived intact and were handled with the proper chain-of-custody procedures, and that appropriate QA/QC guidelines were employed during the analysis on a minimum 5% basis.

Benthic Invertebrate Sampling: The results of the 2004 benthic invertebrate sampling did not detect impacts from the Alviso Salt Pond discharges. Some trends were observed during sampling; however, the results of the sampling could have been more definitive if more data was obtained and the pre-release samples were taken closer to the post-release samples. It is possible that the results were confounded by the difference in the sampling seasons rather than the difference in the water quality coming from the ponds. To improve on the 2004 benthic invertebrate sampling, in 2005 we have included pre-release samples taken just 7 days before the first release from the Phase 2 ponds. The results from the 2005 sampling should provide us with a more appropriate comparison between pre-release and post-release benthic populations.

Calibration and Maintenance: All the instruments used for sampling as part of the South Bay Salt Pond Initial Stewardship Plan's Self-Monitoring Program 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. 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 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. We 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.

2.3 Sediment Monitoring Summary

In late summer and early fall of 2003 and 2004, USGS completed baseline sampling of sediments for mercury and methyl mercury in all Alviso Ponds included in the 2004 release (Ponds A1 through A8). Additional baseline sampling was completed for many Alviso Ponds scheduled to be released in 2005. A full report of their data collection efforts is presented in Appendix C.

USGS collected surface (top 5 centimeters) and inner (15-20 centimeters below surface) sediments from the ponds and analyzed them variously for total mercury and methyl mercury. In addition, sulfide levels were determined for sediment samples collected in 2004. Total mercury results were comparable for surface and inner sediments. However, methyl mercury was significantly higher in surface sediments. Sulfide concentrations alone were poor predictors of either total or methyl mercury concentrations.

Ponds closest to Alviso Slough contained the highest levels of both total mercury and methyl mercury, though Pond A3N at the mouth of Guadalupe Slough contained the highest levels of methyl mercury in the Alviso ponds prior to discharge. Pre- and post discharge data are not yet sufficient to determine the potential impacts of management operations. Additional samples for this pond series will be collected this winter and again in late summer at Ponds AB1, A5 and A7 where north/south depth gradients result in exposed mudflats in portions of these ponds, as well as Pond A3N which contained the highest levels of methyl mercury prior to discharge and is now being managed as a seasonal pond.

3.0 Compliance Evaluation Summary

Continuous Monitoring Datasondes were installed on the water control structures and collected at 15 minute intervals at the outflow of the discharge into the slough at A2W, A3W and A7. . Based on the requirement that DO could never be discharged at levels below 5.0 mg/L, violations are summarized below:

Pond	Sampling Period	Parameters	Total No. of Sample days	No. of Sample days in Violation (based on daily averages)[1]	No. of Sample Days in Violation (based on any discharge of 15 minutes or more)[2]
A2W	7/16/04 – 11/1/04	DO	109	39	82
A3W[3]	7/16/04 – 11/29/04	DO	99	91	95
A7	7/27/04 – 11/29/04	DO	118	77	106

[1] Sample day was determined to be in violation if daily average of dissolved oxygen was below 5.0 mg/L.
[2] Sample day was determined to be in violation if dissolved oxygen was below 5.0 mg/L during any 15-minute interval when tidal discharge gates were open.
[3] A3W discharge gates were closed from 9/9/04 – 10/16/04 and not included in sampling days.

4.0 Data Reporting for Results Not Yet Available:

5.0 Future Monitoring Plans

For the 2005 monitoring period the USFWS will provide the time period each day that ponds discharge as well as an estimate for the quantity of discharge into the sloughs. This will provide context of the amount of pond waters entering sloughs and the Bay relative to ambient flows, intermittent nature of the discharges, and to document the effect of manipulating flow rates on receiving water quality.
We asked Keith Miles from USGS to revise last year's Hg monitoring plan based on the results from the 1st year Hg monitoring. He submitted his proposed plan which we have forwarded to you for your comment. Because the purpose of the Hg monitoring in the ponds is to help us better design the long-term restoration project (South Bay Salt Pond Restoration Project), with your permission, we have asked the SBSP science team to review the Miles revised Hg monitoring plan. They will review the plan in light of the existing Hg studies in the north and South San Francisco Bay as well as the recently proposed Hg study centered on Pond A8 and Alviso Slough. Once we receive these review comments (1 or 2 months), we will work with the

California Department of Fish and Game, USGS and your office to finalize a fundable Hg monitoring plan to add to the ASMR.

Communications: To improve communication and analyze effectiveness of proposed corrective methods an evaluating discharge data, the USFWS will work more closely with USGS and RWQCB to report water quality concerns and discharge violations in a timely manner. As part of internal changes for better communication among Agencies, the USGS and USFWS implemented protocols to stay in weekly and often daily contact concerning water quality issues.

Table 1a – Initial Release Monitoring Plan for Alviso Ponds

Sampling Stations	D.O.	pH	Temperature	Salinity	Benthos	Sample Function
A-A2W-0	E	E	E	E		Management
A-A2W-1	A	A	A	A		Discharge
A-A2W-2	A	A	A	A	D	Receiving Water
A-A2W-3	A	A	A	A	D	Receiving Water
A-A2W-4a	B	B	B	B	D	Receiving Water
A-A2W-4b	B	B	B	B	D	Receiving Water
A-A2W-4c	B	B	B	B	D	Receiving Water
A-A2E-0	E	E	E	E		Management
A-B2-0	E	E	E	E		Management
A-A3W-0	E	E	E	E		Management
A-A3W-1	A	A	A	A		Discharge
A-A3W-2	A	A	A	A	D	Receiving Water
A-A3W-3	A	A	A	A	D	Receiving Water
A-A3W-4	A	A	A	A	D	Receiving Water
A-A3W-6	A	A	A	A	D	Receiving Water
A-A3W-7	A	A	A	A	D	Receiving Water
A-A3W-8	A	A	A	A	D	Receiving Water
A-A3W-9	A	A	A	A	D	Receiving Water
A-A7-0	E	E	E	E		Management
A-A7-1	A	A	A	A		Discharge
A-A7-2	A	A	A	A	D	Receiving Water
A-A7-3	A	A	A	A	D	Receiving Water
A-A7-4	A	A	A	A	D	Receiving Water
A-A7-5	A	A	A	A	D	Receiving Water
A-A7-7	A	A	A	A	D	Receiving Water
A-A7-8	A	A	A	A	D	Receiving Water

Legend for Table 1a

A = Receiving water samples shall be collected at discrete locations from downstream to upstream around high tide at the following frequency: one week before initiating discharge, one day after the initial discharge, +3, +7, then weekly until the Discharger documents that the discharge salinity levels are below 44 ppt. Once discharge begins, discharge pond samples shall be collected before pond water mixes with receiving water using a continuous monitoring device. For days it collects receiving water samples, the Discharger shall also report standard observations, as described in Section D of SMP.

B = Receiving water samples shall be collected at discrete locations in the Bay at the following frequency: one week before initiating discharge, one day after the initial discharge, +3, +7, then weekly until the Discharger documents that discharge salinity levels are below 44 ppt. For days it collects receiving water samples, the Discharger shall also report standard observations, as described in Section D of the SMP.

C = Not Used

D = Samples for benthos shall be collected from discrete locations at the convenient stage of the tide at the following frequency: One week before initiating discharge, 14 days after the initial discharge, +28, once in the late summer (August/September), and then once in the late summer of the following year.

E = Samples shall be collected within ponds at least twice per month for at least the previous 2 months before discharges commences. Dissolved oxygen samples shall be collected between 0800 and 1000 hours. Time of sampling shall be reported.

Table 1b – Continuous Circulation Monitoring for Alviso Ponds

Sampling Station	D.O.	pH	Temp.	Salinity	Chlorophyll a	Metals/Water Column	Sample Function
A-A2W-1	A	A	A	A		C	Discharge
A-A2W-4a	B		B	B			Receiving Water
A-A2W-4b	B		B	B			Receiving Water
A-A2E-0	E	E	E	E	E		Management
A-B2-0	E	E	E	E	E		Management
A-A3N-0	E	E	E	E	E		Management
A-A3W-1	A	A	A	A		C	Discharge
A-A3W-3	A		A	A			Receiving Water
A-A3W-6	A		A	A			Receiving Water
A-A7-1	A	A	A	A		C	Discharge
A-A7-3	A		A	A			Receiving Water
A-A7-7	A		A	A			Receiving Water
A-A8-0	E	E	E	E	E		Management

Legend for Table 1b

A = Receiving water slough samples represent one point upstream and one point downstream of the discharge point. The positions indicated on Figure 2 should be considered approximate. It should be the intent of the Discharger to collect upstream samples at a point where the receiving water is unaffected by the discharge, and downstream samples at a point where the discharge has completely mixed with the receiving water, but as close to the discharge point as practicable. Receiving water slough samples shall be collected monthly from May through October as close to low tide as practicable. Discharge pond samples shall be collected before pond water mixes with receiving water using a continuous monitoring device from May through October. For days it collects receiving waters samples, the Discharger shall also report standard observations, as described in Section D of the SMP.

B = Receiving water bay samples represent one point above and one point below the discharge point. The positions indicated on Figure 2 should be considered approximate. It should be the intent of the Discharger to collect samples as close to the discharge point as practicable with one point unaffected by the discharge, and one point where the discharge has completely mixed with the bay. Receiving water bay samples shall be collected monthly from May through October as close to low tide as practicable. For days it collects receiving water samples, the Discharger shall also report standard observations, as described in Section D of the SMP.

C = Water column samples for total and dissolved arsenic, chromium, nickel, copper, zinc, selenium, silver, cadmium, lead and mercury shall be collected annually in august or September. When collecting metals samples, the Discharger shall also monitor for salinity, and total suspended solids.

D = Not used.

E = Samples shall be collected within ponds monthly from May through October. Dissolved oxygen samples shall be collected between 0800 and 1000 hours. Time of sampling shall be reported.

Table 2: Daily Average for all Sample Points in Receiving Waters

Pond	Date	DO (mg/L)	pH	Temp C	Salinity
A2W	7/11/2004	7.2	7.8	22.2	20.7
A2W	8/9/2004	5.5	7.9	22.6	22.0
A2W	9/20/2004	5.9	7.8	17.1	26.5
A2W	10/27/2004	5.8	7.8	13.3	22.3
A3W	7/12/2004	5.1	7.9	22.9	16.9
A3W	7/20/2004	6.3	7.9	24.4	18.8
A3W	7/22/2004	5.6	7.9	25.5	19.7
A3W	7/26/2004	3.4	8.0	26.5	22.0
A3W	7/29/2004	6.6	8.0	23.9	22.2
A3W	8/2/2004	4.5	7.8	21.3	25.2
A3W	8/9/2004	5.0	8.3	24.2	19.0
A3W	8/16/2004	4.7	7.9	23.4	23.4
A3W	8/23/2004	3.6	8.3	22.6	20.1
A3W	8/30/2004	4.7	7.7	24.5	25.0
A3W	9/13/2004	5.2	7.9	22.8	23.0
A3W	9/20/2004	7.4	7.7	17.9	8.2
A3W	9/27/2004	4.5	7.7	19.8	18.6
A3W	10/4/2004	7.1	7.9	18.8	10.0
A3W	10/12/2004	6.5	7.9	19.0	19.6
A3W	10/18/2004	3.5	8.2	18.0	15.9
A3W	10/27/2004	4.1	7.6	14.9	14.6
A3W	11/5/2004	5.9	7.8	13.7	16.2
A3W	11/12/2004	6.9	7.8	14.6	20.6
A3W	11/19/2004	7.6	8.0	14.8	14.8
A3W	11/24/2004	7.3	7.9	11.7	21.3
A3W	11/30/2004	9.0	8.1	9.6	15.7
A7	7/12/2004	5.4	7.9	24.0	14.5
A7	7/20/2004	5.9	7.7	25.0	10.2
A7	7/27/2004	5.7	7.9	25.0	12.9
A7	7/29/2004	6.0	7.8	24.7	19.4
A7	8/2/2004	3.9	7.7	21.6	20.1
A7	8/9/2004	5.3	7.9	23.7	13.8
A7	8/16/2004	5.4	8.0	23.5	18.2
A7	8/23/2004	5.2	8.2	22.9	15.2
A7	8/30/2004	3.9	7.7	24.5	19.9
A7	9/13/2004	6.8	8.0	23.0	14.9
A7	9/20/2004	6.1	7.9	19.0	7.4
A7	9/27/2004	5.3	7.7	20.6	21.9
A7	10/4/2004	6.2	8.0	19.7	16.2
A7	10/12/2004	6.1	7.9	20.4	22.3
A7	10/18/2004	5.1	8.0	18.8	16.5
A7	10/27/2004	5.2	7.8	15.8	21.0
A7	11/5/2004	5.0	7.9	14.3	15.6
A7	11/12/2004	6.6	7.8	15.0	23.8
A7	11/19/2004	6.1	8.0	15.3	11.9
A7	11/24/2004	6.2	7.8	12.5	23.3
A7	11/30/2004	8.5	8.0	10.6	18.0

Table 3a: Daily Averages of Continuous Monitoring of A2W Discharge

Date	DO (mg/L)	pH	Temp C	Salinity
7/16/2004	6.1	7.9	23.7	30.2
7/17/2004	4.3	7.8	23.3	
7/18/2004	4.4	7.8	23.6	
7/19/2004	3.8	7.8	24.0	
7/20/2004	3.7	7.7	23.5	
7/21/2004	3.8	7.7	23.7	
7/22/2004	2.7	7.6	24.6	
7/23/2004	1.7	7.5	24.3	
7/24/2004	2.7	7.6	24.2	
7/25/2004	3.8	7.8	24.6	30.4
7/26/2004	4.8	7.9	24.8	28.9
7/27/2004	4.2	7.9	24.4	31.1
7/28/2004	3.3	7.9	23.8	31.3
7/29/2004	4.1	7.9	23.4	31.5
7/30/2004	4.2	7.9	23.3	29.0
7/31/2004	4.9	8.0	23.0	31.4
8/1/2004	4.6	8.0	22.3	31.6
8/2/2004	5.6	8.1	21.8	31.5
8/3/2004	6.1	8.2	21.7	31.7
8/4/2004	6.1	8.2	22.2	31.6
8/5/2004	6.3	8.3	22.5	31.3
8/6/2004	5.8	8.3	22.4	31.2
8/7/2004	6.2	8.4	23.5	31.2
8/8/2004	6.3	8.5	24.3	30.8
8/9/2004	5.7	8.5	23.6	31.1
8/10/2004	6.3	8.6	22.9	31.4
8/11/2004	6.2	8.9	23.9	31.9
8/12/2004	5.9	8.8	24.0	31.9
8/13/2004	5.9	8.9	23.7	32.1
8/14/2004	5.0	8.8	23.1	32.0
8/15/2004	5.3	8.9	22.5	32.3
8/16/2004	4.9	8.9	23.1	32.5
8/17/2004	4.7	9.1	23.7	32.6
8/18/2004	4.9	9.1	23.7	32.7
8/19/2004	4.8	8.9	23.6	32.8
8/20/2004	5.3	8.7	23.5	32.5
8/21/2004	4.9	8.8	23.5	32.7
8/22/2004	5.3	8.8	22.9	32.8
8/23/2004	5.3	8.8	23.1	32.8
8/24/2004	5.3	8.8	23.6	32.8
8/25/2004	5.1	8.8	23.5	32.9
8/26/2004	5.4	8.8	23.6	32.8
8/27/2004	5.3	8.7	24.4	32.8
8/28/2004	5.1	8.7	24.8	32.9
8/29/2004	4.9	8.7	24.5	32.9
8/30/2004	5.1	8.7	24.0	32.9

Table 3a continued

Date	DO (mg/L)	pH	Temp C	Salinity
8/31/2004	4.8	8.7	23.8	32.6
9/1/2004	4.8	8.7	23.0	33.1
9/2/2004	5.2	8.7	22.6	33.2
9/3/2004	5.6	8.7	22.8	33.2
9/4/2004	5.7	8.6	23.9	33.3
9/5/2004	5.3	8.6	24.8	33.2
9/6/2004	4.8	8.6	25.1	33.3
9/7/2004	4.1	8.6	25.1	33.8
9/8/2004	3.9	8.6	25.1	34.1
9/9/2004	3.3	8.5	24.6	34.2
9/10/2004	3.1	8.5	23.7	34.3
9/11/2004	3.1	8.5	23.5	34.4
9/12/2004	3.4	8.6	23.5	34.5
9/13/2004	3.6	8.6	22.6	34.6
9/14/2004	5.0	8.6	22.6	34.6
9/15/2004	5.7	8.6	23.1	34.5
9/16/2004	4.8	8.6	23.4	34.5
9/17/2004	4.3	8.6	22.9	34.5
9/18/2004	3.9	8.6	20.1	34.6
9/19/2004	4.5	8.7	18.1	34.1
9/20/2004	5.3	8.8	18.4	34.0
9/21/2004	6.8	8.9	19.2	33.9
9/22/2004	7.6	8.9	20.0	33.9
9/23/2004	7.2	8.9	20.9	33.8
9/24/2004	6.6	8.9	21.6	33.6
9/25/2004	5.9	8.9	21.4	33.7
9/26/2004	6.2	8.9	21.2	33.7
9/27/2004	5.7	8.9	20.5	33.6
9/28/2004	5.7	8.9	20.5	33.5
9/29/2004	4.2	8.9	20.2	33.5
9/30/2004	4.0	8.8	19.8	33.5
10/1/2004	4.4	8.8	19.1	33.5
10/2/2004	4.7	8.8	19.0	33.5
10/3/2004	4.6	8.8	18.9	33.4
10/4/2004	4.6	8.8	18.9	33.4
10/5/2004	5.2	8.9	19.3	33.2
10/6/2004	4.8	8.9	19.4	33.0
10/7/2004		8.9	20.1	32.9
10/8/2004		8.9	20.1	32.8
10/9/2004		8.9	19.9	32.7
10/10/2004		8.8	19.3	32.6
10/11/2004		8.9	19.7	32.8
10/12/2004		8.8	20.1	32.8
10/13/2004		8.8	20.4	32.7
10/14/2004		8.8	20.9	32.6
10/15/2004		8.7	20.7	32.6
10/16/2004		8.7	19.7	32.6
10/17/2004		8.7	19.2	32.3
10/18/2004		8.6	18.0	32.2
10/19/2004		8.5	16.3	31.6
10/20/2004		8.5	15.6	31.1

Table 3a continued

Date	DO (mg/L)	pH	Temp C	Salinity
10/21/2004		8.5	15.4	31.2
10/22/2004		8.6	15.9	31.1
10/23/2004		8.6	15.8	31.0
10/24/2004		8.5	16.0	30.8
10/25/2004	8.6	8.6	15.6	30.8
10/26/2004	6.2	8.6	15.3	30.5
10/27/2004	6.4	8.6	14.7	30.6
10/28/2004	7.0	8.6	14.1	30.6
10/29/2004	6.3	8.6	14.5	30.5
10/30/2004	6.7	8.6	15.2	30.7
10/31/2004	5.8	8.6	16.1	30.6
11/1/2004	5.2	8.6	15.5	30.3
11/2/2004		8.6	15.5	29.9
11/3/2004		8.5	14.6	29.8
11/4/2004		8.5	12.8	29.7
11/5/2004		8.7	12.5	29.5
11/6/2004		8.6	13.4	29.7
11/7/2004		8.6	14.2	29.7
11/8/2004		8.5	14.0	29.7
11/9/2004		8.4	14.1	29.8
11/10/2004		8.5	14.4	29.6
11/11/2004		8.4	14.7	29.2
11/12/2004		8.5	14.9	28.9
11/13/2004		8.5	15.5	28.9
11/14/2004		8.5	15.2	29.1
11/15/2004		8.4	15.1	29.2
11/16/2004		8.3	15.3	29.4
11/17/2004		8.2	14.8	29.6
11/18/2004		8.1	14.6	29.6
11/19/2004		8.1	14.6	29.7
11/20/2004		8.1	13.0	29.8
11/21/2004		8.6	11.0	29.8
11/22/2004		8.5	10.4	28.9
11/23/2004		8.4	10.9	29.9
11/24/2004		8.3	11.2	29.9
11/25/2004		8.2	12.0	30.0
11/26/2004		8.4	13.3	29.8
11/27/2004		8.2	13.4	29.7
11/28/2004		8.4	10.1	29.5
11/29/2004		8.5	7.9	29.4

Table 3b: Daily Averages of Continuous Monitoring of A3W Discharge

Date	DO (mg/L)	pH	Temp C	Salinity
7/16/2004	0.1		24.6	33.2
7/17/2004	0.1		23.8	33.6
7/18/2004	0.1		24.2	34.0
7/19/2004	0.4		24.5	33.8
7/20/2004	0.9		23.9	34.0
7/21/2004	0.8		24.9	34.1
7/22/2004	0.6		24.9	34.2
7/23/2004	0.8		24.4	34.0
7/24/2004	0.9		24.2	33.9
7/25/2004	1.9		24.8	33.7
7/26/2004	1.2	8.6	25.4	33.6
7/27/2004	0.8	8.6	25.2	33.8
7/28/2004	0.8	8.6	24.7	33.7
7/29/2004	0.7	8.6	24.2	33.5
7/30/2004	0.5	8.6	23.9	33.6
7/31/2004	0.7	8.6	23.3	33.0
8/1/2004	1.5	8.7	22.1	33.4
8/2/2004	1.7	8.8	20.2	33.2
8/3/2004	0.8	8.6	21.0	33.5
8/4/2004	1.0	8.6	23.2	33.8
8/5/2004	0.9	8.7	21.9	34.7
8/6/2004	0.8	8.9	24.4	33.2
8/7/2004	2.7	9.1	24.3	33.9
8/8/2004	1.4	9.0	24.9	33.0
8/9/2004	0.5	8.9	23.8	33.3
8/10/2004	0.4	8.9	23.3	33.0
8/11/2004	0.6	8.8	24.2	32.4
8/12/2004	0.5	8.8	24.5	32.8
8/13/2004	0.2	8.8	24.1	32.7
8/14/2004	0.2	8.7	23.3	32.0
8/15/2004	0.5	8.8	22.5	32.5
8/16/2004	1.0	8.9	23.1	32.7
8/17/2004	0.8	8.9	23.8	32.2
8/18/2004	0.6	8.8	23.6	31.5
8/19/2004	0.8	9.1	23.6	32.5
8/20/2004	1.0	9.3	23.9	33.0
8/21/2004	0.6	9.3	23.5	33.0
8/22/2004	0.3	9.3	22.9	33.1
8/23/2004	0.4	9.2	23.0	32.2
8/24/2004	0.7	9.2	23.6	31.8
8/25/2004	0.5	9.2	23.3	32.0
8/26/2004	0.2	9.2	23.3	31.1
8/27/2004	0.3	9.1	24.8	30.9
8/28/2004	0.2	9.0	25.3	31.2

Table 3b continued

Date	DO (mg/L)	pH	Temp C	Salinity
8/29/2004	0.7	9.0	24.3	30.4
8/30/2004	0.7	8.9	23.9	30.6
8/31/2004	0.9	8.9	23.3	31.6
9/1/2004	0.7	8.8	22.3	31.4
9/2/2004	0.7	8.9	22.3	31.7
9/3/2004	1.0	9.1	23.0	31.7
9/4/2004	1.3	9.1	24.2	31.4
9/5/2004	0.7	9.0	25.5	32.0
9/6/2004	0.2	9.0	25.7	32.2
9/7/2004	0.1	8.9	25.3	32.2
9/8/2004	0.1	8.8	25.4	32.4
9/9/2004	0.1	8.6	24.1	32.8
9/10/2004	1.1	8.5	23.9	
9/11/2004	2.1	8.6	23.9	
9/12/2004	0.9	8.8	23.9	
9/13/2004	0.4	8.8	22.6	30.4
9/14/2004	0.9	8.8	22.6	30.6
9/15/2004	0.1	8.8	23.5	30.6
9/16/2004	0.3	8.8	23.4	30.7
9/17/2004	0.2	8.8	22.8	30.8
9/18/2004	1.1	8.8	19.2	30.9
9/19/2004	0.1	8.8	17.8	31.1
9/20/2004	0.4	8.8	18.6	31.1
9/21/2004	1.9	8.9	19.1	31.5
9/22/2004	3.2	8.9	20.4	
9/23/2004	2.8	8.9	21.3	29.5
9/24/2004	2.1	8.9	22.1	29.4
9/25/2004	0.7	8.7	21.5	29.5
9/26/2004	0.3	8.8	21.8	29.7
9/27/2004	0.1	8.8	20.7	29.6
9/28/2004	1.3	8.9	20.6	29.8
9/29/2004	1.6	9.0	20.4	30.0
9/30/2004	3.3	9.0	19.6	30.1
10/1/2004	2.1	8.9	19.3	30.1
10/2/2004	1.0	8.6	19.3	29.9
10/3/2004	0.6	8.7	19.0	29.8
10/4/2004	0.4	8.8	18.8	30.1
10/5/2004	1.4	8.7	19.4	30.0
10/6/2004	2.8	8.7	20.1	29.9
10/7/2004	2.1	8.7	20.5	29.9
10/8/2004	0.7	8.7	20.4	30.0
10/9/2004	1.1	8.7	20.1	30.1
10/10/2004	0.7	8.8	19.3	30.3
10/11/2004	2.4	8.8	20.1	30.3
10/12/2004	3.7	8.8	20.9	30.3
10/13/2004	3.7	8.8	21.3	30.4
10/14/2004	3.8	8.7	21.6	30.5
10/15/2004	2.3	8.7	21.2	30.3

Table 3b continued

10/16/2004	3.5	8.8	19.6	30.5
10/17/2004	1.2	8.7	19.2	30.4
10/18/2004	0.4	8.6	18.0	30.4
10/19/2004	2.3	8.6	16.1	29.8
10/20/2004	4.0	8.6	16.2	29.4
10/21/2004	3.4	8.5	16.0	29.4
10/22/2004	4.8	8.6	16.5	29.5
10/23/2004	4.5	8.6	15.8	29.6
10/24/2004	2.6	8.5	16.2	29.2
10/25/2004	6.0	8.6	16.4	29.0
10/26/2004	6.8	8.6	15.7	28.4
10/27/2004	5.9	8.6	15.2	28.4
10/28/2004	5.3	8.6	14.4	28.4
10/29/2004	3.8	8.5	15.1	28.3
10/30/2004	2.8	8.5	16.1	28.4
10/31/2004	1.7	8.4	16.4	27.9
11/1/2004	4.1	8.5	15.3	28.1
11/2/2004	6.1	8.6	16.1	28.4
11/3/2004	2.9	8.5	14.8	27.8
11/4/2004	4.2	8.6	12.4	28.5
11/5/2004	5.3	8.6	12.7	28.5
11/6/2004	6.0	8.7	14.1	28.6
11/7/2004	6.3	8.7	15.1	28.8
11/8/2004	4.5	8.6	14.5	26.4
11/9/2004	4.7	8.4	14.2	23.6
11/10/2004	6.4	8.3	14.3	22.8
11/11/2004	5.8	8.2	14.5	20.4
11/12/2004	6.3	8.2	15.3	17.5
11/13/2004	7.0	8.2	15.3	18.0
11/14/2004	5.9	8.1	15.4	18.2
11/15/2004	5.5	8.1	15.0	18.3
11/16/2004	5.3	8.0	15.0	17.7
11/17/2004	5.3	8.1	15.0	17.5
11/18/2004	5.6	8.1	15.1	16.9
11/19/2004	5.6	8.3	14.5	16.5
11/20/2004	6.0	8.5	13.2	16.9
11/21/2004	4.2	8.4	12.0	18.2
11/22/2004	6.8	8.5	11.7	19.1
11/23/2004	11.6	8.7	11.9	19.1
11/24/2004	11.8	8.7	11.8	19.1
11/25/2004	11.6	8.7	12.3	19.2
11/26/2004	10.0	8.7	13.2	18.6
11/27/2004	7.7	8.8	13.1	20.2
11/28/2004	9.5	8.8	10.4	19.1
11/29/2004	6.8	8.6	9.2	16.7

Table 3c: Daily Averages of Continuous Monitoring of A7 Discharge

Date	DO (mg/L)	pH	Temp C	Salinity
7/27/2004	1.8		24.0	51.7
7/28/2004	5.1	9.0	24.4	52.9
7/29/2004	3.3	9.0	23.0	52.3
7/30/2004	3.5	8.9	22.8	51.3
7/31/2004	2.2	8.8	22.4	51.0
8/1/2004	1.7	8.8	22.5	50.8
8/2/2004	1.4	8.8	21.6	50.2
8/3/2004	2.2	8.8	21.2	49.4
8/4/2004	2.5	8.7	21.9	48.4
8/5/2004	3.0	8.7	22.6	47.5
8/6/2004	4.8	8.7	22.4	45.9
8/7/2004	6.1	8.8	23.4	44.8
8/8/2004	5.9	8.9	24.4	43.8
8/9/2004	4.8	8.9	24.1	43.1
8/10/2004	4.6	8.9	23.1	42.4
8/11/2004	5.1	9.0	23.5	41.0
8/12/2004	4.5	8.9	23.8	40.1
8/13/2004	4.6	8.9	23.6	39.3
8/14/2004	4.2	8.9	23.0	39.0
8/15/2004	4.2	8.9	22.7	38.9
8/16/2004	4.5	8.9	22.8	38.5
8/17/2004	4.7	8.9	23.4	37.9
8/18/2004	4.6	8.9	23.6	37.6
8/19/2004	4.6	8.9	23.4	36.8
8/20/2004	4.9	8.9	23.4	36.5
8/21/2004	4.7	8.9	23.5	36.3
8/22/2004	5.1	8.9	23.3	35.8
8/23/2004	5.0	8.9	23.2	35.7
8/24/2004	5.1	8.9	23.7	35.4
8/25/2004	4.9	8.9	23.6	35.3
8/26/2004	4.0	8.9	23.3	35.3
8/27/2004	4.4	8.9	23.5	35.4
8/28/2004	3.7	8.9	24.0	35.2
8/29/2004	3.1	8.9	24.3	35.2
8/30/2004	3.4	8.9	23.9	35.1
8/31/2004	3.2	8.9	23.6	35.1
9/1/2004	2.6	8.9	22.9	34.9
9/2/2004	2.4	8.9	22.7	34.7
9/3/2004	2.2	8.8	22.6	34.5
9/4/2004	2.2	8.8	23.1	34.3
9/5/2004	2.3	8.8	23.9	34.1
9/6/2004	2.4	8.8	24.6	33.9
9/7/2004	3.6	8.8	24.8	33.9
9/8/2004	3.6	8.9	24.9	33.9
9/9/2004	2.4	8.8	24.2	34.1

Table 3c continued

Date	DO (mg/L)	pH	Temp C	Salinity
9/10/2004	2.0	8.8	23.5	34.4
9/11/2004	2.0		22.7	34.7
9/12/2004	1.4		21.9	35.0
9/13/2004	1.4	8.8	21.7	35.0
9/14/2004	2.4	8.9	21.9	35.0
9/15/2004	2.9	8.9	22.3	34.7
9/16/2004	2.0	8.9	22.8	34.6
9/17/2004	2.2	8.9	22.4	33.8
9/18/2004	1.2	8.9	20.0	33.4
9/19/2004	3.2	8.9	17.5	32.8
9/20/2004	3.5	8.9	17.1	32.1
9/21/2004	3.9	8.8	18.1	31.8
9/22/2004	7.0	8.7	19.0	31.4
9/23/2004	5.5	8.7	19.7	31.3
9/24/2004	3.6	8.6	20.5	31.5
9/25/2004	1.4	8.6	20.8	31.8
9/26/2004	1.3	8.5	21.0	31.9
9/27/2004	1.3	8.5	20.4	32.0
9/28/2004	2.3	8.5	20.5	31.9
9/29/2004	2.3	8.5	19.8	32.0
9/30/2004	2.3	8.5	19.3	32.2
10/1/2004	3.0	8.5	18.6	32.3
10/2/2004	3.5	8.5	18.2	32.6
10/3/2004	4.3	8.5	18.4	32.6
10/4/2004	4.5	8.5	18.6	32.4
10/5/2004	6.5	8.6	18.9	32.3
10/6/2004	8.6	8.8	19.4	31.9
10/7/2004	7.4	8.8	19.7	31.7
10/8/2004	6.4	8.8	20.0	31.6
10/9/2004	4.9	8.8	20.0	31.4
10/10/2004	6.3	8.9	19.3	31.2
10/11/2004	8.3	8.9	19.1	30.7
10/12/2004	8.9	9.0	19.5	30.2
10/13/2004	8.3	9.0	19.7	29.8
10/14/2004	7.9	9.0	20.3	29.6
10/15/2004	6.5	9.0	20.5	29.7
10/16/2004	6.2	9.0	19.7	29.6
10/17/2004	5.9	9.0	19.1	29.4
10/18/2004	4.3	9.0	17.5	29.2
10/19/2004	3.8	8.8	15.3	28.5
10/20/2004	4.2	8.7	15.2	28.2
10/21/2004	4.5	8.7	15.0	28.5
10/22/2004	6.4	8.7	14.6	28.5
10/23/2004	7.9	8.8	15.2	27.9
10/24/2004	5.3	8.8	15.7	27.6
10/25/2004	5.1	8.8	15.6	26.8
10/26/2004	4.6	8.8	14.4	25.5
10/27/2004	4.4	8.7	14.4	25.7

Table 3c continued

Date	DO (mg/L)	pH	Temp C	Salinity
10/28/2004	4.6	8.8	13.9	25.5
10/29/2004	2.7	8.7	14.0	25.6
10/30/2004	1.5	8.6	14.6	25.5
10/31/2004	1.7	8.6	15.8	25.3
11/1/2004	2.3	8.6	15.9	25.3
11/2/2004	3.6	8.6	15.2	25.4
11/3/2004	2.3	8.5	14.8	25.2
11/4/2004	2.6	8.5	13.1	25.1
11/5/2004	3.3	8.5	12.2	25.0
11/6/2004	4.5	8.5	12.1	24.8
11/7/2004	4.5	8.5	13.2	24.9
11/8/2004	3.4	8.7	13.6	25.0
11/9/2004		9.1	14.2	25.3
11/10/2004		9.1	14.5	25.3
11/11/2004		9.0	14.6	25.1
11/12/2004		9.1	14.8	25.0
11/13/2004		9.1	14.9	25.1
11/14/2004		9.1	14.8	25.2
11/15/2004		9.1	14.8	25.3
11/16/2004		9.2	14.9	25.4
11/17/2004	8.2	8.9	15.0	25.4
11/18/2004	5.6	8.6	14.7	25.4
11/19/2004	5.4	8.7	14.7	25.4
11/20/2004	5.5	8.7	13.4	25.6
11/21/2004	6.5	8.7	11.2	25.7
11/22/2004	6.7	8.7	10.9	25.7
11/23/2004	8.4	8.8	10.9	25.8
11/24/2004	7.8	8.8	11.0	25.9
11/25/2004	8.8	8.8	11.4	26.1
11/26/2004	8.8	8.8	12.4	26.3
11/27/2004	7.3	8.7	12.8	26.4
11/28/2004	7.0	8.7	11.5	26.3
11/29/2004	7.9	8.7	9.8	26.4

TABLE 4a – Benthic Invertebrate Sampling in Guadalupe Slough (A3W Receiving water)

		Upstream								
		4/6/2004			7/29/2004		8/2/2004		8/16/2004	
		GUAB1A	GUAB1B	GUAB1C	A3W-3	A3W-4	A3W-3	A3W-4	A3W-3	A3W-4
Annelida	*Capitella*	0	0	0	40	12	71	4	99	134
	Cirratulus	0	0	0	0	0	0	0	0	0
	Eteone	0	0	0	0	0	0	0	0	0
	Goniadidae	0	0	0	0	0	0	0	0	0
	Heteromastus	0	0	0	0	0	0	0	0	0
	Nereis	0	0	0	0	0	0	0	0	0
	Polydora	0	0	0	4	2	0	1	5	0
	Sabellidae	0	0	0	0	0	0	0	0	1
	Spionidae	0	0	3	0	0	0	0	0	1
	Streblospio	0	0	0	0	0	0	0	0	0
	Tubificoides	7	2	121	0	0	0	0	0	0
Nematoda	Nematoda	0	0	2	0	0	0	0	0	0
Bivalvia	*Gemma gemma*	0	0	0	0	0	0	0	1	0
	Macoma balthica	0	0	0	2	0	1	0	0	1
	Potamacorbula	0	0	0	0	0	1	0	2	3
Crustacea	*Balanus*	0	0	0	0	0	0	0	0	0
	Copepoda	0	0	0	0	0	0	0	0	0
	Corophium	0	0	0	0	0	0	0	1	0
	Cumacea	0	1	33	52	10	8	0	12	23
	Ericthonius	0	0	0	0	0	0	0	0	0
	Melita Californica	0	0	0	0	0	0	0	0	0
	Synidotea	0	0	0	1	0	0	0	0	0

		Midstream											
		4/6/2004			7/29/2004			8/2/2004			8/16/2004		
		GUAB2A	GUAB2B	GUAB2C	A3W-1	A3W-2	A3W-6	A3W-1	A3W-2	A3W-6	A3W-1	A3W-2	A3W-6
Annelida	*Capitella*	0	0	0	263	151	410	93	220	41	0	0	5
	Cirratulus	0	0	0	2	0	2	0	0	0	0	0	0
	Eteone	0	0	1	0	0	0	0	0	1	1	0	0
	Goniadidae	0	0	0	0	0	0	1	0	0	0	0	0
	Heteromastus	0	0	0	5	0	0	0	0	86	64	73	0
	Nereis	1	0	0	0	0	0	0	0	1	0	0	1
	Polydora	0	0	0	0	0	0	0	0	0	1	0	0
	Sabellidae	0	0	0	0	0	0	0	0	0	0	0	0
	Spionidae	0	0	0	0	0	0	0	0	0	0	0	0
	Streblospio	4	0	20	0	0	0	0	0	0	0	0	0
	Tubificoides	3	5	82	0	0	0	33	0	36	210	0	0
Nematoda	Nematoda	4	4	0	0	0	8	0	0	0	2	0	0
Bivalvia	*Gemma gemma*	0	0	0	0	0	0	0	0	0	0	0	0
	Macoma balthica	3	3	0	0	16	15	9	8	5	5	4	6
	Potamacorbula	0	1	0	0	0	3	1	0	13	1	1	6
Crustacea	*Balanus*	0	0	0	0	0	0	0	0	0	0	0	0
	Copepoda	0	1	0	0	0	0	0	0	0	0	0	0
	Corophium	0	0	0	0	0	1	0	0	0	0	0	0
	Cumacea	13	5	105	45	2	66	15	33	5	6	1	27
	Ericthonius	0	0	1	0	0	0	0	0	0	0	0	0
	Melita Californica	0	0	0	0	0	0	0	0	1	0	0	0
	Synidotea	0	0	0	0	0	0	0	0	2	0	0	0

		Mouth											
		4/6/2004			7/29/2004			8/2/2004			8/16/2004		
		GUAB3A	GUAB3B	GUAB3C	A3W-7	A3W-8	A3W-9	A3W-7	A3W-8	A3W-9	A3W-7	A3W-8	A3W-9
Annelida	*Capitella*	0	0	0	11	0	0	0	0	0	7	0	0
	Cirratulus	0	0	0	0	0	0	0	0	0	0	0	0
	Eteone	0	0	4	0	0	0	0	0	0	0	0	0
	Goniadidae	0	0	0	0	0	0	0	0	0	0	0	0
	Heteromastus	1	0	1	0	0	0	0	1	0	0	0	0
	Nereis	0	0	0	0	0	2	0	2	0	1	0	1
	Polydora	0	0	0	3	0	0	0	0	0	7	0	0
	Sabellidae	0	0	0	0	0	0	0	0	0	1	0	0
	Spionidae	0	0	0	0	0	1	0	0	0	0	0	2
	Streblospio	20	1	21	0	0	0	0	0	0	0	0	0
	Tubificoides	12	7	449	0	0	0	0	0	0	0	0	0
Nematoda	Nematoda	3	3	89	0	0	0	0	0	0	0	0	0
Bivalvia	*Gemma gemma*	0	0	0	0	0	0	0	0	0	0	0	0
	Macoma balthica	2	1	7	0	0	23	2	6	4	16	0	3
	Potamacorbula	0	0	0	53	0	63	4	49	84	17	29	83
Crustacea	*Balanus*	0	0	0	0	0	0	0	0	0	0	2	0
	Copepoda	0	0	0	0	0	0	0	0	0	0	0	0
	Corophium	0	0	0	0	0	0	0	0	0	0	0	0
	Cumacea	11	1	52	3	0	6	0	1	0	8	0	0
	Ericthonius	0	0	0	0	0	0	0	0	0	0	0	0
	Melita Californica	0	0	0	0	0	0	0	0	0	0	0	0
	Synidotea	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 4b – Benthic Invertebrate Sampling in Alviso Slough (A7 Receiving water)

		Upstream								
		4/7/2004			7/29/2004		8/9/2004		8/23/2004	
		ALVB1A	ALVB1B	ALVB1C	A7-4	A7-5	A7-4	A7-5	A7-4	A7-5
Annelida	*Capitella*	0	0	1	0	19	0	60	0	20
	Cirratulus	0	0	0	0	0	0	0	0	25
	Eteone	0	0	1	0	0	0	1	0	0
	Fabricia berkeleyi	0	0	0	0	27	0	0	0	0
	Heteromastus	1	0	1	0	0	0	0	9	1
	Mediomastus	0	0	0	0	0	0	0	0	0
	Nereis	5	1	1	0	1	3	0	0	0
	Phyllodocidae	0	0	0	0	0	0	0	1	0
	Polydora	0	0	1	0	135	0	0	0	5
	Pseudopolydora	0	0	0	0	0	0	0	0	0
	Sabellidae	0	0	0	0	0	2	0	0	4
	Spionidae	0	0	0	0	0	3	0	0	0
	Streblospio	16	3	14	1	67	0	0	0	0
	Tubificoides	0	0	0	0	0	0	0	0	0
Bivalvia	*Gemma gemma*	0	0	0	0	0	0	0	0	0
	Macoma balthica	2	0	2	5	0	1	12	3	0
	Mya arenaria	0	0	0	0	0	0	0	0	0
	Potamacorbula	0	1	1	0	0	1	5	4	2
Crustacea	*Balanus*	0	0	0	0	0	0	0	0	0
	Cirripedia	0	0	0	0	0	0	0	0	0
	Corophium	0	2	0	0	1	0	0	0	0
	Cumacea	0	1	391	0	5	9	4	13	21
	Ericthonius	1	0	0	0	0	0	0	0	0
	Melita Californica	0	0	0	0	0	0	0	0	0
	Synidotea	0	0	0	0	0	0	0	0	0

		Midstream											
		4/7/2004			7/29/2004			8/9/2004			8/23/2004		
		ALVB2A	ALVB2B	ALVB2C	A7-1	A7-2	A7-3	A7-1	A7-2	A7-3	A7-1	A7-2	A7-3
Annelida	*Capitella*	0	0	0	0	11	70	0	0	64	2	0	0
	Cirratulus	0	0	0	0	0	0	0	0	0	0	0	0
	Eteone	0	0	0	0	0	0	0	0	1	0	0	0
	Fabricia berkeleyi	0	0	0	0	0	0	0	0	0	0	0	0
	Heteromastus	0	0	0	0	0	3	0	1	0	0	0	0
	Mediomastus	0	0	0	0	0	0	0	0	0	0	0	0
	Nereis	3	7	6	0	4	2	1	1	0	1	1	2
	Phyllodocidae	0	0	0	0	0	0	0	0	0	0	0	0
	Polydora	0	1	2	0	0	0	0	0	0	0	0	0
	Pseudopolydora	0	0	0	0	0	0	3	0	0	0	0	0
	Sabellidae	0	0	0	0	0	0	0	0	0	0	0	0
	Spionidae	0	0	0	0	2	0	0	0	1	0	0	0
	Streblospio	0	1	40	0	0	0	0	0	0	0	0	0
	Tubificoides	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	*Gemma gemma*	0	0	0	0	0	0	0	0	0	0	0	0
	Macoma balthica	2	0	0	0	16	14	18	7	14	6	8	9
	Mya arenaria	0	0	0	0	0	0	0	0	0	0	0	0
	Potamacorbula	2	4	7	0	8	0	15	12	6	13	7	2
Crustacea	*Balanus*	0	0	0	0	0	0	0	0	0	0	0	0
	Cirripedia	4	0	0	0	0	0	0	0	0	0	0	0
	Corophium	2	11	5	0	0	0	0	0	0	0	0	0
	Cumacea	1	0	8	0	0	36	2	0	3	8	5	5
	Ericthonius	10	13	0	0	0	0	0	0	0	0	0	0
	Melita Californica	0	0	0	0	0	0	0	0	0	0	0	0
	Synidotea	0	0	0	0	0	0	0	0	0	2	0	0

		Mouth								
		4/7/2004			7/29/2004		8/9/2004		8/23/2004	
		ALVB3A	ALVB3B	ALVB3C	A7-7	A7-8	A7-7	A7-8	A7-7	A7-8
Annelida	*Capitella*	0	0	0	0	0	0	0	0	0
	Cirratulus	0	0	0	0	0	0	0	0	0
	Eteone	0	0	0	0	0	0	0	0	0
	Fabricia berkeleyi	0	0	0	0	0	0	0	0	0
	Heteromastus	0	0	0	0	2	1	4	0	8
	Mediomastus	0	0	0	0	0	0	3	3	0
	Nereis	0	0	1	0	1	1	1	5	2
	Phyllodocidae	0	0	0	0	0	0	0	0	0
	Polydora	0	0	0	0	5	0	0	0	0
	Pseudopolydora	0	0	0	0	0	0	0	0	0
	Sabellidae	0	0	0	0	0	0	0	0	0
	Spionidae	0	1	0	0	0	3	0	10	0
	Streblospio	0	2	58	0	2	0	0	0	0
	Tubificoides	0	1	60	0	0	0	0	0	0
Bivalvia	*Gemma gemma*	0	0	0	1	0	0	0	2	4
	Macoma balthica	1	1	2	3	2	8	6	3	0
	Mya arenaria	1	0	0	0	0	0	0	0	0
	Potamacorbula	1	1	0	9	34	23	38	8	4
Crustacea	*Balanus*	0	0	0	0	0	1	0	0	0
	Cirripedia	0	0	0	0	0	0	0	0	0
	Corophium	0	0	0	0	0	0	0	0	5
	Cumacea	12	10	124	0	0	1	6	6	0
	Ericthonius	0	0	0	0	0	0	0	0	0
	Melita Californica	0	0	0	0	0	0	0	0	5
	Synidotea	0	0	0	0	0	0	0	0	0

Table 5: Chlorophyll-a Sampling

	Chl *a* (µg/L)	
Date/ Pond	9/13/2004	10/20/2004
A2E	22.99 ± 28.13 *n*=3	111.42 ± 7.50 *n*=6
A3N	295.24 ± 9.94 *n*=2	24.94 ± 1.37 *n*=4
AB2	116.16 ± 71.64 *n*=3	12.51 ± 8.60 *n*=6

Table 6: Annual Water Column Monitoring for Metals

	Ag		Cd		Cr		Cu		Ni	
Pond	Tot. µg/L	Dis. µg/L	Tot. µg/L	Dis. µg/L	Tot. µg/L	Dis. µg/L	Tot. µg/L	Dis. µg/L	Tot. µg/L	Dis. µg/L
A2W	ND	ND	ND	ND	2.50	ND	4.60	3.90	ND	ND
A3W	ND	ND	ND	ND	ND	ND	3.70	3.40	ND	ND
A7	ND	ND	ND	ND	2.30	ND	4.00	3.20	ND	ND

	Pb		Zn		As		Hg		Se		
Pond	Tot. µg/L	Dis. µg/L	Tot. µg/L	Dis. µg/L	Tot. µg/L	Dis. µg/L	Tot. ng/L	Dis. ng/L	Tot. µg/L	Dis. µg/L	TSS mg/L
A2W	ND	ND	6.80	11.00	7.20	6.60	6.00	1.70	ND	ND	9.60
A3W	ND	ND	12.00	8.00	7.90	7.60	5.10	1.30	ND	ND	4.80
A7	ND	ND	ND	7.30	5.90	5.80	9.20	2.50	ND	ND	6.00

All results are in micrograms/L except for total suspended solids which is reported in mg/L.

Legend for 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
Total Suspended Solids	160.20

ND refers to no detected level

Detection Limits

As	Hg	Ag	Cd	Cr
1.0 ug/L	1.0 ng/L	1.0 ug/L	1.0 ug/L	2.0 ug/L
Cu	**Ni**	**Pb**	**Zn**	**Se**
1.0 ug/L	2.0 ug/L	1.0 ug/L	5.0 ug/L	1.0 ug/L

Estimated Maximum Salinities and Metals Levels for Continuous Circulation [1]

Maximum Salinity	CR	Ni	Cu	Zn	As	Se	Ag	Cd	Hg	Pb
44	1.22	8.05	2.98	1.83	10.7	0.4	0.012	0.078	1.8	0.307
WQO [2]	11.4	27	13	86	36	5	2.2	0.27	50	3.2

[1] To estimate the maximum metals concentrations from the Alviso System for continuous discharges, the ROWS considered an average of RMP data from 1997 - 1999 at the South Bay Station and salt ponds with salinities of 31.6 and 42 ppt.

[2] The Basin plan only specifies water quality objectives south of the Dumbarton Bridge for copper and nickel. For the other inorganics, water quality objectives are from the California Toxics Rule. Since the Board must express limits for metals in the total recoverable form, Board staff used default translators to convert dissolved water quality objectives of 100 mg/L as $CaCO_3$, which is
the lowest value found in sloughs (in this case Guadalupe Slough) monitored near the discharge in the Regional Monitoring Program.

Table 7a Closing of Discharge Gates

Pond A2W

All data — Discharges open 100% of the time

From	To	10th percentile	Mean	Median	
7/16/2004	**11/29/2004**	**3.85**	**5.96**	**5.95**	
7/16/2004	7/17/2004	3.85	5.96	5.95	
7/18/2004	7/24/2004	4.48	6.05	6.28	
7/25/2004	7/31/2004	1.81	5.00	5.00	
8/1/2004	8/7/2004	3.09	5.04	5.01	
8/8/2004	8/14/2004	5.57	6.84	7.03	
8/15/2004	8/21/2004	5.08	7.00	6.96	
8/22/2004	8/28/2004	4.40	5.96	5.73	
8/29/2004	9/4/2004	4.60	6.09	5.99	
9/5/2004	9/11/2004	4.28	6.27	6.24	
9/12/2004	9/18/2004	2.75	4.58	4.51	
9/19/2004	9/25/2004	3.69	5.32	5.26	
9/26/2004	10/2/2004	4.91	7.11	7.08	
10/3/2004	10/9/2004	3.82	5.86	5.74	
10/10/2004	10/16/2004				no data
10/17/2004	10/23/2004				no data
10/24/2004	10/30/2004	0.00	0.00	0.00	
10/31/2004	11/6/2004	5.33	7.11	7.17	
11/7/2004	11/13/2004				no data
11/14/2004	11/20/2004				no data
11/21/2004	11/27/2004				no data
11/28/2004	12/4/2004				no data

Discharges open only from 10 am - 10pm

From	To	10th percentile	Mean	Median
7/16/2004	**11/29/2004**	**3.85**	**5.96**	**5.95**
7/16/2004	7/17/2004	4.48	6.05	6.28
7/18/2004	7/24/2004	1.81	5.00	5.00
7/25/2004	7/31/2004	3.09	5.04	5.01
8/1/2004	8/7/2004	5.57	6.84	7.03
8/8/2004	8/14/2004	5.08	7.00	6.96
8/15/2004	8/21/2004	4.40	5.96	5.73
8/22/2004	8/28/2004	4.60	6.09	5.99
8/29/2004	9/4/2004	4.28	6.27	6.24
9/5/2004	9/11/2004	2.75	4.58	4.51
9/12/2004	9/18/2004	3.69	5.32	5.26
9/19/2004	9/25/2004	4.91	7.11	7.08
9/26/2004	10/2/2004	3.82	5.86	5.74
10/3/2004	10/9/2004	4.03	5.36	5.50
10/10/2004	10/16/2004			
10/17/2004	10/23/2004			
10/24/2004	10/30/2004	5.33	7.11	7.17
10/31/2004	11/6/2004	5.15	5.92	5.71
11/7/2004	11/13/2004			
11/14/2004	11/20/2004			
11/21/2004	11/27/2004			
11/28/2004	12/4/2004			

Table 7b Closing of Discharge Gates

Pond A3W

All times — Discharges open 100% of the time

From	To	10th percentile	Mean	Median
7/16/2004	**11/29/2004**	**2.72**	**1.02**	**0.00**
7/16/2004	7/17/2004	0.09	0.08	0.00
7/18/2004	7/24/2004	0.81	0.09	0.00
7/25/2004	7/31/2004	0.90	0.21	0.00
8/1/2004	8/7/2004	1.54	0.42	0.00
8/8/2004	8/14/2004	0.28	0.13	0.00
8/15/2004	8/21/2004	0.72	0.19	0.00
8/22/2004	8/28/2004	0.17	0.11	0.00
8/29/2004	9/4/2004	0.61	0.33	0.00
9/5/2004	9/11/2004	0.66	0.06	0.00
9/12/2004	9/18/2004	0.68	0.14	0.00
9/19/2004	9/25/2004	1.74	1.12	0.00
9/26/2004	10/2/2004	1.51	0.73	0.00
10/3/2004	10/9/2004	1.29	0.81	0.00
10/10/2004	10/16/2004	3.24	3.05	0.00
10/17/2004	10/23/2004	3.38	3.35	0.00
10/24/2004	10/30/2004	5.17	5.10	0.00
10/31/2004	11/6/2004	4.91	5.11	0.00
11/7/2004	11/13/2004	6.80	6.05	0.00
11/14/2004	11/20/2004	5.69	5.30	0.00
11/21/2004	11/27/2004	10.44	10.01	0.00
11/28/2004	12/4/2004	11.43	12.41	0.00

Discharges open only from 10am-10pm

From	To	10th percentile	Mean	Median
7/16/2004	**11/29/2004**	**0.07**	**2.72**	**1.02**
7/16/2004	7/17/2004	0.06	0.09	0.08
7/18/2004	7/24/2004	0.06	0.81	0.09
7/25/2004	7/31/2004	0.08	0.90	0.21
8/1/2004	8/7/2004	0.09	1.54	0.42
8/8/2004	8/14/2004	0.10	0.28	0.13
8/15/2004	8/21/2004	0.10	0.72	0.19
8/22/2004	8/28/2004	0.08	0.17	0.11
8/29/2004	9/4/2004	0.06	0.61	0.33
9/5/2004	9/11/2004	0.05	0.66	0.06
9/12/2004	9/18/2004	0.06	0.68	0.14
9/19/2004	9/25/2004	0.07	1.74	1.12
9/26/2004	10/2/2004	0.06	1.51	0.73
10/3/2004	10/9/2004	0.04	1.29	0.81
10/10/2004	10/16/2004	0.06	3.24	3.05
10/17/2004	10/23/2004	0.03	3.38	3.35
10/24/2004	10/30/2004	1.70	5.17	5.10
10/31/2004	11/6/2004	0.56	4.91	5.11
11/7/2004	11/13/2004	4.40	6.80	6.05
11/14/2004	11/20/2004	4.34	5.69	5.30
11/21/2004	11/27/2004	4.36	10.44	10.01
11/28/2004	12/4/2004	7.27	11.43	12.41

Table 7c Closing of Discharge Gates

Pond A7

All times — Discharges open 100% of the time

From	To	10th percentile	Mean	Median
7/27/2004	**11/29/2004**	**5.35**	**5.12**	**0.00**
7/25/2004	7/31/2004	4.53	4.01	0.00
8/1/2004	8/7/2004	3.89	3.90	0.00
8/8/2004	8/14/2004	5.60	5.65	0.00
8/15/2004	8/21/2004	5.46	5.80	0.00
8/22/2004	8/28/2004	5.53	5.55	0.00
8/29/2004	9/4/2004	3.46	3.54	0.00
9/5/2004	9/11/2004	3.76	3.95	0.00
9/12/2004	9/18/2004	2.90	2.53	0.00
9/19/2004	9/25/2004	5.02	5.17	0.00
9/26/2004	10/2/2004	3.45	3.10	0.00
10/3/2004	10/9/2004	8.02	7.66	0.00
10/10/2004	10/16/2004	8.81	8.97	0.00
10/17/2004	10/23/2004	6.00	5.76	0.00
10/24/2004	10/30/2004	4.44	4.47	0.00
10/31/2004	11/6/2004	3.75	3.37	0.00
11/7/2004	11/13/2004	5.34	5.14	0.00
11/14/2004	11/20/2004	7.26	7.02	0.00
11/21/2004	11/27/2004	9.04	8.39	0.00
11/28/2004	12/4/2004	8.99	9.04	0.00

Discharges open only from 10am-10pm

From	To	10th percentile	Mean	Median
7/27/2004	**11/29/2004**	**1.91**	**5.35**	**5.12**
7/25/2004	7/31/2004	1.81	4.53	4.01
8/1/2004	8/7/2004	1.14	3.89	3.90
8/8/2004	8/14/2004	4.61	5.60	5.65
8/15/2004	8/21/2004	3.59	5.46	5.80
8/22/2004	8/28/2004	3.88	5.53	5.55
8/29/2004	9/4/2004	1.74	3.46	3.54
9/5/2004	9/11/2004	1.19	3.76	3.95
9/12/2004	9/18/2004	1.19	2.90	2.53
9/19/2004	9/25/2004	1.30	5.02	5.17
9/26/2004	10/2/2004	0.87	3.45	3.10
10/3/2004	10/9/2004	4.19	8.02	7.66
10/10/2004	10/16/2004	5.29	8.81	8.97
10/17/2004	10/23/2004	3.06	6.00	5.76
10/24/2004	10/30/2004	1.79	4.44	4.47
10/31/2004	11/6/2004	1.55	3.75	3.37
11/7/2004	11/13/2004	3.41	5.34	5.14
11/14/2004	11/20/2004	5.13	7.26	7.02
11/21/2004	11/27/2004	6.85	9.04	8.39
11/28/2004	12/4/2004	7.17	8.99	9.04

no data
no data

no data
no data
no data
no data

Figure 1. Site Location Map

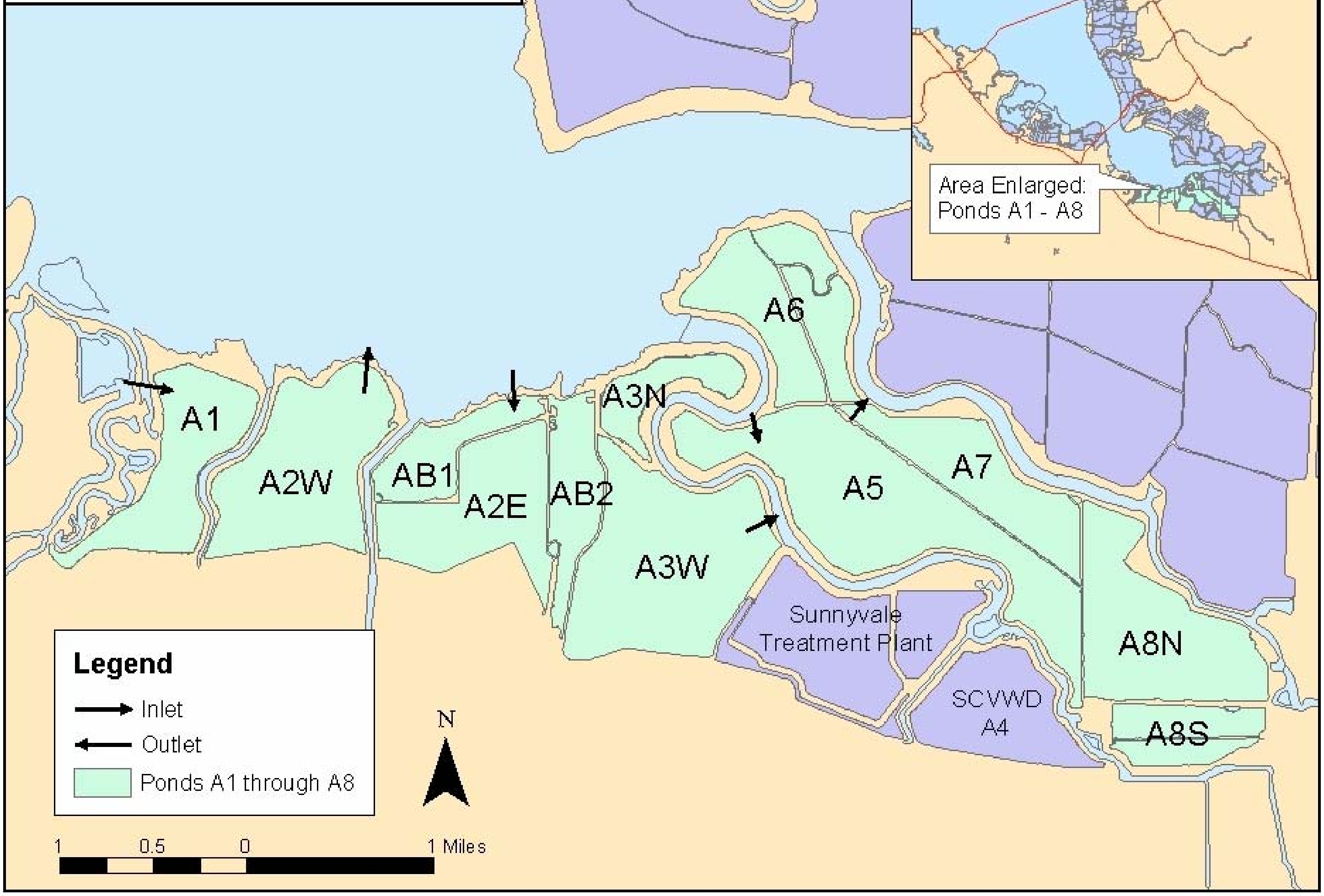


Figure 2a. Sampling Locations for Receiving Waters

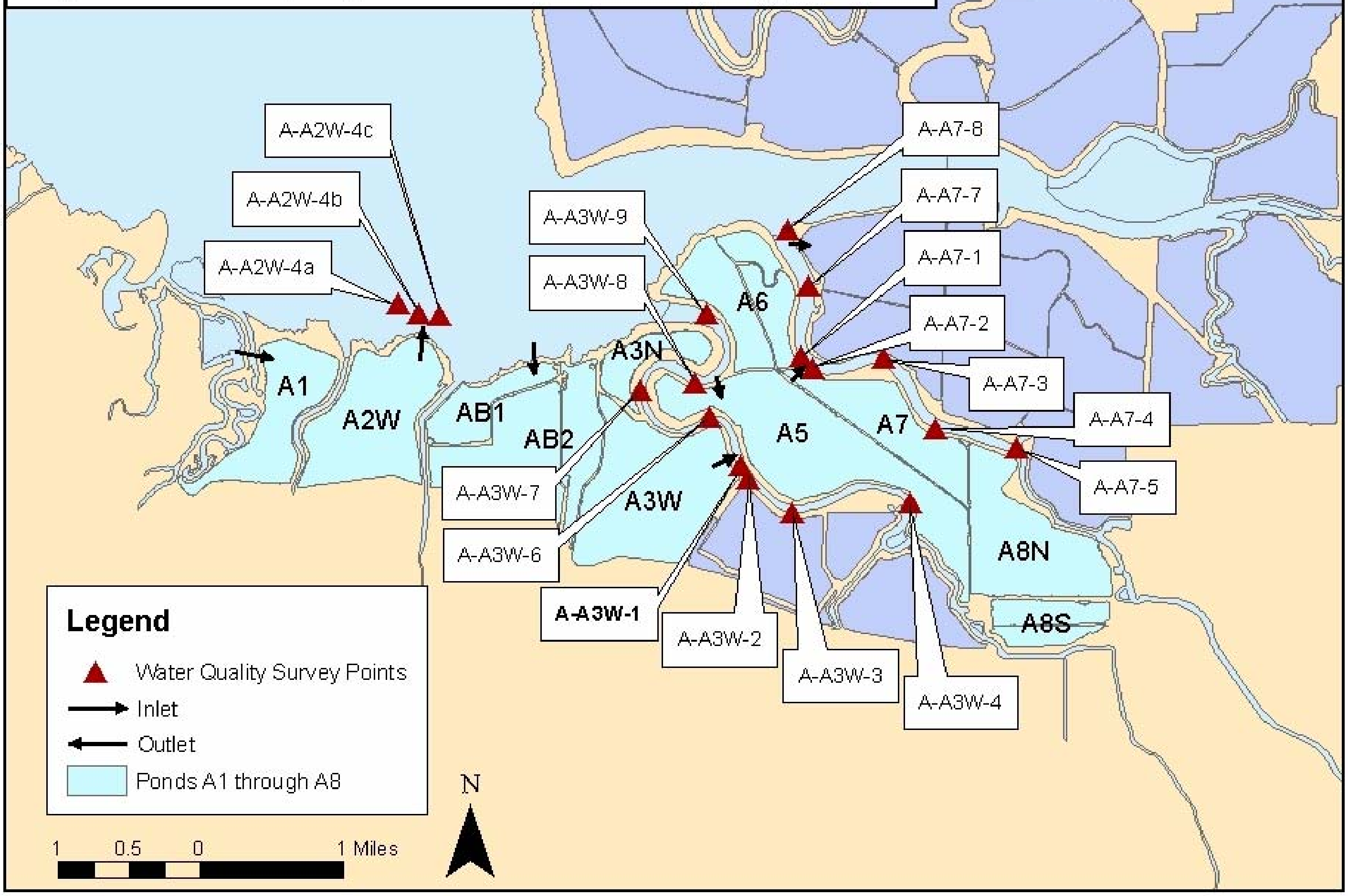


Figure 2b. Sampling Locations for Management Samples

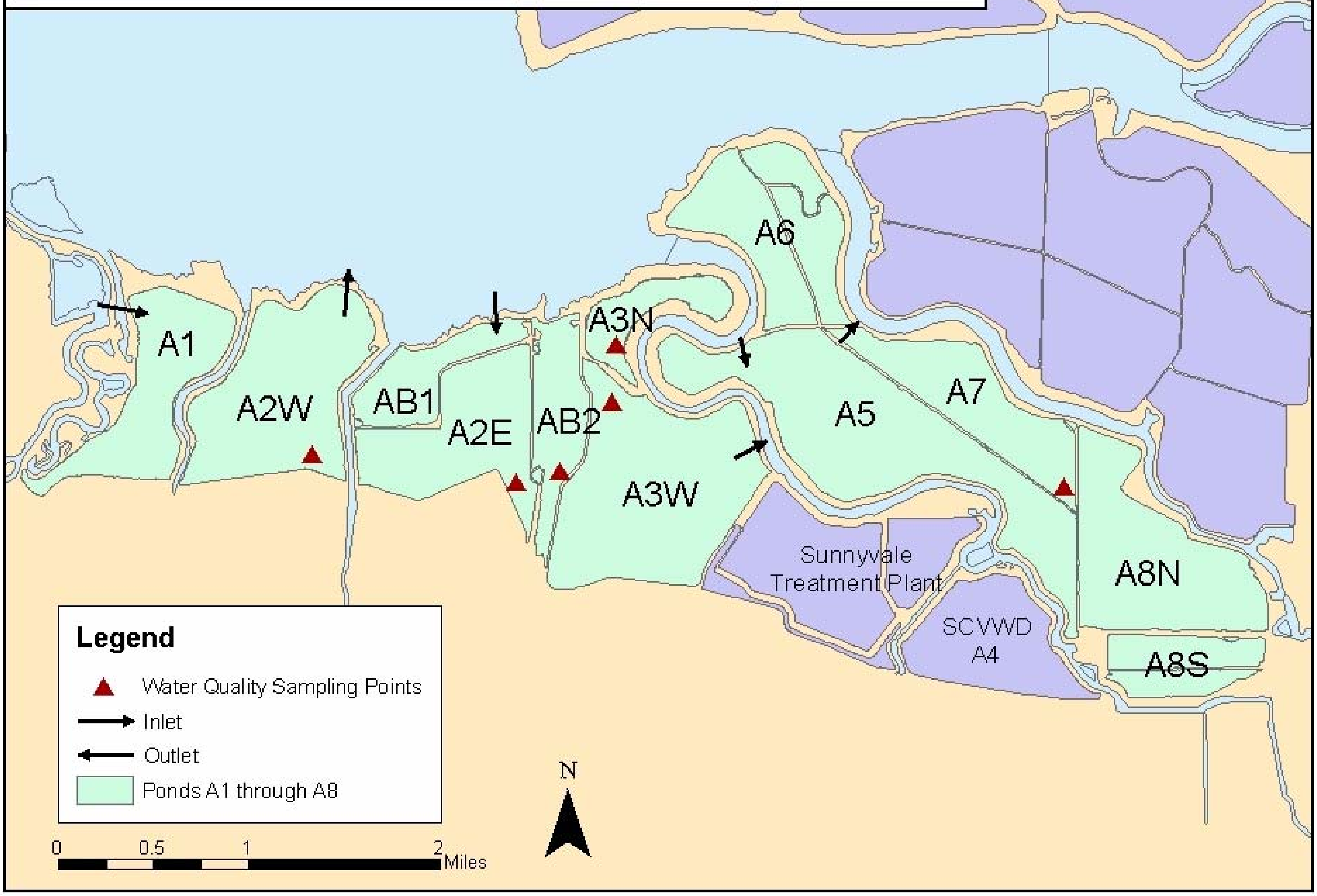
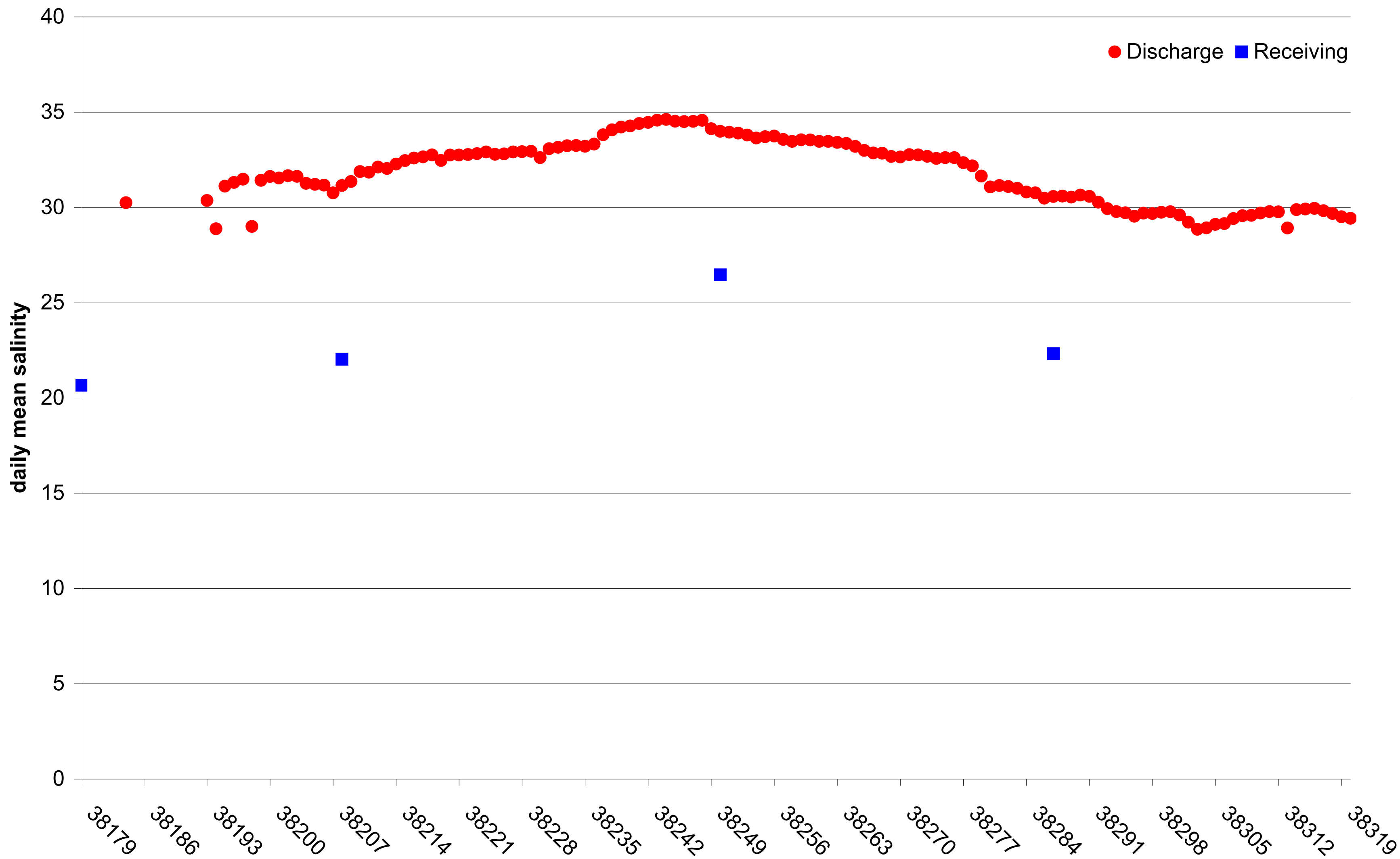


Figure 3 - A2W Salinity



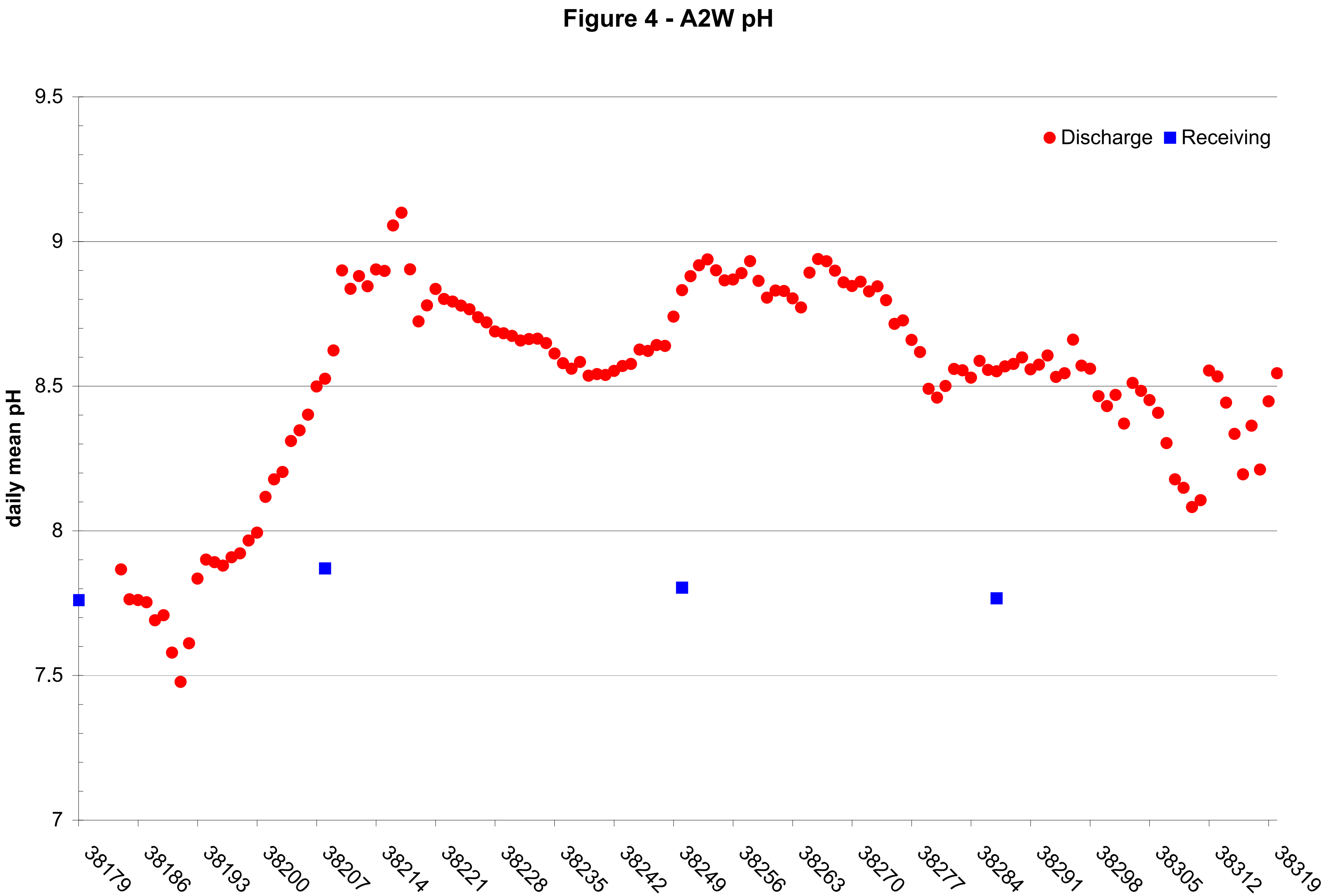


Figure 4 - A2W pH
Discharge
Receiving
daily mean pH
9.5
9
8.5
8
7.5
7
38179
38186
38193
38200
38207
38214
38221
38228
38235
38242
38249
38256
38263
38270
38277
38284
38291
38298
38305
38312
38319

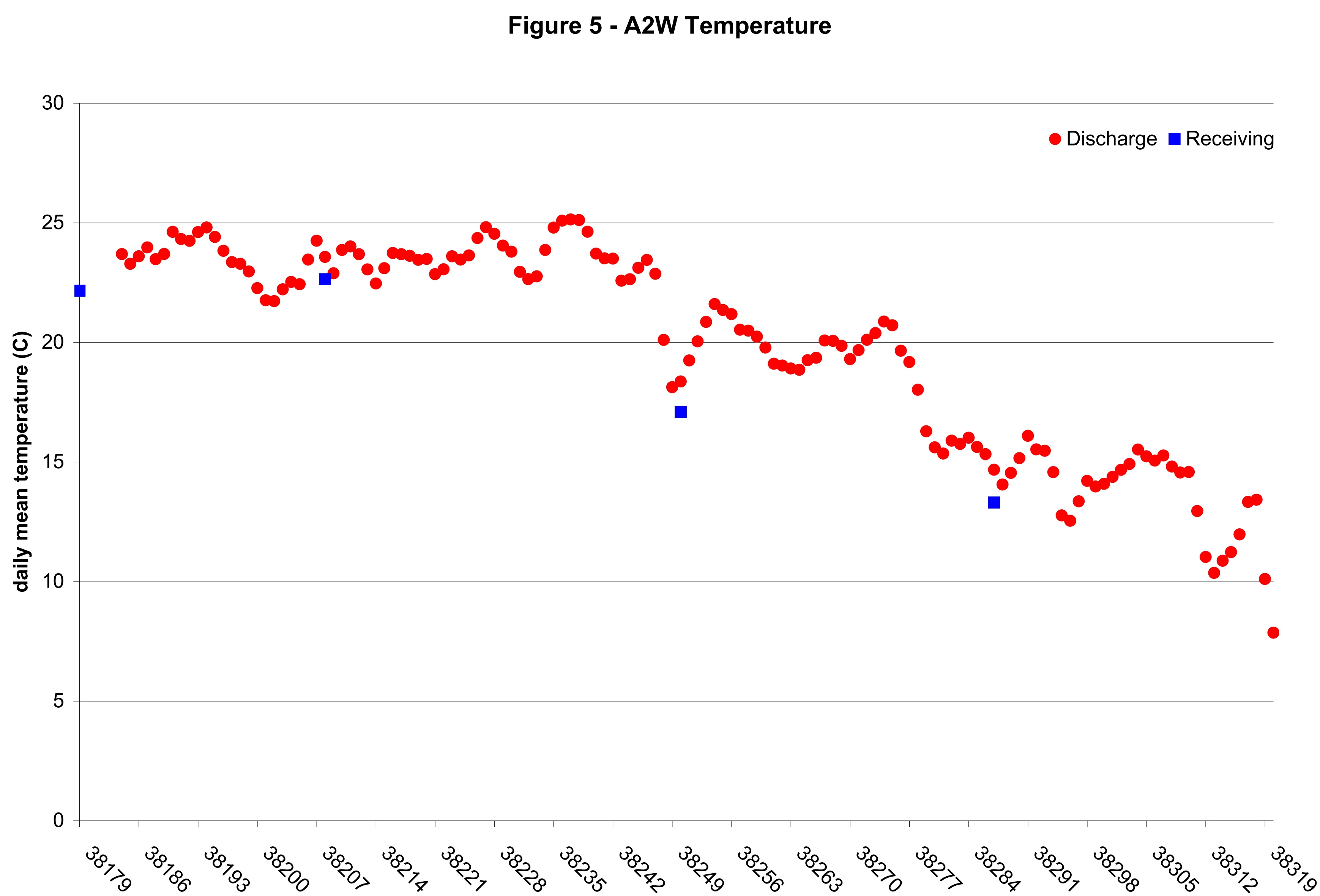


Figure 5 - A2W Temperature
daily mean temperature (C)
0
5
10
15
20
25
30
Discharge
Receiving
38179
38186
38193
38200
38207
38214
38221
38228
38235
38242
38249
38256
38263
38270
38277
38284
38291
38298
38305
38312
38319

Figure 6 - A2W DO

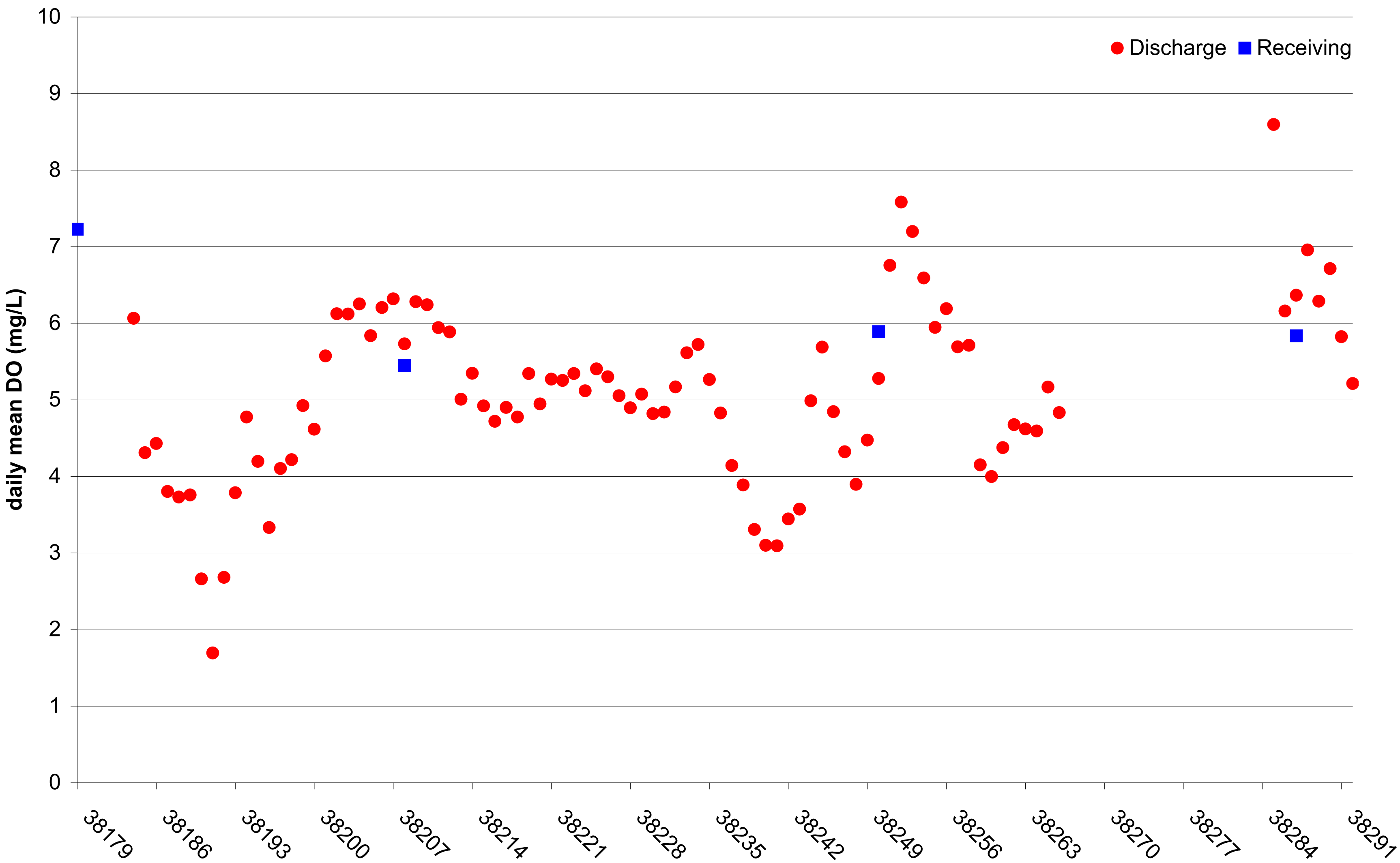


Figure 7 - A3W Salinity

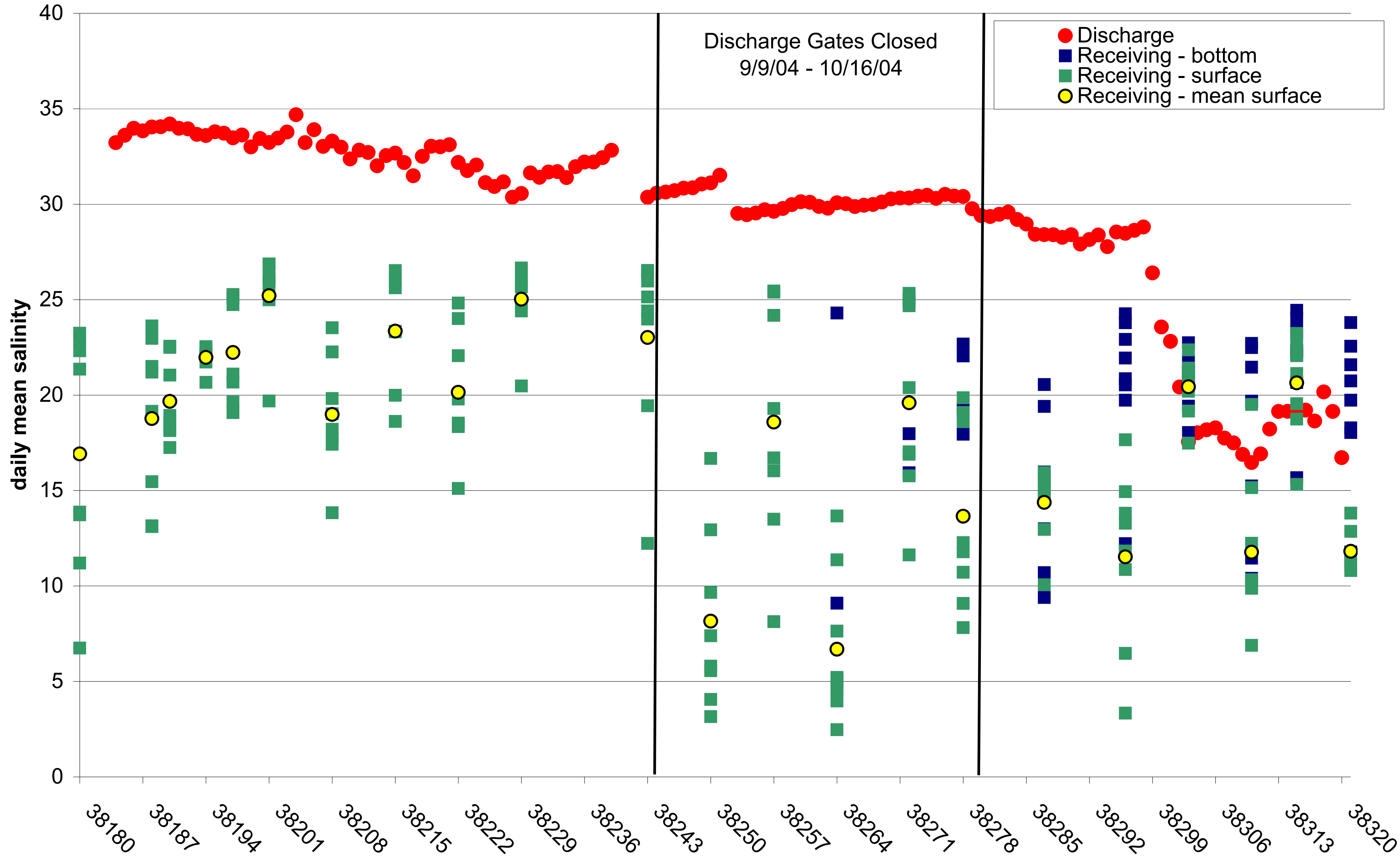


Figure 8 - A3W pH

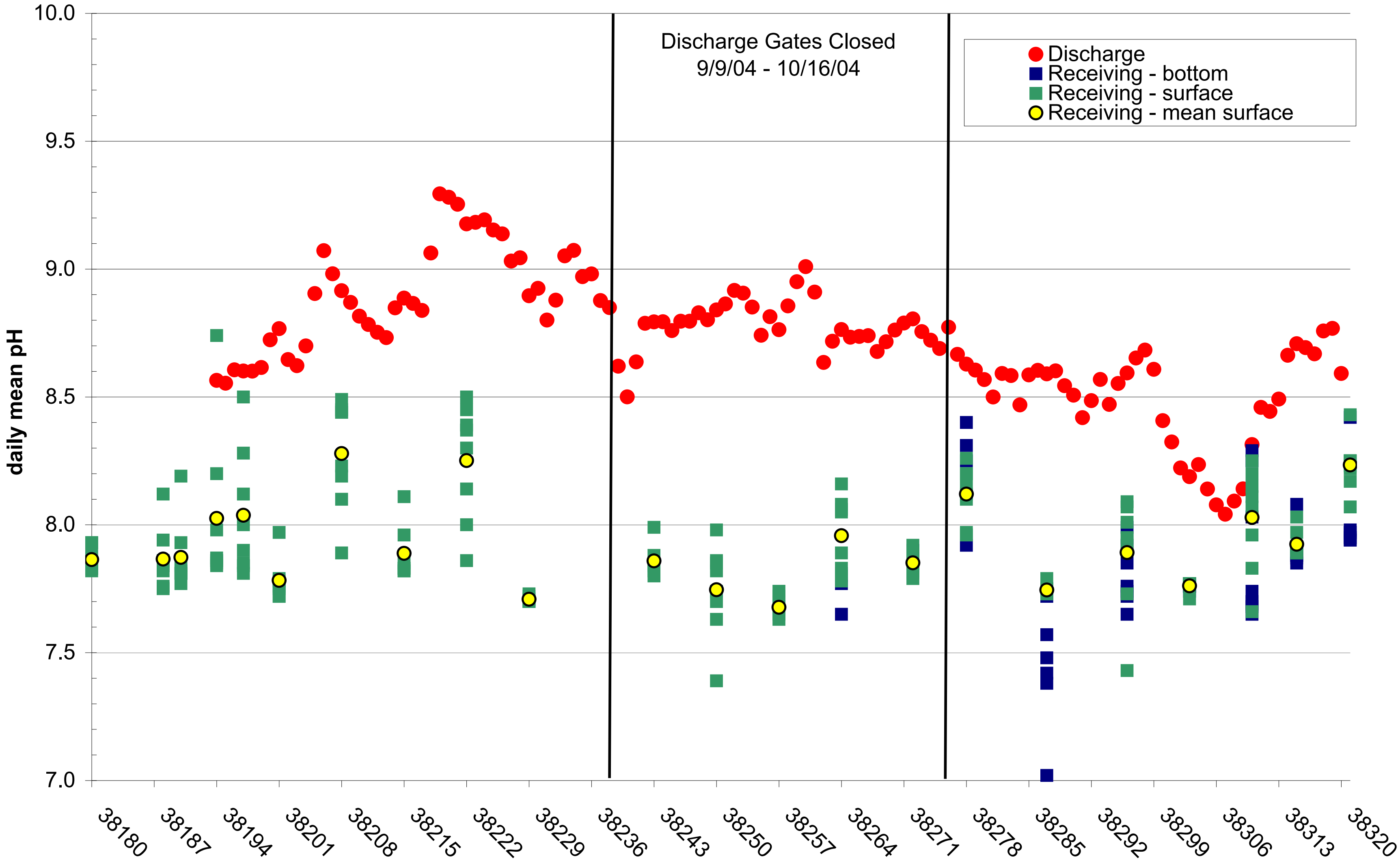


Figure 9 - A3W Temperature

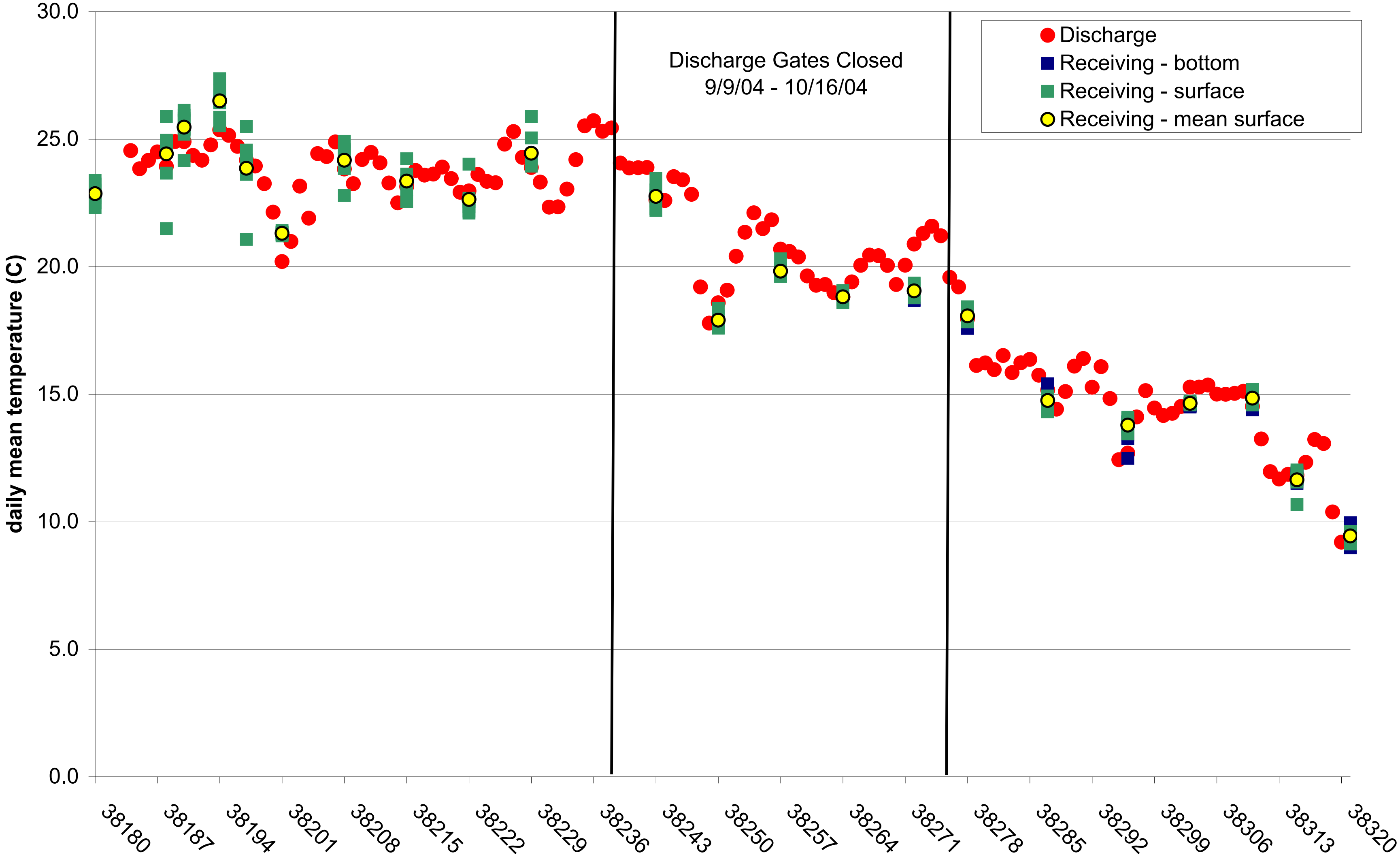


Figure 10 - A3W DO

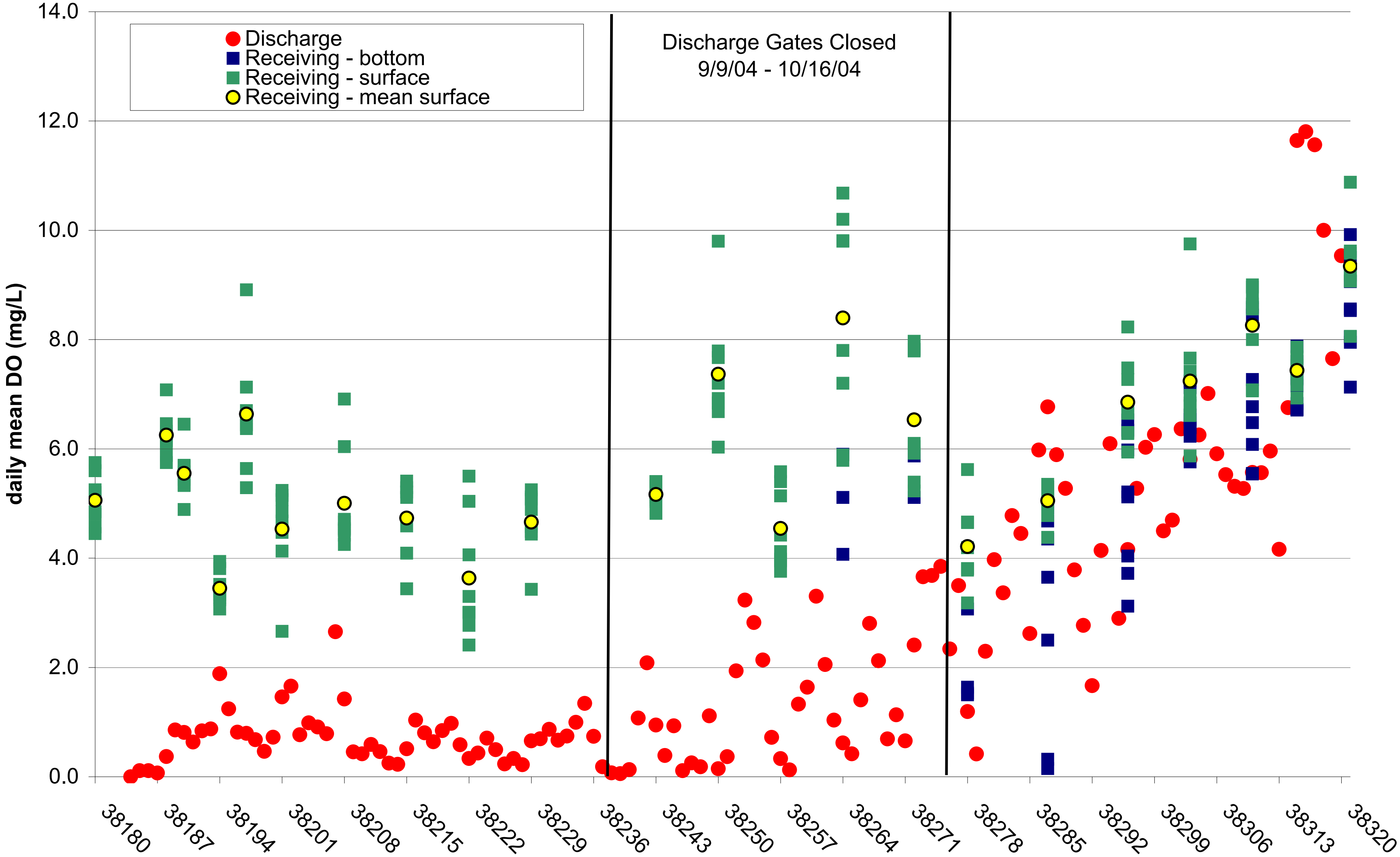
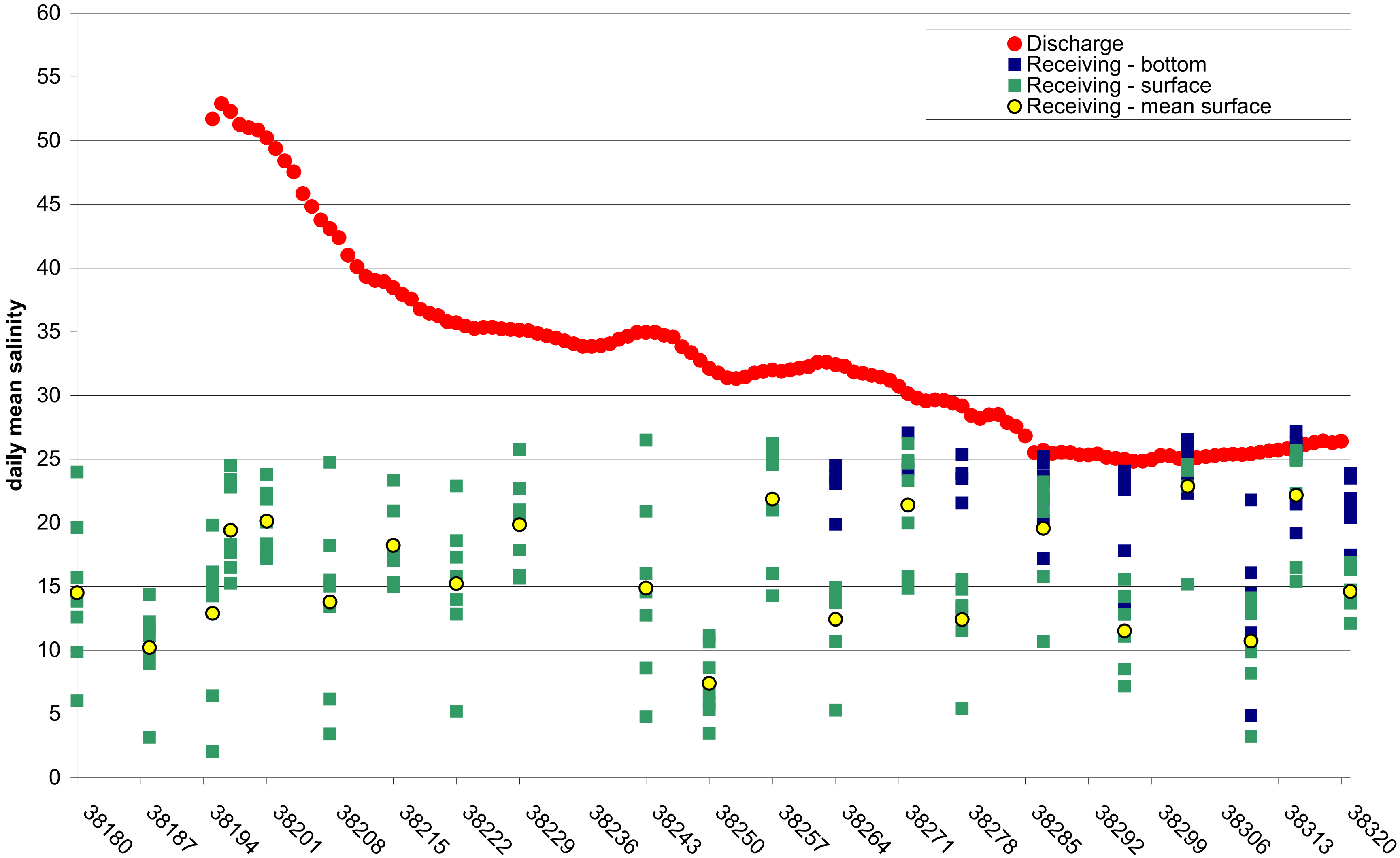


Figure 11 - A7 Salinity



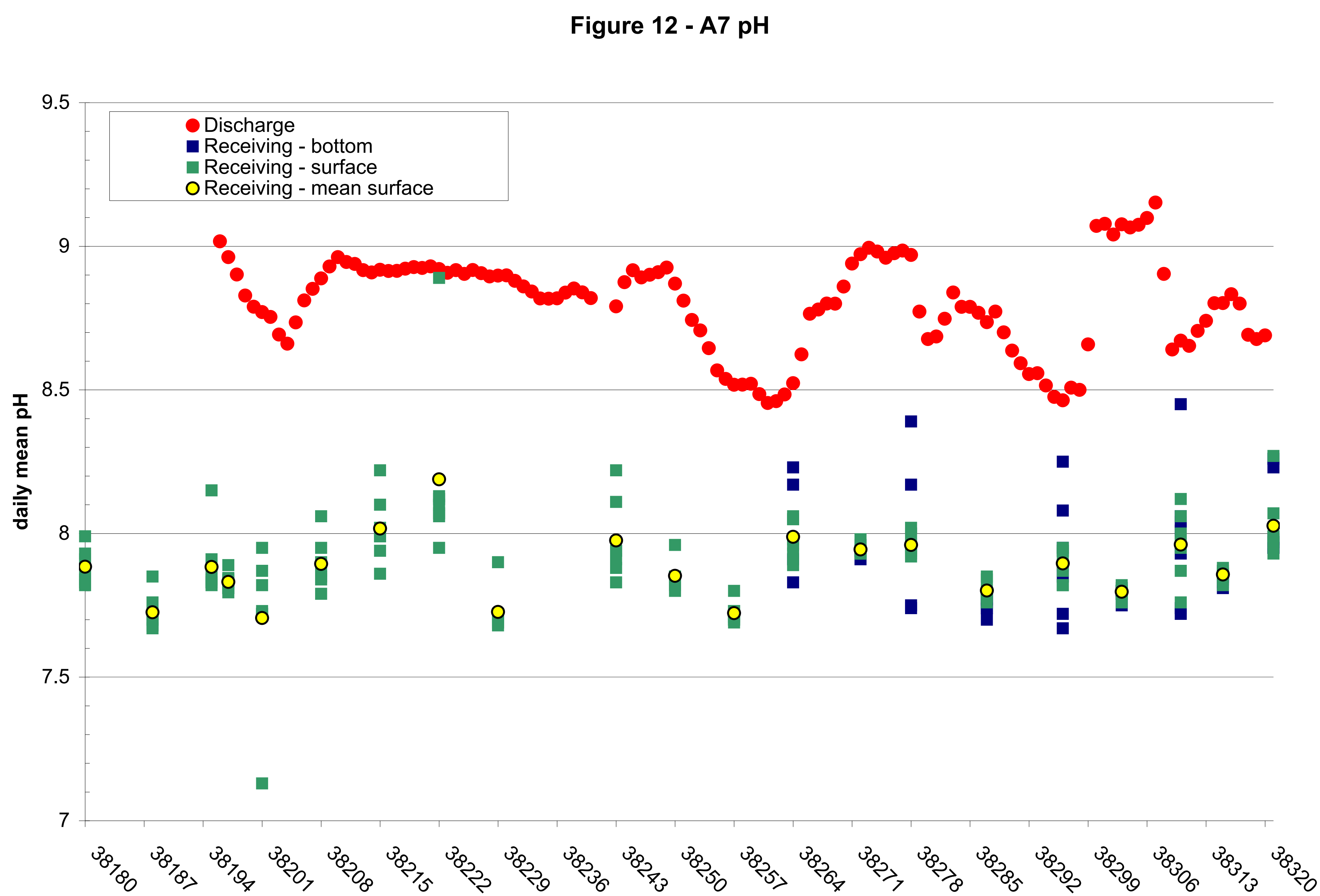


Figure 12 - A7 pH
Discharge
Receiving - bottom
Receiving - surface
Receiving - mean surface
daily mean pH
9.5
9
8.5
8
7.5
7
38180
38187
38194
38201
38208
38215
38222
38229
38236
38243
38250
38257
38264
38271
38278
38285
38292
38299
38306
38313
38320

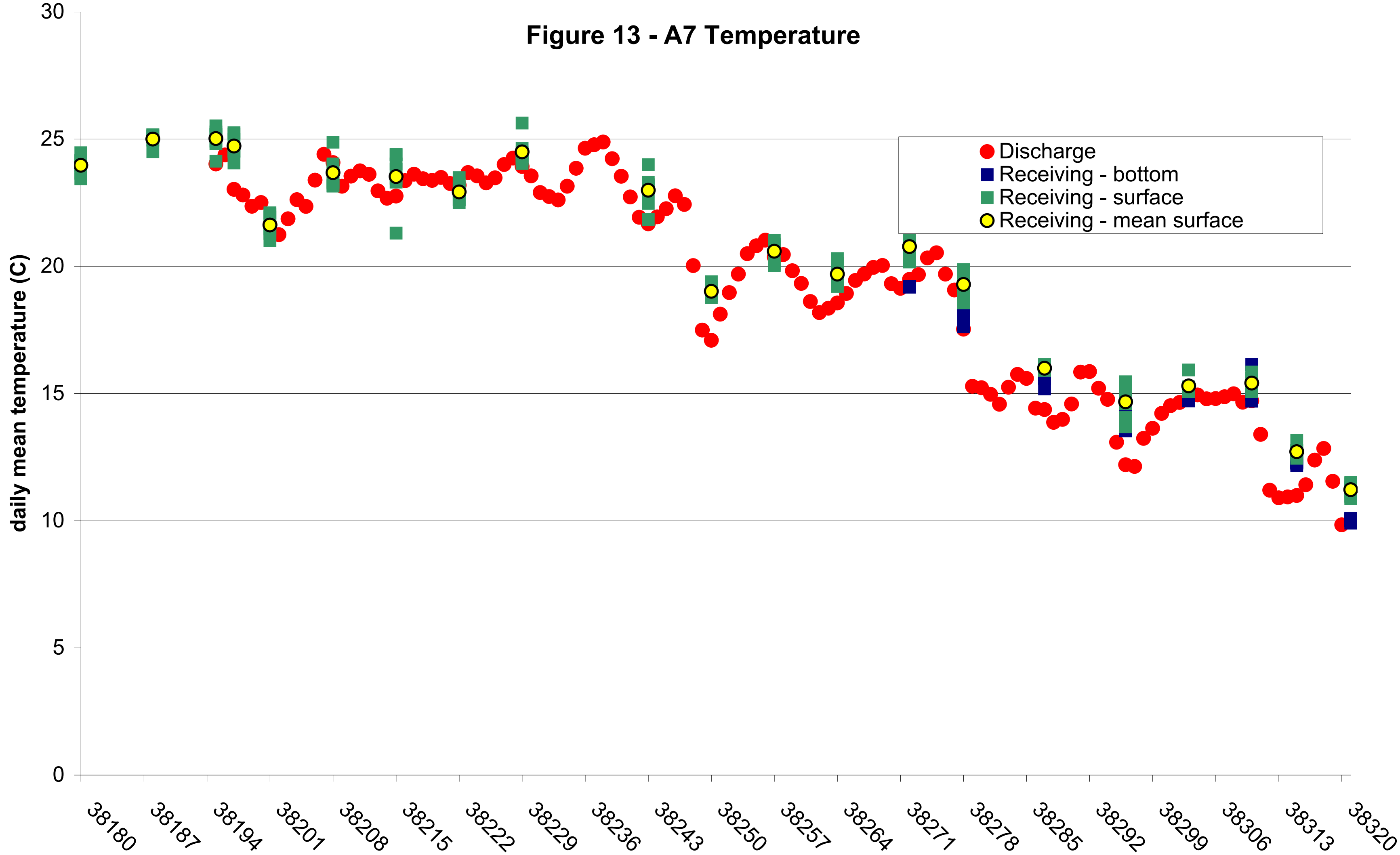
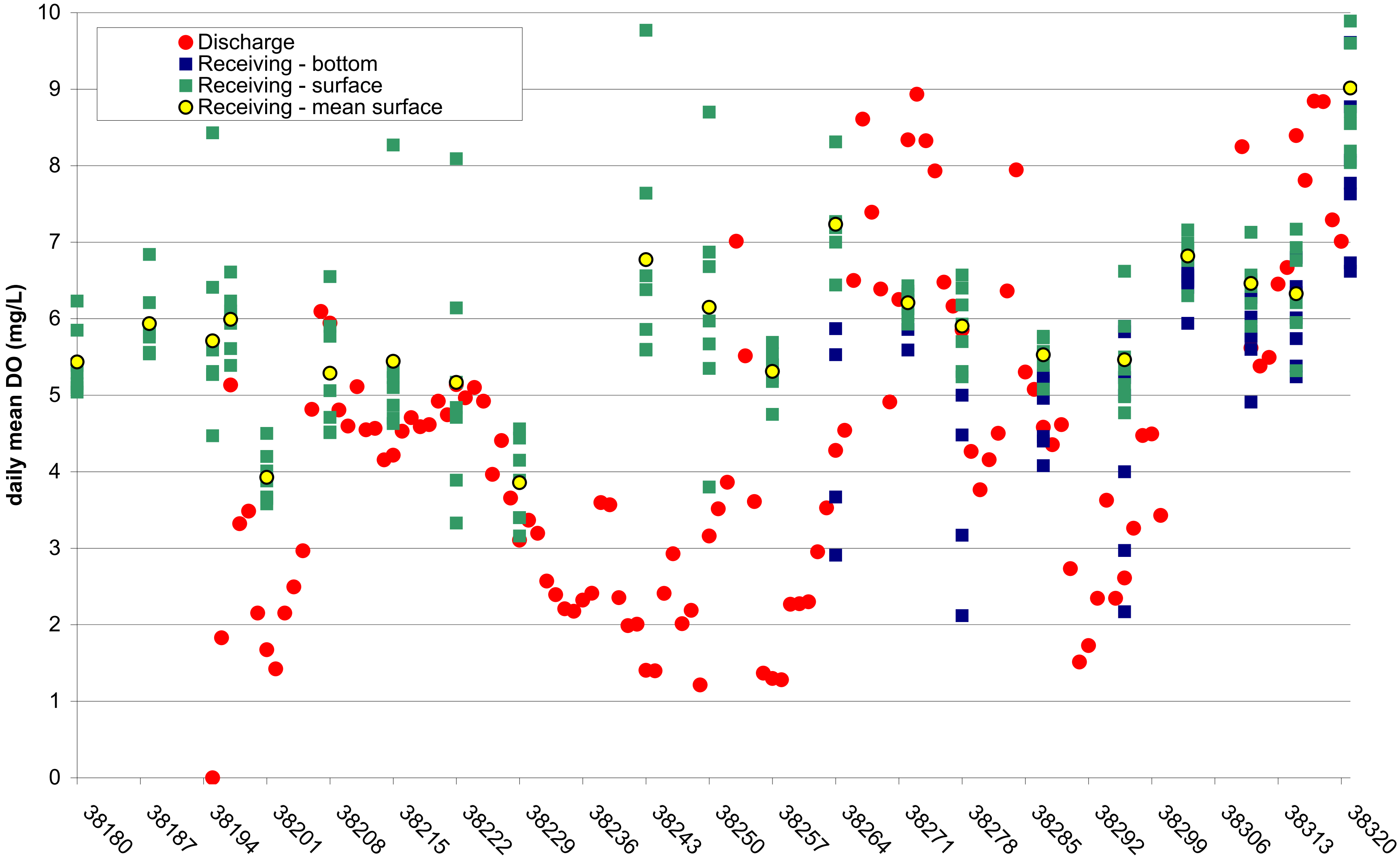


Figure 13 - A7 Temperature
daily mean temperature (C)
30
25
20
15
10
5
0
38180
38187
38194
38201
38208
38215
38222
38229
38236
38243
38250
38257
38264
38271
38278
38285
38292
38299
38306
38313
38320
Discharge
Receiving - bottom
Receiving - surface
Receiving - mean surface

Figure 14 - A7 DO



Appendix A: Discharge Limitations in Final Order

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

Pond System	Salinity (ppt) Instantaneous Maximum
A2W	60
A3W	50
A7	90

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

Constituent	Instantaneous Maximum	Instantaneous Minimum	Units
Salinity for continuous circulation	44		ppt
Dissolved Oxygen[1]		5	mg/L
pH[2]	8.5	6.5	

[1] This limitation applies when receiving waters contain at least 5.0 mg/L of dissolved oxygen. In cases where receiving waters do not meet the Basin Plan objective, pond discharges must be at or above the dissolved oxygen level in the receiving water.

[2] The Discharger may determine compliance with the pH limitation at the point of discharge or in the receiving water.

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

4. Dissolved Oxygen Trigger. Within each pond, once the salinity levels at the discharge point are below 44 ppt, if the dissolved oxygen concentration falls below 1.0 mg/L, the Discharger shall implement corrective measures to increase dissolved oxygen concentrations to above 1.0 mg/L in the pond systems in question, and revise its Operation Plan as necessary to minimize reoccurrence.

Appendix B: Summary of Management Sampling

POND	Location	Grid	Date	Time	Depth S= Surf. B= Bot.	Cond. uS/cm	Temp.	Turbidity (NTU)	pH	D.O. mg/L	Hydrometer Salinity	Spec. Grav.	Sonde Salinity
A2E	A-A2E-0	A2EE5	5/4/2004	8:12	S		19.43		8.03	3.31	25.1	1.0170	
A2E	A-A2E-0	A2EE5	5/18/2004	8:14	S		17.26	24.4	8.12	5.70	25.1	1.0175	
A2E	A-A2E-0	A2EG6	6/1/2004	8:46	S		20.83	153.5	7.85	3.21	29.7	1.0200	
A2E	A-A2E-0	A2EG6	6/15/2004	8:26	S		20.82	24.2	7.90	1.86	29.0	1.0195	
A2E	A-A2E-0	A2EG6	6/29/2004	8:51	S		21.78	24.5	8.29	3.55	32.6	1.0220	
A2E	A-A2E-0	A2EG6	7/13/2004	8:49	S	47.8	20.87	13	8.66	4.65	33.4	1.0230	31.21
A2E	A-A2E-0	A2EF6	7/27/2004	8:13	S	48.3	23.02	9.9	9.12	7.15	31.7	1.0205	31.58
A2E	A-A2E-0	A2EF6	8/17/2004	9:06	S	45.61	23.93		9.43	6.92	29.7	1.0185	29.58
A2E	A-A2E-0	A2EF6	8/25/2004	8:32	S	44.25	22.38	6.5	9.18	4.36	29.0	1.0190	28.55
A2E	A-A2E-0	A2EF1	9/13/2004	14:51	S	40.72	24.86		8.5	1.89			26.07
A2E	A-A2E-0	A2EF6	9/13/2004	15:03	S	43.85	23.87		8.6	4.27			28.32
A2E	A-A2E-0	A2EH7	9/13/2004	15:10	S	44.57	24.89		8.7	7.10			28.87
A2E	A-A2E-0	A2EF6	9/14/2004	8:15	S	43.36	20.89	27.1	8.78	3.98	29.7	1.0200	27.98
A2E	A-A2E-0	A2EF1	10/20/2004	14:15	S	40.59	18.13		8.35	7.39			26.00
A2E	A-A2E-0	A2EF6	10/20/2004	14:23	S	40.49	17.53	97.5	8.35	6.62			25.91
A2E	A-A2E-0	A2EH7	10/20/2004	14:36	S	40.20	17.82		8.4	9.03			25.67
A2W	A-A2W-0	A2WF4	5/5/2004	8:00	S		18.86	125.0	7.91	0.81	22.4	1.0150	
A2W	A-A2W-0	A2WF4	5/19/2004	8:14	S		17.66	29.8	8.08	4.73	23.1	1.0161	
A2W	A-A2W-0	A2WH6	6/1/2004	9:30	S		21.44	132.2	7.79	3.89	27.7	1.0180	
A2W	A-A2W-0	A2WH6	6/15/2004	9:15	S		21.75	21.5	8.06	4.02	27.1	1.0175	
A2W	A-A2W-0	A2WH6	6/29/2004	8:33	S		21.73	45.9	8.02	2.26	30.4	1.0200	
A2W	A-A2W-0	A2WH6	7/13/2004	8:33	S	44.97	20.32	56.3	8.21	3.52	30.4	1.0205	29.16
A2W	A-A2W-0	A2WH5	7/27/2004	8:54	S	46.03	23.00	21.8	8.54	6.21	32.6	1.0215	29.91
A3N	A-A3N-0	A3ND2	7/27/2004	8:27	S	93.19	20.29	75.6	8.65	0.61	69.3	1.0490	65.50
A3N	A-A3N-0	A3ND2	8/17/2004	9:32	S	n/a	22.98	32.3	8.94	4.68	79.8	1.0560	70.74
A3N	A-A3N-0	A3ND2	8/25/2004	8:48	S	n/a	20.15	54.8	8.73	1.55	85.1	1.0610	
A3N	A-A3N-0	A3NB1	9/13/2004	15:56	S	n/a	23.55		8.69	3.83			
A3N	A-A3N-0	A3ND1	9/13/2004	15:47	S	n/a	24.50		9.09	9.34			
A3N	A-A3N-0	A3ND2	9/14/2004	8:38	S		19.47	164.6	8.98	2.25	96.5	1.0700	
A3N	A-A3N-0	A3NB1	10/20/2004	13:07	S	77.12	15.99	125	8.29	4.18			53.22
A3N	A-A3N-0	A3ND1	10/20/2004	13:19	S	75.31	18.18	118.3	8.23	4.87			51.71
A3W	A-A3W-0	A3WD4	5/4/2004	9:31	S		20.45	33.5	8.51	4.98	28.4	1.0190	
A3W	A-A3W-0	A3WD4	5/18/2004	9:35	S		17.94	18.5	8.51	5.94	29.0	1.0205	
A3W	A-A3W-0	A3WA3	6/1/2004	9:00	S		20.6	97.1	8.25	3.95	31.7	1.0215	
A3W	A-A3W-0	A3WA3	6/15/2004	8:36	S		20.66	62.1	8.20	3.76	32.6	1.0220	
A3W	A-A3W-0	A3WA3	6/29/2004	9:07	S		20.39	42.2	8.33	4.25	34.3	1.0235	
A3W	A-A3W-0	A3WG2	7/13/2004	9:36	S	50.66	21.78		8.57	4.24	36.1	1.0240	33.29
A3W	A-A3W-0	A3WA3	7/27/2004	8:24	S	53.78	21.44	8.1	8.95	7.83	38.3	1.0255	35.60

Appendix B Continued

POND	Location	Grid	Date	Time	Depth S= Surf. B= Bot.	Cond. uS/cm	Temp.	Turbidity (NTU)	pH	D.O. mg/L	Hydrometer Salinity	Spec. Grav.	Sonde Salinity
A7	A-A7-0	A7E8	5/5/2004	9:05	S		18.52	66.5	9.52	4.80	49.5	1.0345	
A7	A-A7-0	A7E8	5/19/2004	9:23	S		18.05	41.5	9.54	6.15	50.1	1.0355	
A7	A-A7-0	A7G9	6/1/2004	10:00	S		23.6	235.4	9.55	11.01	46.9	1.0310	
A7	A-A7-0	A7G9	6/15/2004	9:48	S		24.36	110	9.41	10.66	55.4	1.0370	
A7	A-A7-0	A7G9	6/29/2004	9:46	S		22.94	76.3	9.33	6.37	57.4	1.0390	
A7	A-A7-0	A7G9	7/14/2004	8:36	S	81.43	20.82	108.5	9.11	2.67	60.7	1.0425	56.53
A7	at breach	A7A2	7/27/2004	9:54	S	78.71	23.90	97.5	8.98	2.04	54.8	1.0365	54.48
A7	A-A7-0	A7G9	7/27/2004	9:33	S	70.79	23.56	58.1	8.87	9.50	52.1	1.0350	48.41
AB2	A-B2-0	AB2D1	5/4/2004	8:47	S		19.12	329.0	9.11	6.55	21.8	1.0147	
AB2	A-B2-0	AB2D1	5/18/2004	8:50	S		15.94	10.9	9.39	7.01	19.8	1.0143	
AB2	A-B2-0	AB2I1	6/1/2004	9:10	S		18.86	75.1	8.89	0.25	25.1	1.0170	
AB2	A-B2-0	AB2I1	6/15/2004	8:50	S		19.66	19.6	9.00	0.41	28.4	1.0195	
AB2	A-B2-0	AB2I1	6/29/2004	8:58	S		20.95	22.6	9.55	2.44	29.7	1.0200	
AB2	A-B2-0	AB2H1	7/13/2004	9:31	S	48.12	20.57		9.38	2.68	29.7	1.0230	31.45
AB2	A-B2-0	AB2H2	7/27/2004	8:34	S	42.43	21.36	39.5	9.22	2.60	29.0	1.0190	27.32
AB2	A-B2-0	AB2H2	8/17/2004	9:17	S	40.67	21.58	60.5	8.76	0.89	27.7	1.0180	25.99
AB2	A-B2-0	AB2H2	8/25/2004	8:40	S	42.29	18.25	26.2	8.25	0.41	25.7	1.0180	27.23
AB2	A-B2-0	AB2A2	9/13/2004	16:02	S	45.27	25.28		8.39	8.09			29.34
AB2	A-B2-0	AB2C2	9/13/2004	15:34	S	40.89	26.19		8.29	5.02			26.23
AB2	A-B2-0	AB2I2	9/13/2004	15:22	S	43.76	26.61		8.61	9.92			28.31
AB2	A-B2-0	AB2H2	9/14/2004	8:23	S	42.08	18.11	105.3	8.36	0.29	28.4	1.0200	27.05
AB2	A-B2-0	AB2A2	10/20/2004	13:02	S	36.13	16.94	64.2	8.09	7.51			22.81
AB2	A-B2-0	AB2C2	10/20/2004	13:28	S	37.62	15.87	75.9	8.15	5.71			23.87
AB2	A-B2-0	AB2I2	10/20/2004	13:58	S	38.35	17.88	37.2	8.07	4.78			24.39
A2E	A-A2E-0	A2EF6	10/28/2004	9:26	S	40.31	13.03	n/a	8.67	7.89	26.4	1.0200	25.83
AB2	A-B2-0	AB2H2	10/28/2004	9:57	S	37.94	12.51	n/a	8.80	6.79	22.4	1.0175	24.10
A3N	A-A3N-0	A3ND2	10/28/2004	9:44	S	56.56	11.95	n/a	8.64	11.07	37.6	1.0280	38.06

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Progress Report for Mercury in Sediments of the Alviso, Eden Landing, and Ravenswood Salt Ponds

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Background

We collected sediment cores for mercury analysis 21 – 27 October 2003, in the Alviso, Eden Landing, and Ravenswood salt ponds, and 30 August – 3 September 2004 in the Alviso salt ponds. Pond selection was based in part on identification of ponds requiring baseline Hg determination to enhance adaptive management with changing water regimes (L. Stallings, Additional sediment sampling and analysis plan, south bay salt ponds ISP, August 2003; and A.K. Miles and J.Y. Takekawa, Proposed Scope of Work, ISP monitoring protocol for mercury in sediments of Alviso and some Baumberg salt ponds, July 2004). Briefly, 3 sites at each pond were sampled using a 2 cm diameter corer made of PVC pipe driven approximately 20 cm into the sediment. GPS coordinates and discrete water quality measurements (e.g. pH, temperature, salinity, Redox potential, dissolved oxygen) were recorded. At each site, 3 sub-sample sediment cores were collected approximately 5 – 10 m apart and composited as 1 surface and 1 inner sample per site. Cores were divided into surface (top 5 cm) and inner (bottom 15-20 cm) samples and placed in separate chemically clean jars. The corer was cleaned between each site, cores were handled with latex gloved hands, and jars were placed on ice until frozen (within hours of collection). We sampled sites in a random fashion in 2003. In 2004, we collected sediments from sites 1) near an area of water exchange, 2) a distance of about halfway across the pond and 3) a distance at the far end of the pond away from water exchange.

In 2003, samples collected at each of the 3 sites per pond were analyzed separately. Total Hg and methyl Hg (meHg) were analyzed in surface and inner samples from all ponds, while arsenic and selenium were analyzed only in Alviso samples. In 2004, sites were composited into 1 surface sediment and 1 inner sediment sample per pond because of limited funding. Also, we analyzed only meHg in inner sediments and total Hg in surface sediments. This was done because we initially inferred higher meHg concentrations in inner sediments when in fact surface sediments contained higher meHg concentrations (see below). We will rectify this problem by analyzing meHg in all surface sediment samples collected during 2004. We also determined sulfide concentrations in sediments sampled in 2004.

Frontier Geosciences (Seattle, WA) conducted Hg analyses on 2003 samples, and Battelle Marine Sciences Lab (Sequim, WA) conducted Hg analyses on 2004 samples. Battelle is and will be analyzing Hg or meHg for several related USGS –USFWS studies at San Francisco Bay and the Sacramento-San Joaquin Delta. Analytical Resources, Inc (Tukwila, WA) conducted analytical chemistry for sulfide analysis. All laboratory results met QA/QC standards. All concentrations reported are on a dry weight basis.

Preliminary Results

Sampling locations are presented in Appendices 1a -1c. We sampled 10 Alviso (A10, A11, A12, A13, A14, A16, A2E, A3N, A7, A8), 4 Eden Landing (B2, B6A, B11, B12), and 2 Ravenswood ponds (R2, R4) in 2003. Eight Alviso ponds (A1, A2E, A2W, A3W, A5, A7, AB1, AB2) were sampled in August 2004 following manipulation of water movement or exchange at those ponds in July 2004. Alviso ponds A2E and A7 were the only 2 ponds sampled both in 2003 and 2004.

Surface sediment Hg concentrations

Hg concentrations for surface sediment samples collected during 2003 and 2004 are presented in Table 1. Sediments from Alviso pond A12 (1697 ng/g) and A13 (1068 ng/g) had the highest mean concentrations of total Hg, while Ravenswood pond R4 had the lowest concentrations (38.8 ng/g). Sediments from Eden Landing pond-B11 (10.7 ng/g) and Alviso pond A3N (5.8 ng) had the highest concentrations of meHg, while Eden Landing pond B6A had the lowest (0.12 ng/g).

Inner sediment Hg concentrations

Hg concentrations for inner sediment samples collected in 2003 and 2004 are presented in Table 2. Total Hg was highest in Alviso Pond A7 (1291 ng/g) and lowest in Ravenswood Pond R4 (85.7 ng/g). Concentrations of meHg were highest in Alviso pond A14 (0.549 ng/g) and Eden Landing Pond B12 (0.547 ng/g), and lowest in Eden Landing pond B2 (0.03 ng/g).

Surface vs. inner sediment Hg concentrations

We compared surface vs. inner sediments samples from 2003 (samples from 2004 could not be included because of our compositing scheme). Mean concentrations of total Hg did not differ between surface (481.5 ng/g) and inner sediments (501.2 ng/g) (paired t-test, $P = 0.32$). However, mean concentrations of meHg were significantly higher in surface (2.4 ng/g) compared to inner sediments (0.320 ng/g; paired t-test, $P = 0.003$). Concentrations of total Hg in surface sediments were significantly correlated ($P < 0.001$) to total Hg concentrations in inner sediments and the relationship was reasonably predictable ($R^2 = 0.58$) (Figure 1a). Concentrations of meHg in surface sediments were also significantly correlated ($P < 0.001$) to meHg concentrations in inner sediments, but the relationship showed less predictability ($R^2 = 0.30$) (Figure 1b). Also, concentrations of total Hg and meHg were significantly ($P \leq 0.004$) related to each other in both surface and inner sediments, but predictability was poor especially for inner sediments ($R^2 = 0.10$) (Figure 2a, 2b).

Comparison to samples collected by USFWS-ECD

For comparison, we also include estimates of total Hg in sediments from 6 Alviso ponds (including pond A9) sampled during July 2002 by the USFWS Environmental Contaminants Division (Table 1). Note that concentrations between their study and this study may not be directly comparable because their samples were taken from the top 10-15 cm of sediment. However, assuming comparability, geometric mean concentrations in 2002 (502 ng/g) did not differ significantly from total Hg concentrations in surface sediments from the same ponds sampled in 2003 - 2004 (480 ng/g) (paired t-test, $P = 0.40$).

Hg – sulfide relations

For samples collected in 2004, sulfide concentrations were not significantly related to concentrations of either total or methyl Hg ($P \geq 0.55$) (Figure 3) (Table 3). Sulfide concentrations alone do not appear to be good predicators of Hg concentrations.

Spatial variability in Hg concentrations among ponds

Figures 4a-4b depict concentrations of total Hg in surface sediments and meHg in inner sediments for both years in the Alviso ponds and demonstrate geographic variability within the salt pond complex. Note that only concentrations of total Hg from surface sediments and MeHg from inner sediments are mapped because they were analyzed in both years. Our preliminary results indicate:

- Total Hg concentrations were highest at ponds A12 and A13 (> 1.0 µg/g) followed by A5, A7, A8, A10, A11, and A13 (> 0.5 µg/g), and appear to decline in ponds further away from Alviso slough (Figure 4a).

- There is considerably less geographic variability in meHg concentrations, and these concentrations are consistently low (<1.0 ng/g) (Figure 4b).
- Ponds A2E and A7 were sampled in 2003 and 2004 and had relatively similar concentrations of total Hg (Figure 4a) and meHg (Figure 4b) between years.

For general comparison, mean concentrations of meHg in surface sediments are plotted for the 2003 results in Figure 5. Pond A3N has the highest average meHg concentration (5.8 ng/g), and ponds A12 and A13 average over 3.0 ng/g.

Spatial variability in Hg concentrations within ponds

Figures 6a – 6f show surface sediment concentrations from individual sites at all ponds sampled in 2003, and demonstrate some spatial variability in Hg concentrations within ponds. We focus on surface sediments herein because they contained higher concentrations of meHg than inner samples, and surface concentrations were significant predictors of inner concentrations.

Among Alviso ponds, the highest point concentrations of total Hg were from ponds A8, A12, and A13 ($\geq$ 3μg/g) and were usually > 2.5 μg/g at all other sites (Figure 6a). Considerably higher variation occurred among meHg concentrations. Samples from A3N and A7 had concentrations > 11 ng/g, and intermediate concentrations were found in samples from A8, A12, and A13 (3 – 6 ng/g). Ponds A2E, A10, A14, and A16 all had consistently lower concentrations (< 2 ng/g; Figure 6b).

Total Hg concentrations were consistently low (< 0.5 μg/g) at sample sites in Eden Landing ponds (Figure 6c). Pond B11 was a meHg 'hotspot' (> 11 ng/g), but concentrations were considerably lower at all other sample points (< 2.2 ng/g) (Figure 6d). Consistently low concentration of total Hg (<0.5 μg/g) and meHg (<3 ng/g) were found in sediments from the 2 Ravenswood Ponds sampled (Figures 6e-6f).

Spatially explicit concentrations from inner sediments are presented in Appendices 2a-2f but not elaborated upon because they contained lower concentrations of meHg.

Current/Future Analyses

Because our analysis of paired surface and inner sediment samples from 2003 indicated significantly higher surface concentrations of meHg, we will analyze meHg in surface sediment samples from the 8 Alviso ponds sampled in 2004. Analytical chemistry and data QA/QC for these samples will be completed by March 1, 2005. This will complete our baseline dataset for late summer – early fall total Hg and meHg concentrations in the Alviso salt ponds with currently altered water regimes.

The protocol set forth in our proposed scope of work identified 2 main objectives for the study. First, we will establish a set of baseline concentrations of total and meHg in south bay salt ponds, primarily during late summer and/or early winter. Second, we will conduct additional sampling during winter and subsequent summer months in ponds that 1) have the highest baseline meHg concentrations, 2) are scheduled for changing water and salinity regimes (i.e. ponds A16, A17), or 3) are characterized by important physical features. Accordingly, we will sample or re-sample Alviso ponds A9, A15, A17, A3N, A12, A13, AB1, A5, A7, A19, A20, and A21 during February 2005.

- Ponds A3N, A12, and A13 contained surface sediments with the highest concentrations of meHg and will be re-sampled according to our objectives.
- We also will re-sample ponds AB1, A5, and A7 because they are characterized by increasing depth associated with increasing distance from the south bay which causes exposed mudflats as water flow changes (C. Morris, personal communication). Thus, we will sample 3 points (near, midway, and farthest from the bay) in order describe potential variation in Hg concentrations associated with depth.
- Ponds A9, A15, A17, A19, A20, and A21 are or may be slated for water regime changes in the near future and we need to establish a baseline for those ponds. We will concentrate our efforts on collecting surface sediments at all ponds, although inner sediments will be collected at ponds not sampled previously.
- Sediments from the above mentioned ponds will not be composited in the field as conducted in 2004 because of the inability to determine variability within ponds, particularly those with heterogeneous depths. These samples may be analyzed separately rather than composited if adequate funding is available. Collectively, these ponds will provide a mid-winter baseline Hg dataset for Alviso.

In addition, we are currently collecting composite sediment samples for baseline Hg analysis in all Eden Landing Ponds, which will be completed by the end of January 2005. We are collecting both surface and inner sediments, but we will initially only determine total Hg and MeHg in surface sediments (inner sediments will remain frozen and archived). Analytical chemistry and data QA/QC for these samples will be completed by March 1, 2005. This will provide a baseline dataset for mid winter concentrations of total Hg and MeHg in the Eden Landing Ponds.

Finally, we are developing a draft 5 year monitoring plan to determine the effects of changing water management on Hg concentrations in the south bay salt ponds. This draft will be ready for discussion or review after analytical chemistry for all samples noted above has been completed and results are analyzed thoroughly.

Table 1. Summary results for dry weight geometric mean concentrations of Hg (total and methyl) As, and Se for surface sediments from salt ponds in the Alviso, Eden Landing, and Ravenswood Salt Pond Complexes. 2004 results are from a single composite sample per pond.

				Surface sediment samples				
Pond Complex	Pond	Year [a]	*n*	Total Hg (ng/g)	meHg (ng/g)	As (µg/g)	Se (µg/g)	% Total Solids
Alviso	A2E	2003	3	486.6	0.724	12.1	0.45	37.0
	A3N	2003	3	380.6	5.773	12.0	0.54	44.5
	A7	2003	5	810.5	2.826	13.8	0.57	27.4
	A8	2003	3	695.4	1.450	12.0	0.36	29.6
	A10	2003	3	722.3	1.425	11.5	0.50	35.3
	A11	2003	3	649.5	2.308	14.6	0.61	35.9
	A12	2003	3	1697.4	3.344	11.1	0.62	39.5
	A13	2003	3	1068.5	3.027	17.3	0.71	30.8
	A14	2003	3	276.5	1.435	10.0	0.31	26.4
	A16	2003	3	411.4	1.210	13.0	0.42	27.2
Alviso	A1	2004	1	301	na	na	na	35.1
	A2E	2004	1	436	na	na	na	36.5
	A2W	2004	1	307	na	na	na	41.7
	A3W	2004	1	181	na	na	na	39.2
	A5	2004	1	736	na	na	na	35.3
	A7	2004	1	554	na	na	na	44.5
	AB1	2004	1	390	na	na	na	45.7
	AB2	2004	1	387	na	na	na	38.8
	Geometric mean			*504.8*	*1.993*	*12.6*	*0.49*	*35.7*
Eden Landing	B2	2003	3	134.4	0.655	na	na	35.3
	B6A	2003	3	69.6	0.121	na	na	43.1
	B11	2003	3	156.1	10.711	na	na	42.7
	B12	2003	3	64.0	2.073	na	na	51.1
	Geometric mean			*98.3*	*1.151*	*na*	*na*	*42.7*
Ravenswood	R2	2003	3	44.0	0.882	na	na	64.9
	R4	2003	3	38.8	0.295	na	na	60.8
	Geometric mean			*41.3*	*0.510*	*na*	*na*	*62.8*
	Geometric mean (all ponds)			*312.0*	*1.465*	*12.6*	*0.5*	*38.5*
Alviso - USFWS [b]	A1	2002	3	312.8	na	6.2	0.10	na
	AB1	2002	3	562.8	na	14.5	0.19	na
	A5	2002	3	372.5	na	14.1	0.56	na
	A9	2002	3	478.7	na	8.2	0.18	na
	A10	2002	3	919.5	na	9.0	0.53	na
	A16	2002	3	532.6	na	11.3	0.62	na

[a] 2003 ponds sampled during October, 2004 ponds sampled during late August-early September, 2002 ponds sampled during July

[b] data from Maurer and Adelsbach (Phase 2 Environmental Site Assessment, USFW Environmental Contaminants Division, Sacramento CA). Samples collected in top 10-15 cm

n/a = not analyzed

Table 2. Summary results for dry weight geometric mean concentrations of Hg (total and methyl), As, and Se for inner sediments from salt ponds in the Alviso, Eden Landing, and Ravenswood Salt Pond Complexes. 2004 results are from a single composite sample per pond.

			Inner (bottom 15-20 cm) sediment samples					
Pond Complex	Pond	Year [a]	*n*	Total Hg (ng/g)	meHg (ng/g)	As (µg/g)	Se (µg/g)	% Total Solids
Alviso	A2E	2003	3	378.9	0.075	10.6	0.55	35.8
	A3N	2003	3	103.5	0.322	10.1	0.61	36.4
	A7	2003	3	1290.8	0.421	15.1	0.73	39.3
	A8	2003	5	818.6	0.392	8.7	0.79	38.1
	A10	2003	3	890.9	0.308	18.1	0.52	40.3
	A11	2003	3	543.0	0.219	15.2	0.57	49.2
	A12	2003	3	1121.4	0.415	13.2	0.61	44.7
	A13	2003	3	985.2	0.549	15.3	0.55	44.0
	A14	2003	3	583.4	0.299	11.3	0.41	45.5
	A16	2003	3	722.0	0.821	14.4	0.84	33.1
Alviso	A1	2004	1	na	0.051	na	na	na
	A2E	2004	1	na	0.348	na	na	na
	A2W	2004	1	na	0.313	na	na	na
	A3W	2004	1	na	0.164	na	na	na
	A5	2004	1	na	0.368	na	na	na
	A7	2004	1	na	0.405	na	na	na
	AB1	2004	1	na	0.462	na	na	na
	AB2	2004	1	na	0.065	na	na	na
	Geometric mean			*626.6*	*0.271*	*12.9*	*0.605*	*40.4*
Eden Landing	B2	2003	3	132.3	0.031	n/a	n/a	30.8
	B6A	2003	3	91.7	0.040	n/a	n/a	54.0
	B11	2003	3	49.3	0.311	n/a	n/a	41.9
	B12	2003	3	133.8	0.547	n/a	n/a	49.3
	Geometric mean			*94.6*	*0.120*	*na*	*na*	*43.1*
Ravenswood	R2	2003	3	85.7	0.264	n/a	n/a	56.8
	R4	2003	3	89.8	0.102	n/a	n/a	54.2
	Geometric mean			*87.7*	*0.164*	*na*	*na*	*55.5*
	Geometric mean (all ponds)			*305.4*	*0.227*	*12.9*	*0.6*	*42.7*

[a] 2003 ponds sampled during October, 2004 ponds sampled during late August-early September, 2002 ponds sampled during July

n/a = not analyzed

Table 3. Summary results for dry weight concentrations of Hg (total and methyl) and sulfide in sediments from salt ponds in the Alviso Salt Pond Complex, August-September 2004.

	Hg (ng/g)			Sulfide (µg/g)		
Pond	*n*	Total Hg	MeHg	*n*	Geomean	SD
A1	1	301	0.0508	3	1115	1015
A2E	1	436	0.348	3	597	201
A2W	1	307	0.313	3	2631	1858
A3W	1	181	0.164	3	38	779
A5	1	736	0.368	3	1014	3372
A7	1	554	0.405	3	539	856
AB1	1	390	0.462	3	1208	686
AB2	1	387	0.065	3	1091	2852

Figure 1. Relationship between Total Hg (A) and meHg (B) concentrations in paired surface (top 5 cm) and inner (bottom 15-20) cm sediment samples from Alviso, Eden Landing, and Ravenswood Salt Ponds, October 2003. Concentrations are log transformed.

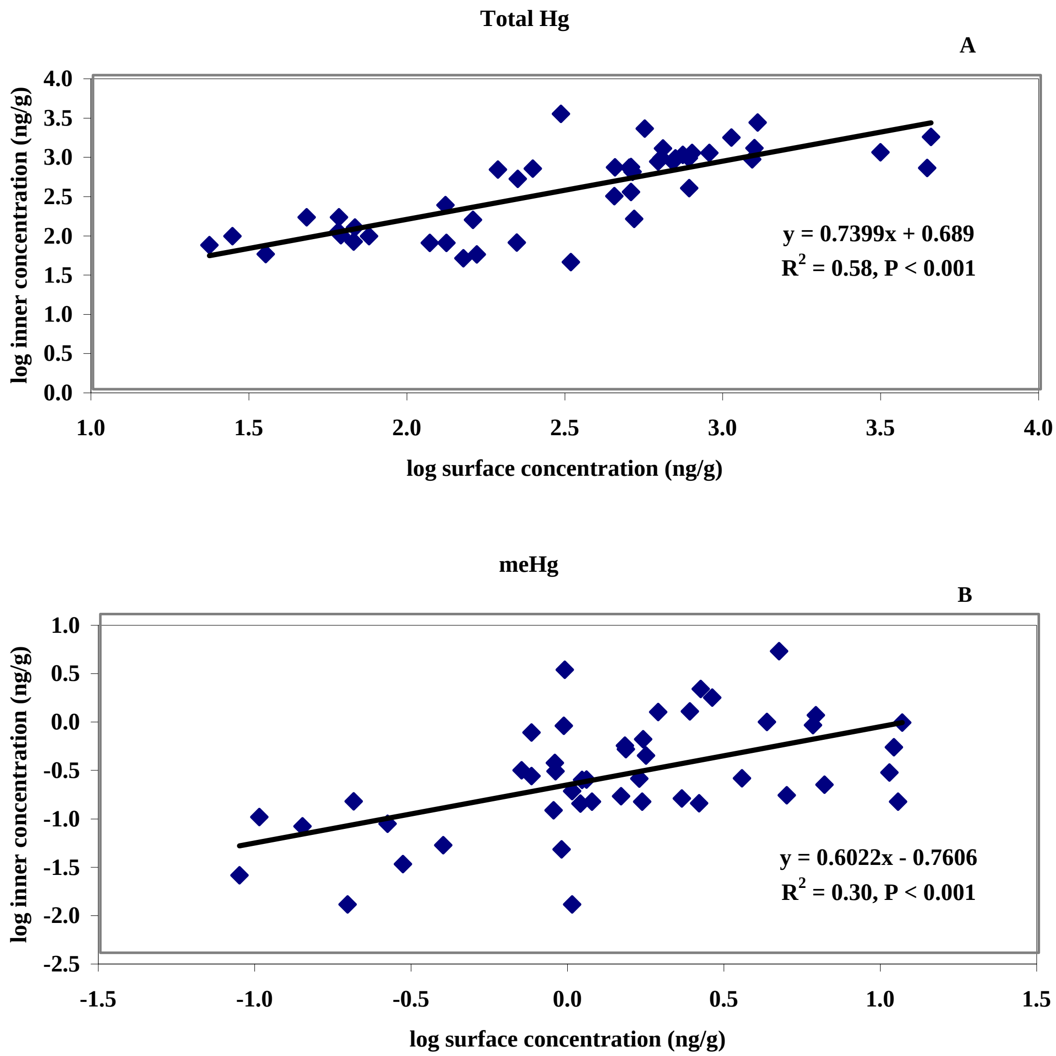
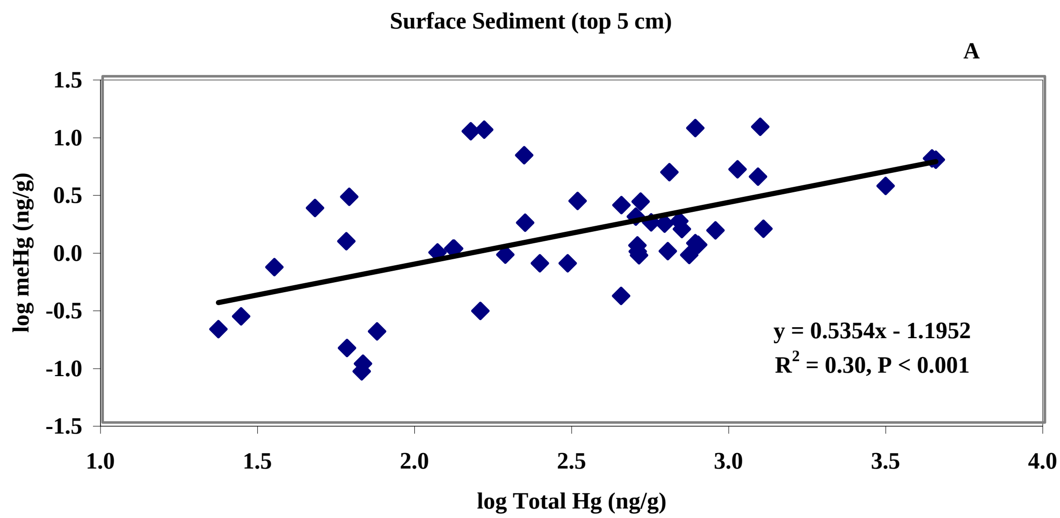


Figure 2. Relationship between Total Hg and meHg concentrations from paired surface (top 5 cm) (A) and inner (bottom 15-20 cm) (B) sediment samples from Alviso, Eden Landing, and Ravenswood Salt Ponds, October 2003. Concentrations are log transformed.



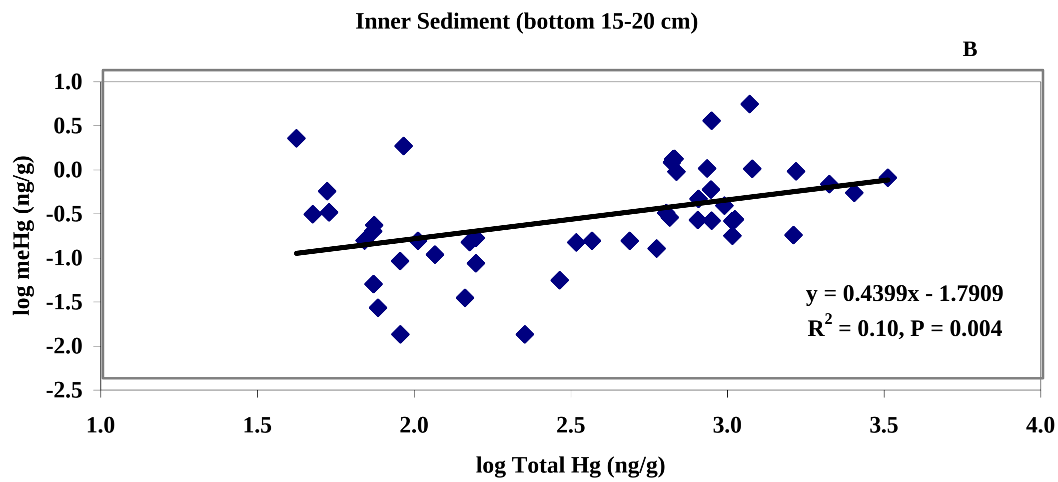


Figure 3. Relations between mean sulfide concentration and total Hg (A) and methyl mercury (meHg) (B) in sediments from Alivso Salt Ponds, South San Francisco Bay, August-September 2004. Concentrations are log transformed.

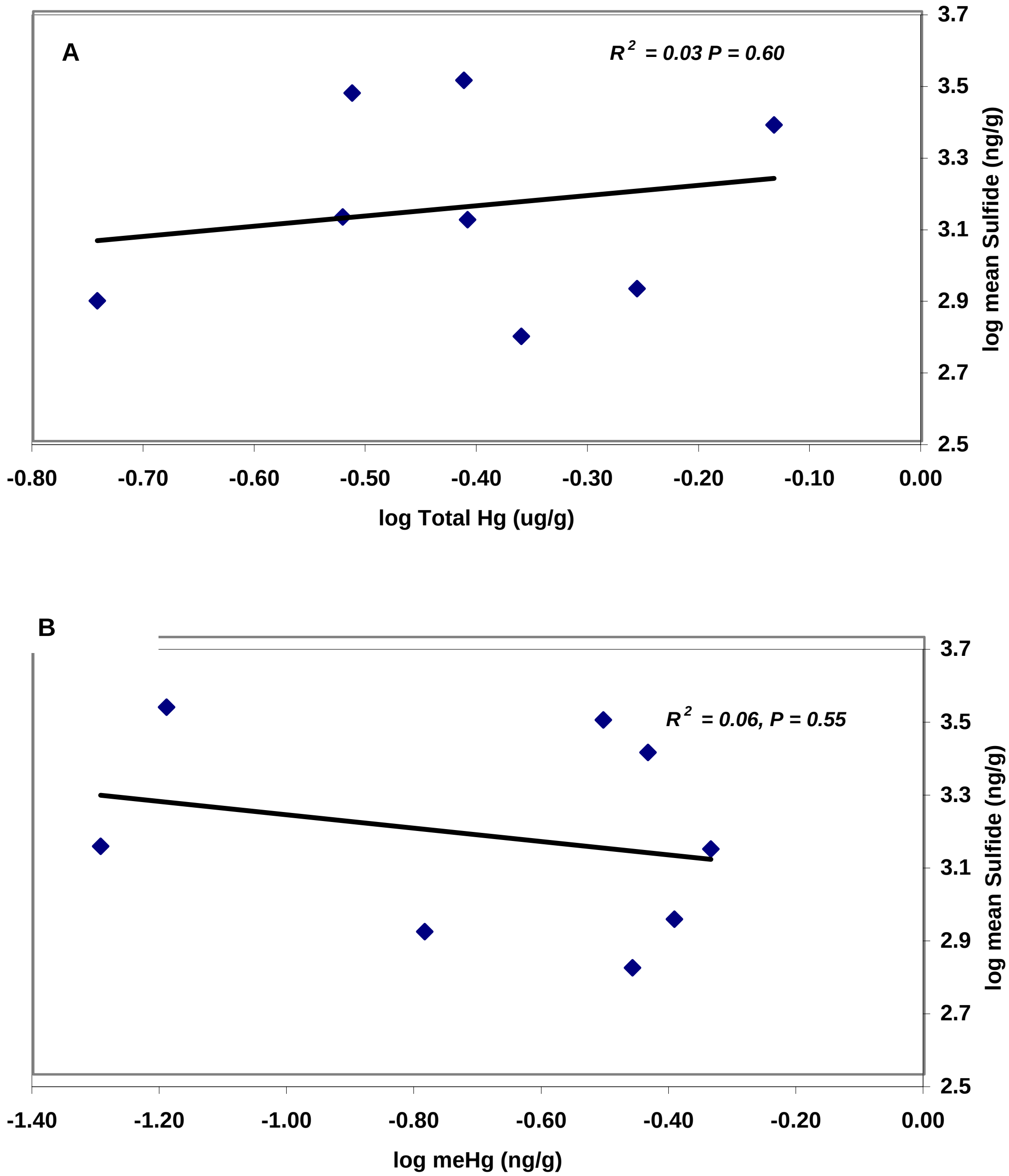
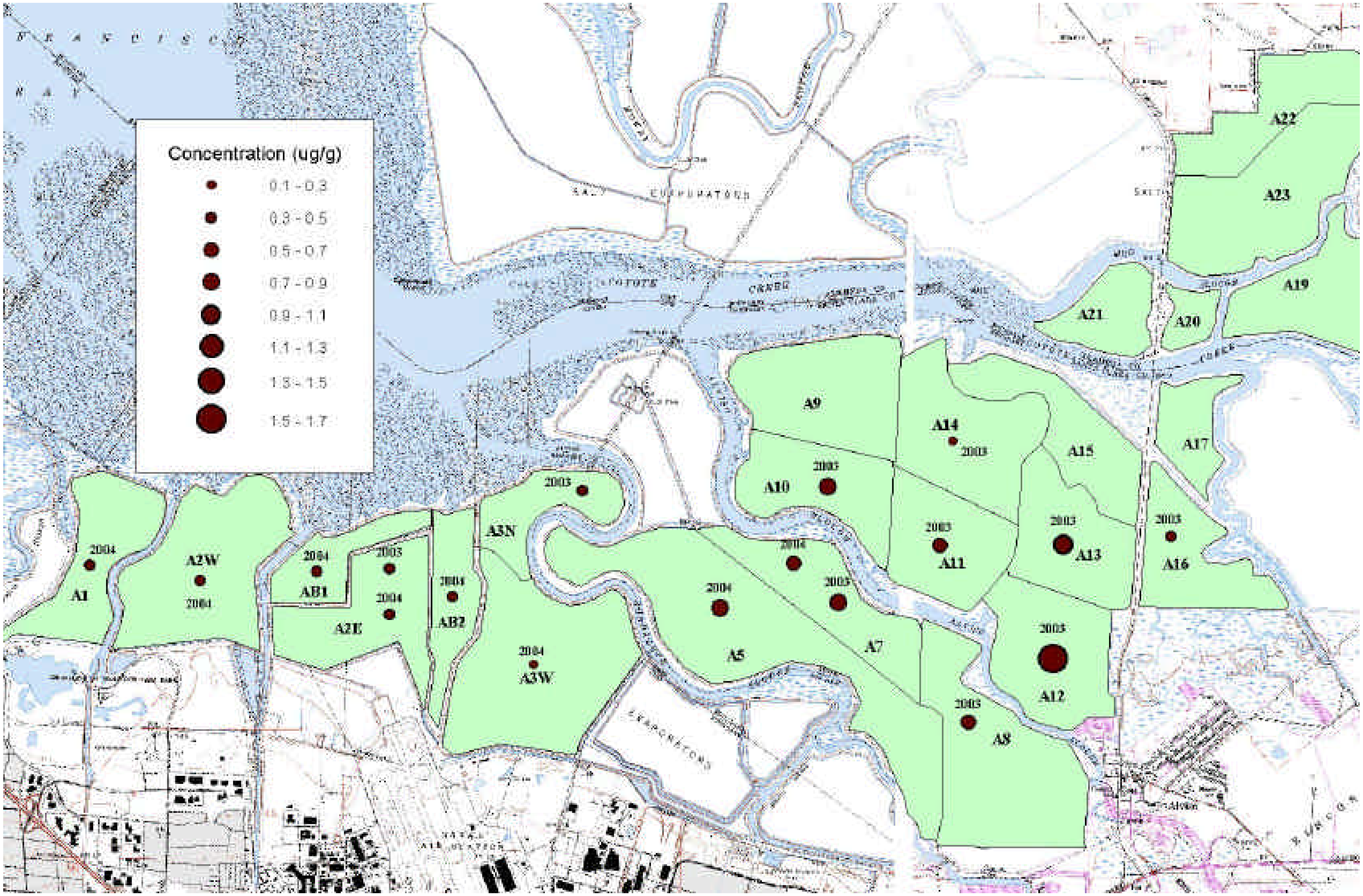
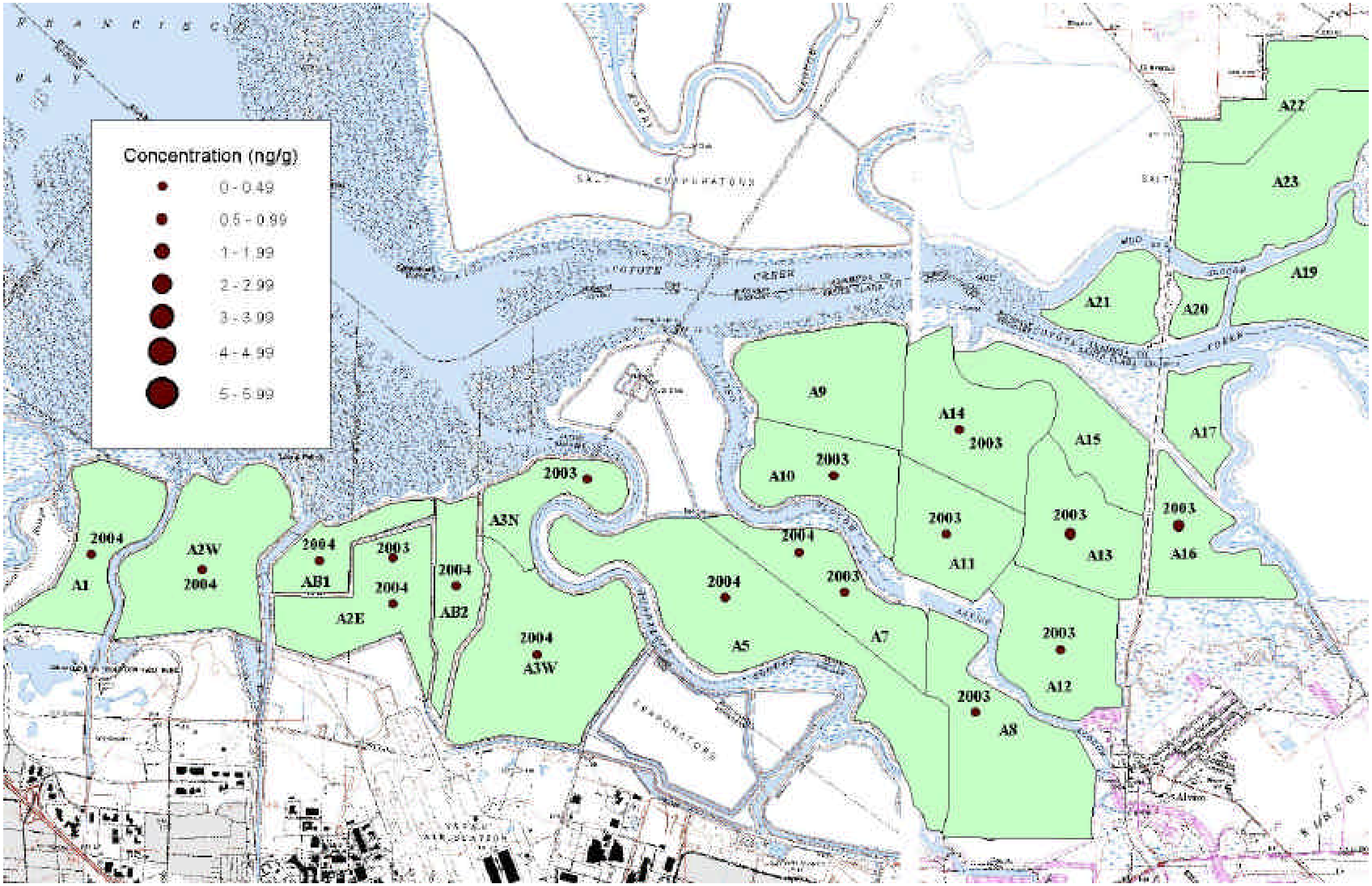


Fig 4a. Concentrations of total Hg (µg/g, dry weight, surface sediments) in Alviso Salt Ponds, 2003-2004



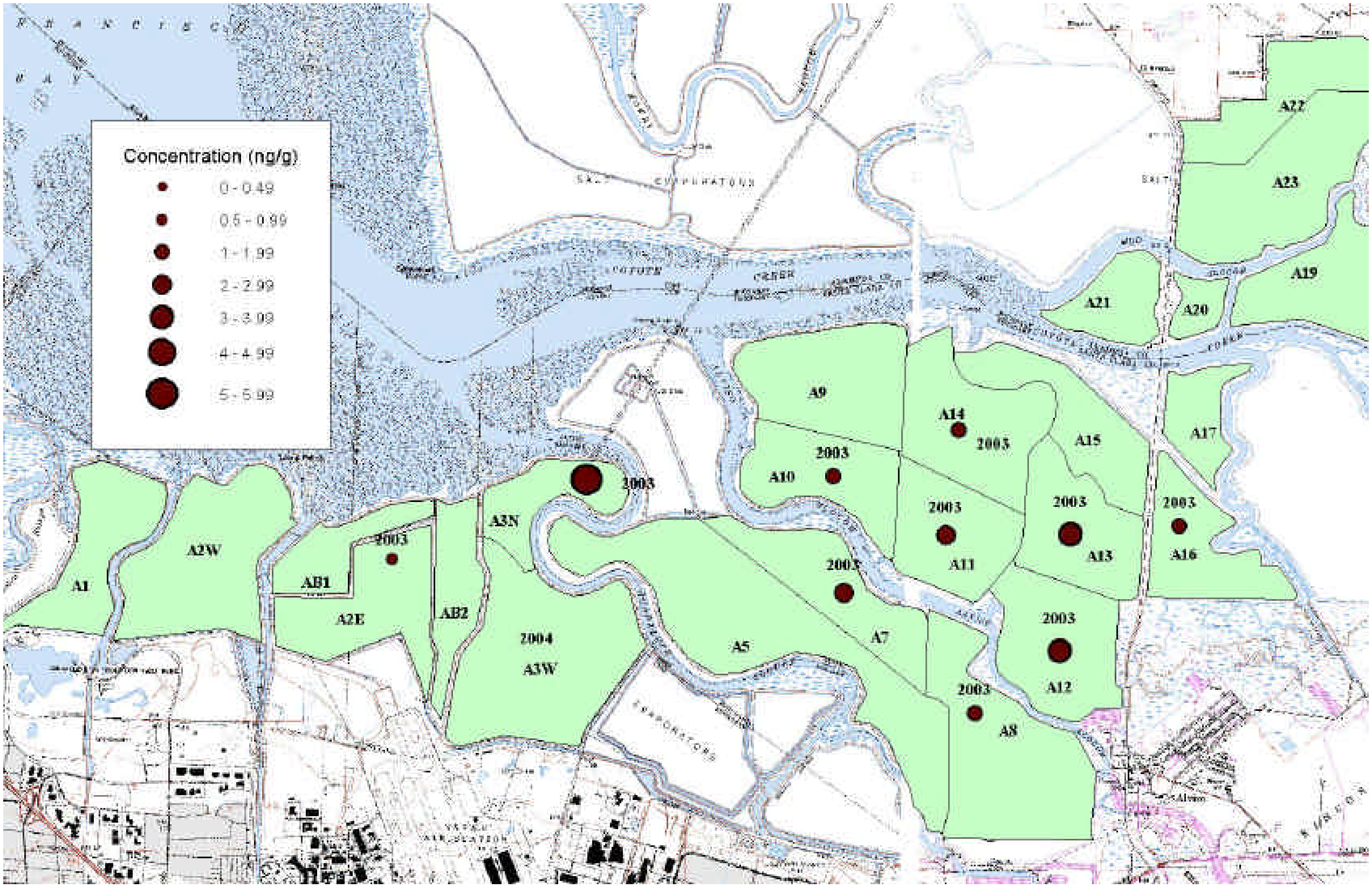
Points do not represent actual sampling locations. 3 sub samples per pond were analyzed in 2003 and mean concentrations are plotted; 1 composite sample from 3 sub samples per pond analyzed in 2004.

Fig 4b. Concentrations of meHg (ng/g, dry weight, inner sediments) in Alviso Salt Ponds, 2003-2004



Points do not represent actual sampling locations. 3 sub samples per pond were analyzed in 2003 and mean concentrations are plotted; 1 composite sample from 3 sub samples per pond analyzed in 2004.

Fig 5. Concentrations of meHg (ng/g, dry weight, surface sediments) in Alviso Salt Ponds, 2003



Points do not represent actual sampling locations. 3 sub samples per pond were analyzed in 2003 and mean concentrations are plotted.

Fig 6a. Spatial distribution of total Hg concentrations in surface sediments, Alviso Salt Ponds, 2003

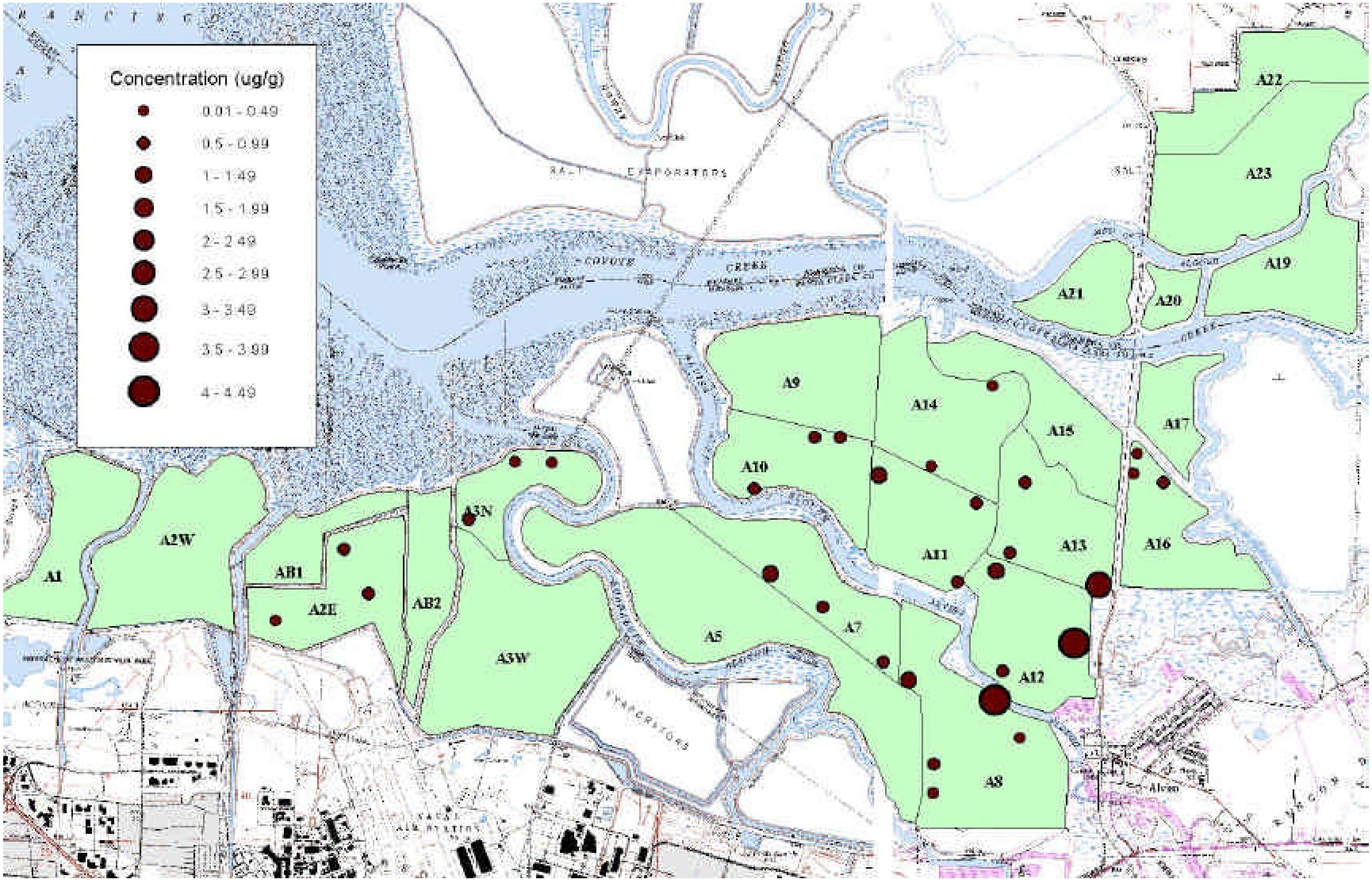


Fig 6b. Spatial distribution of meHg concentrations in surface sediments, Alviso Salt Ponds, 2003

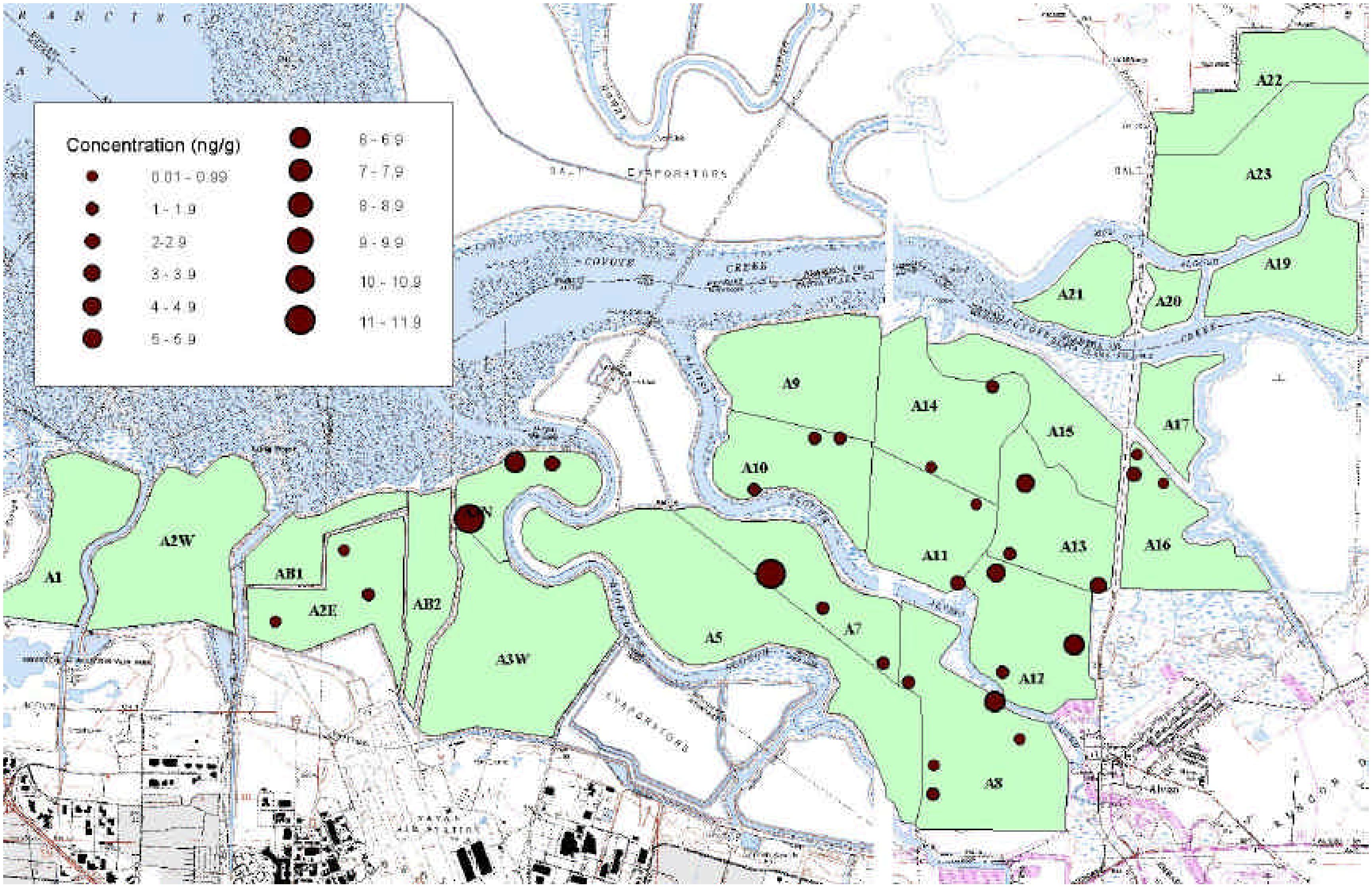


Fig 6c. Spatial distribution of Hg concentrations in surface sediments, Eden Landing Ponds, 2003

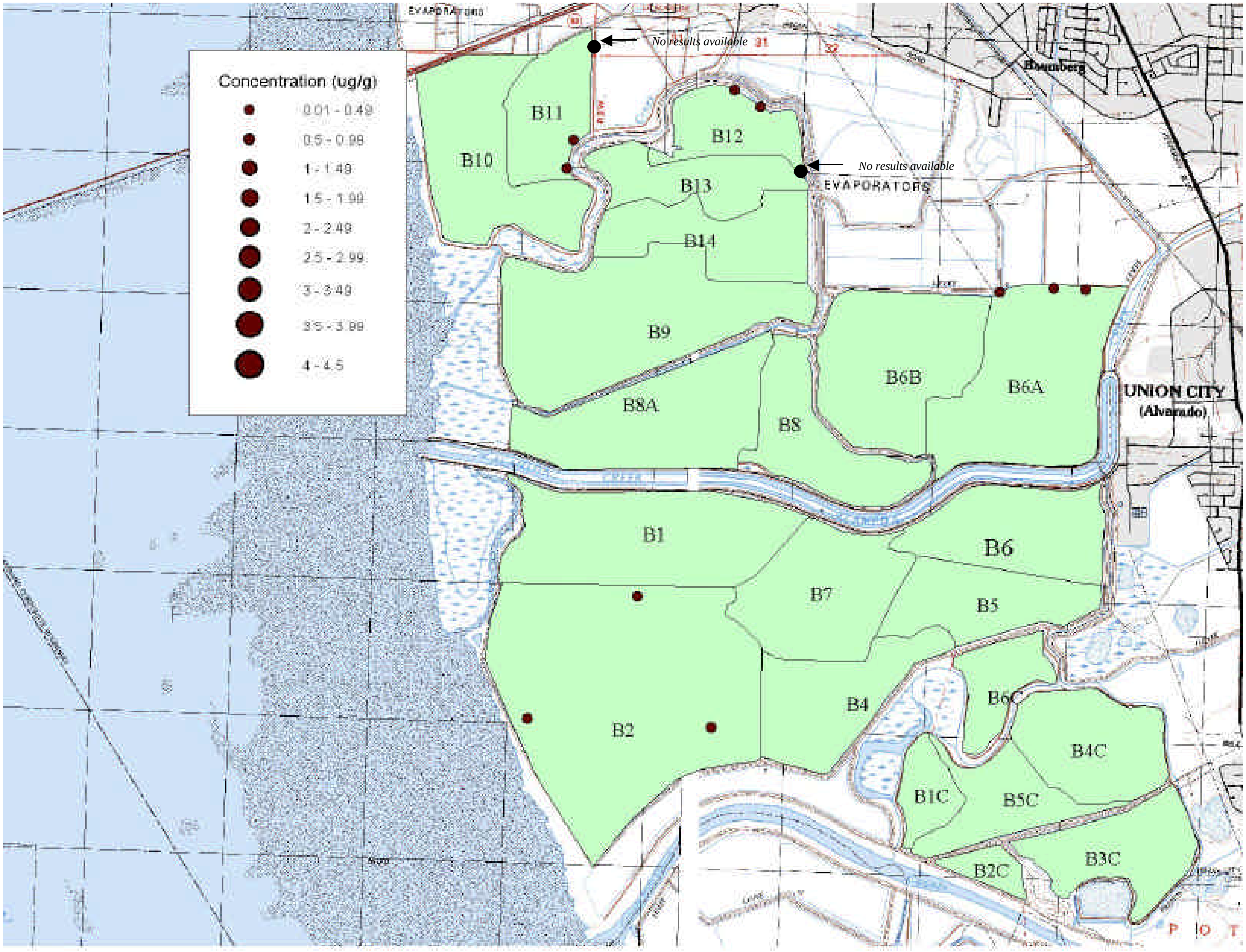


Fig. 6d. Spatial distribution of meHg concentrations in surface sediments, Eden Landing Ponds, 2003

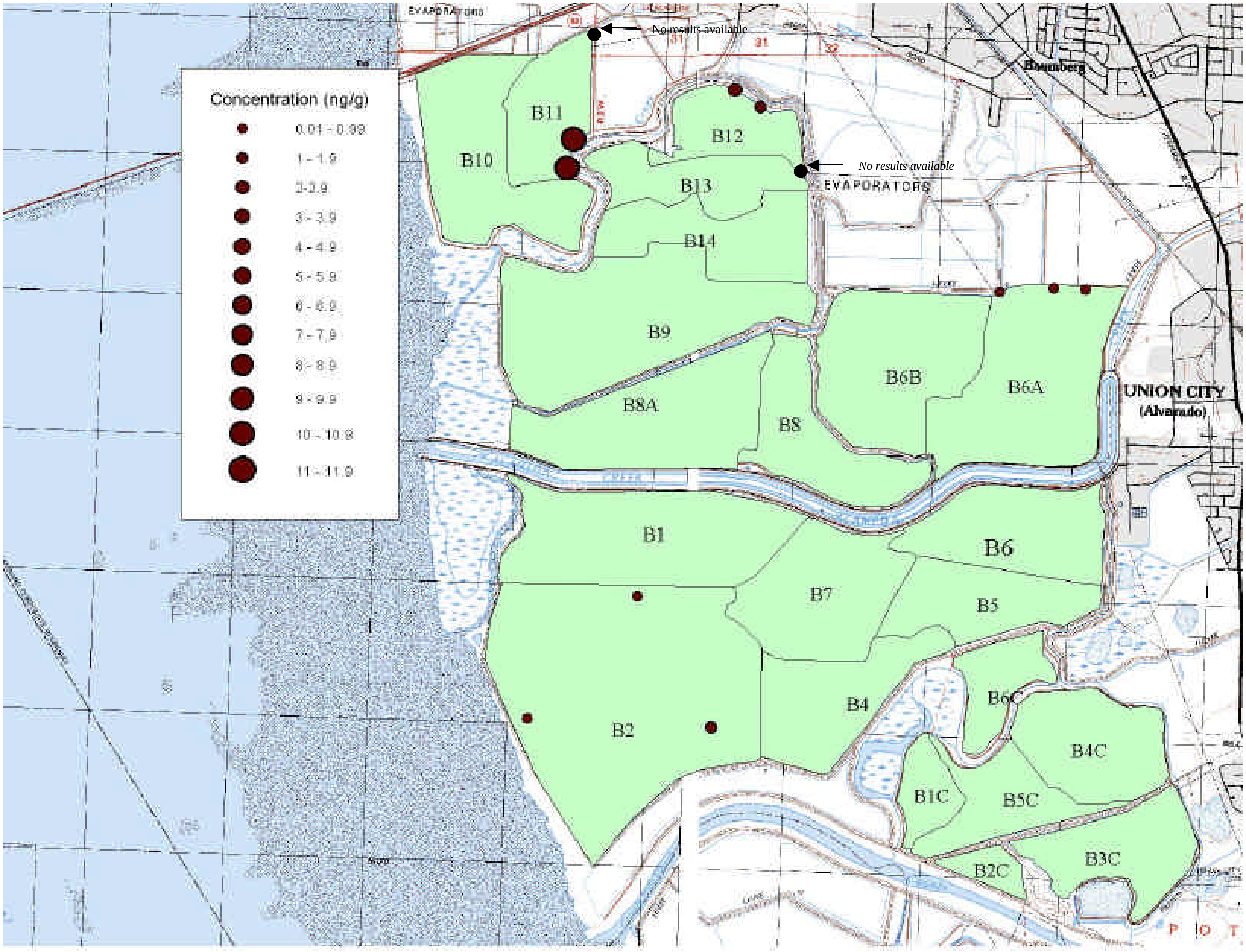


Fig. 6e. Spatial distribution of Hg concentrations in surface sediments, Ravenswood Ponds, 2003

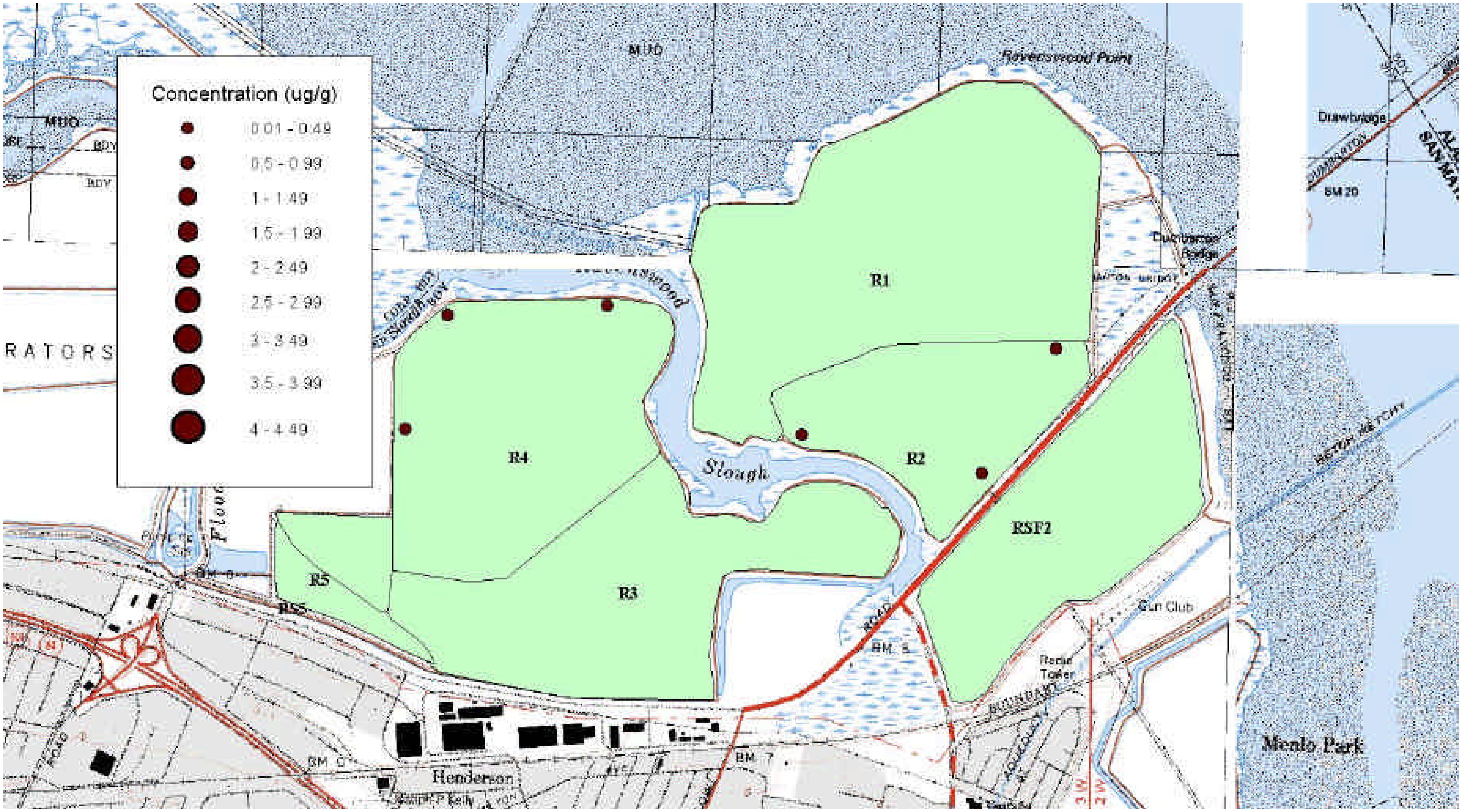
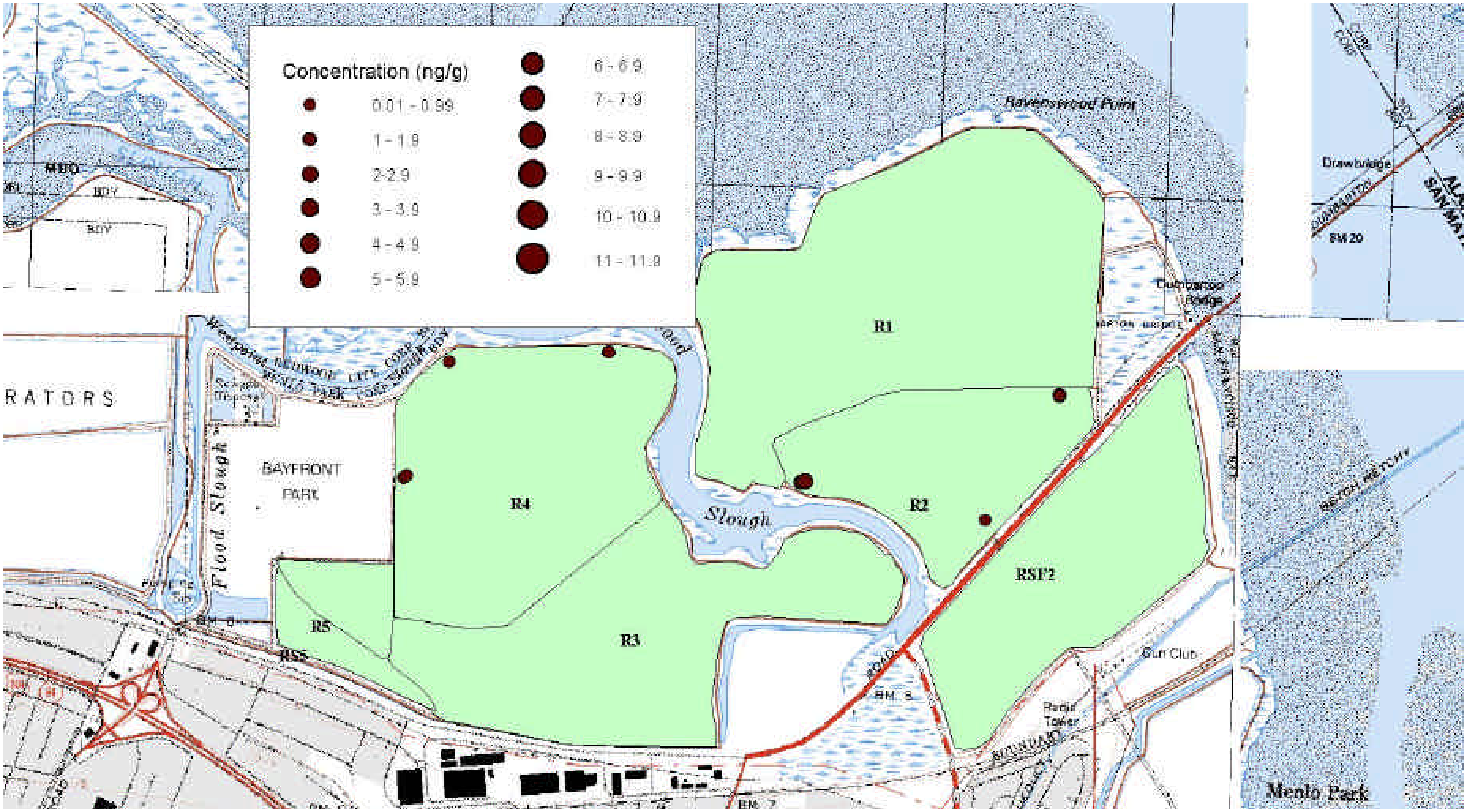
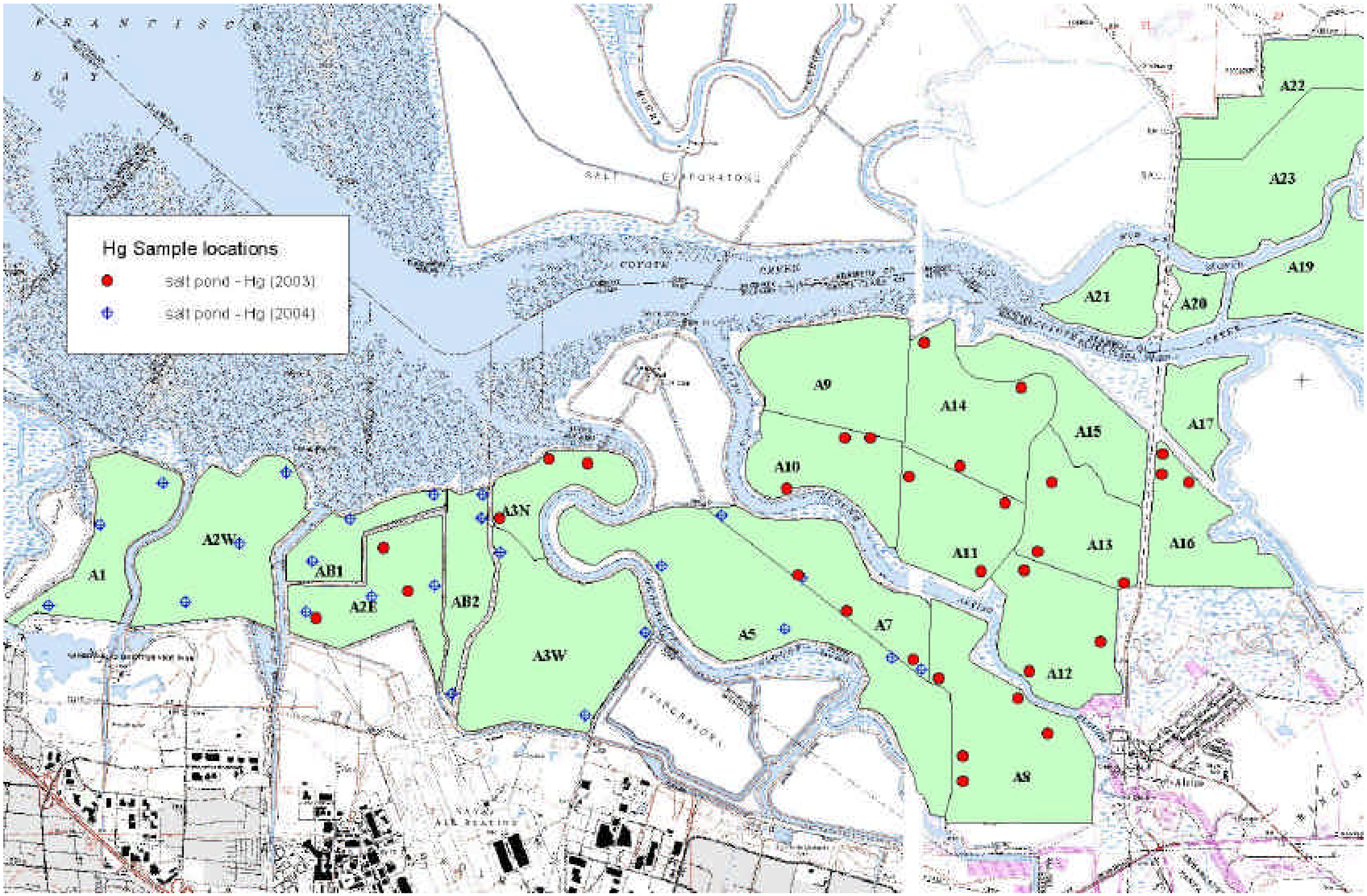


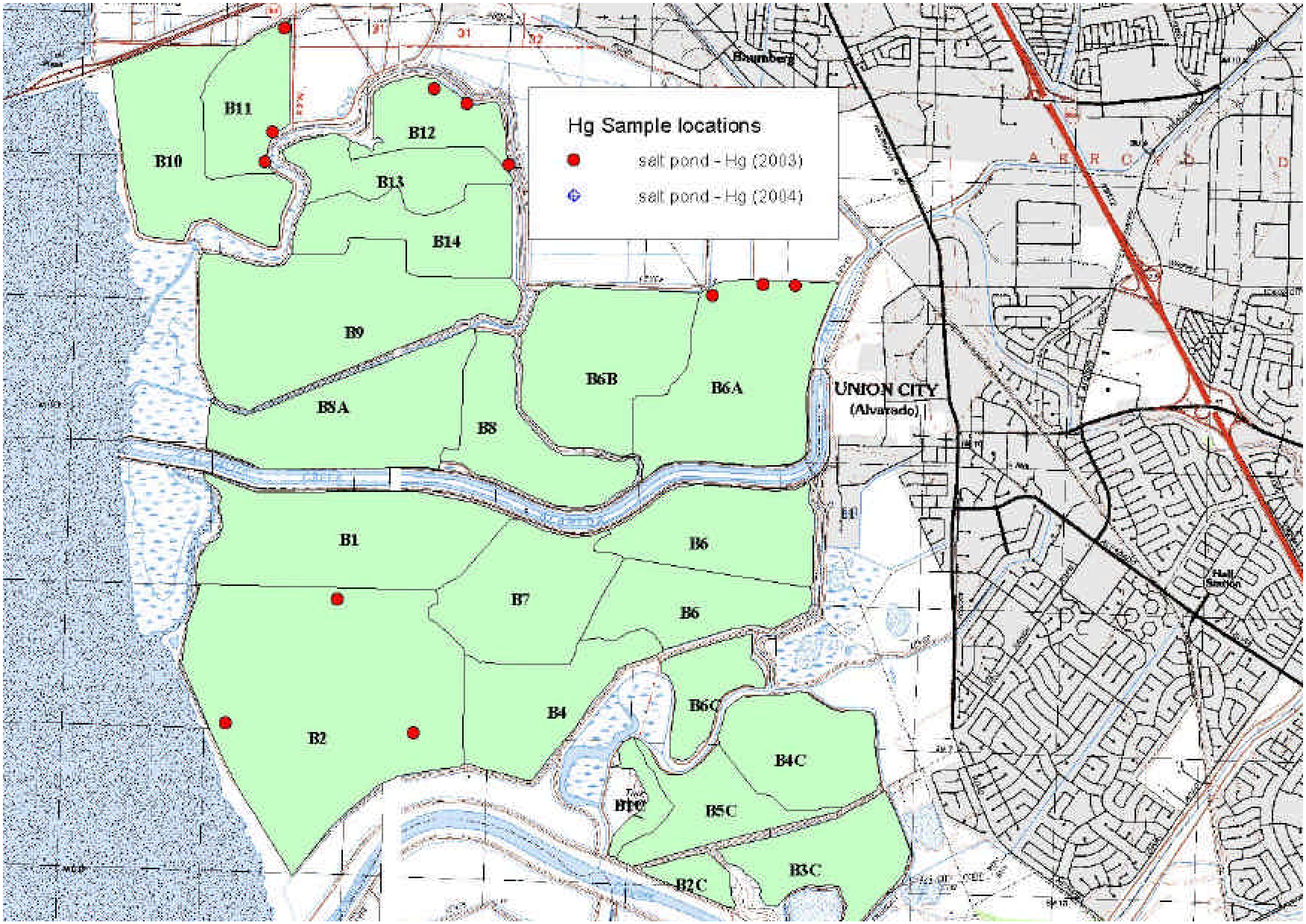
Fig. 6f. Spatial distribution of meHg concentrations in surface sediments, Ravenswood Ponds, 2003



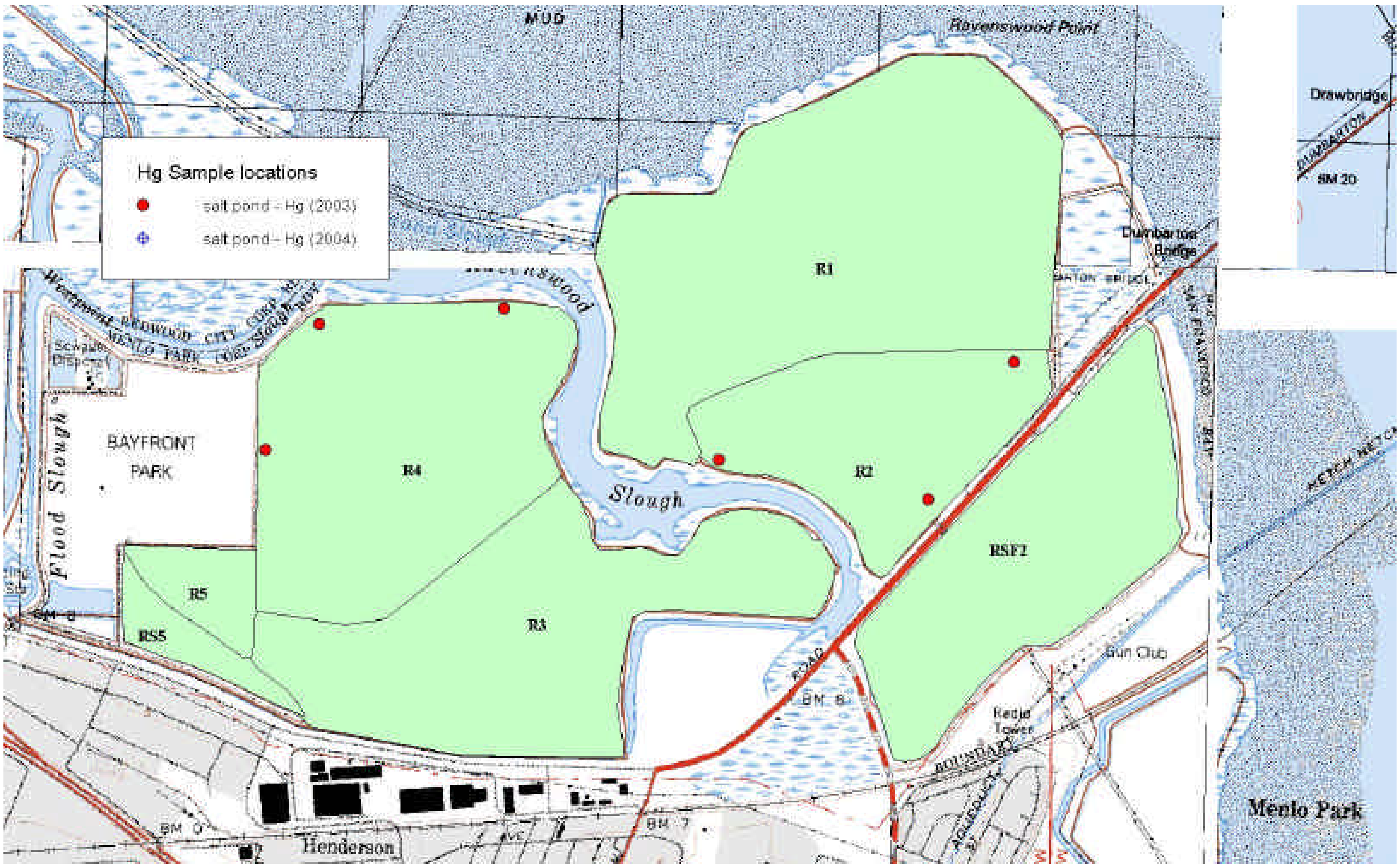
Appendix 1a. Hg sampling locations for the Alviso Pond Complex, 2003-2004



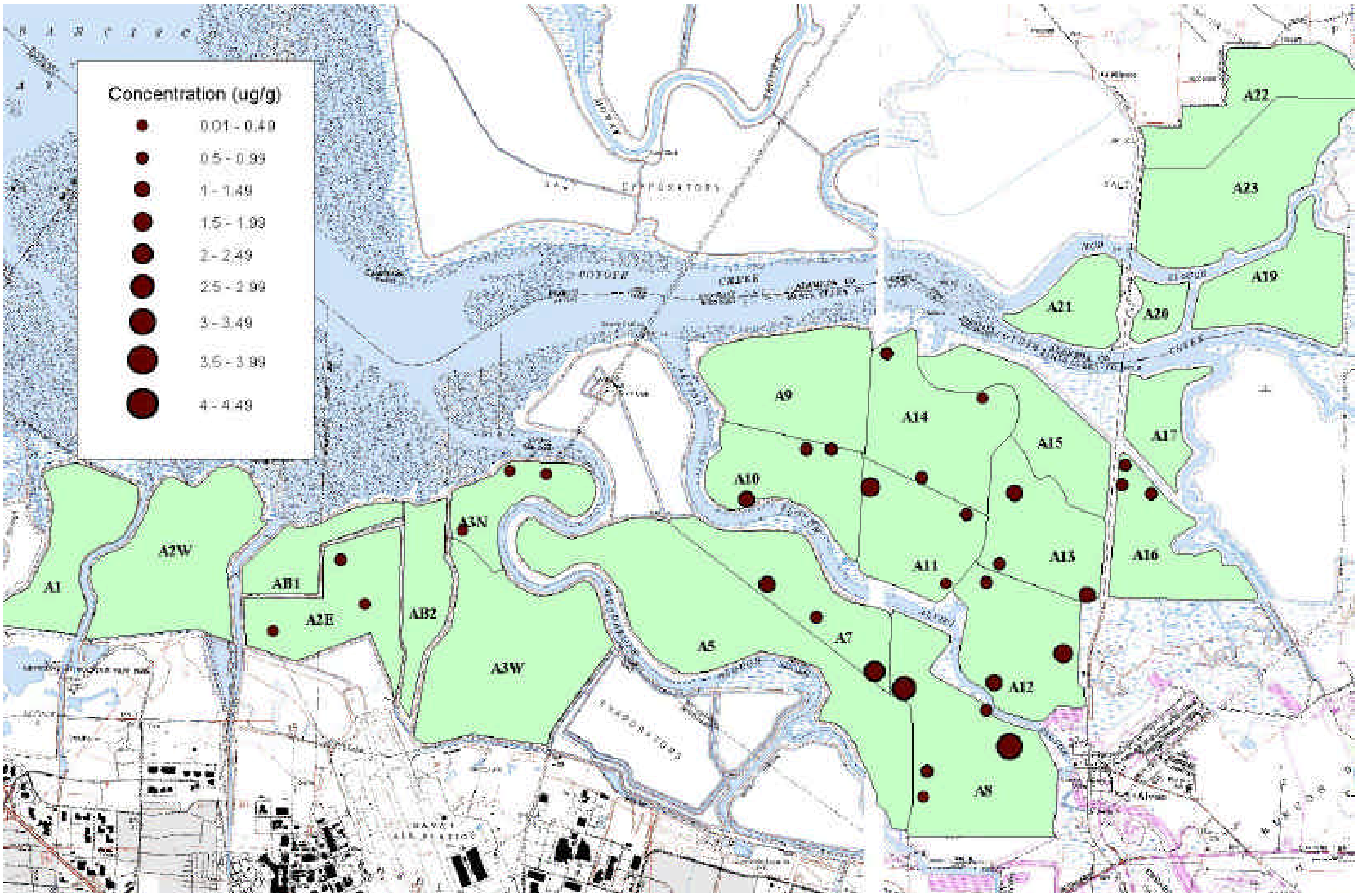
Appendix 1b. Hg sampling locations for the Eden Landing Pond Complex, 2003



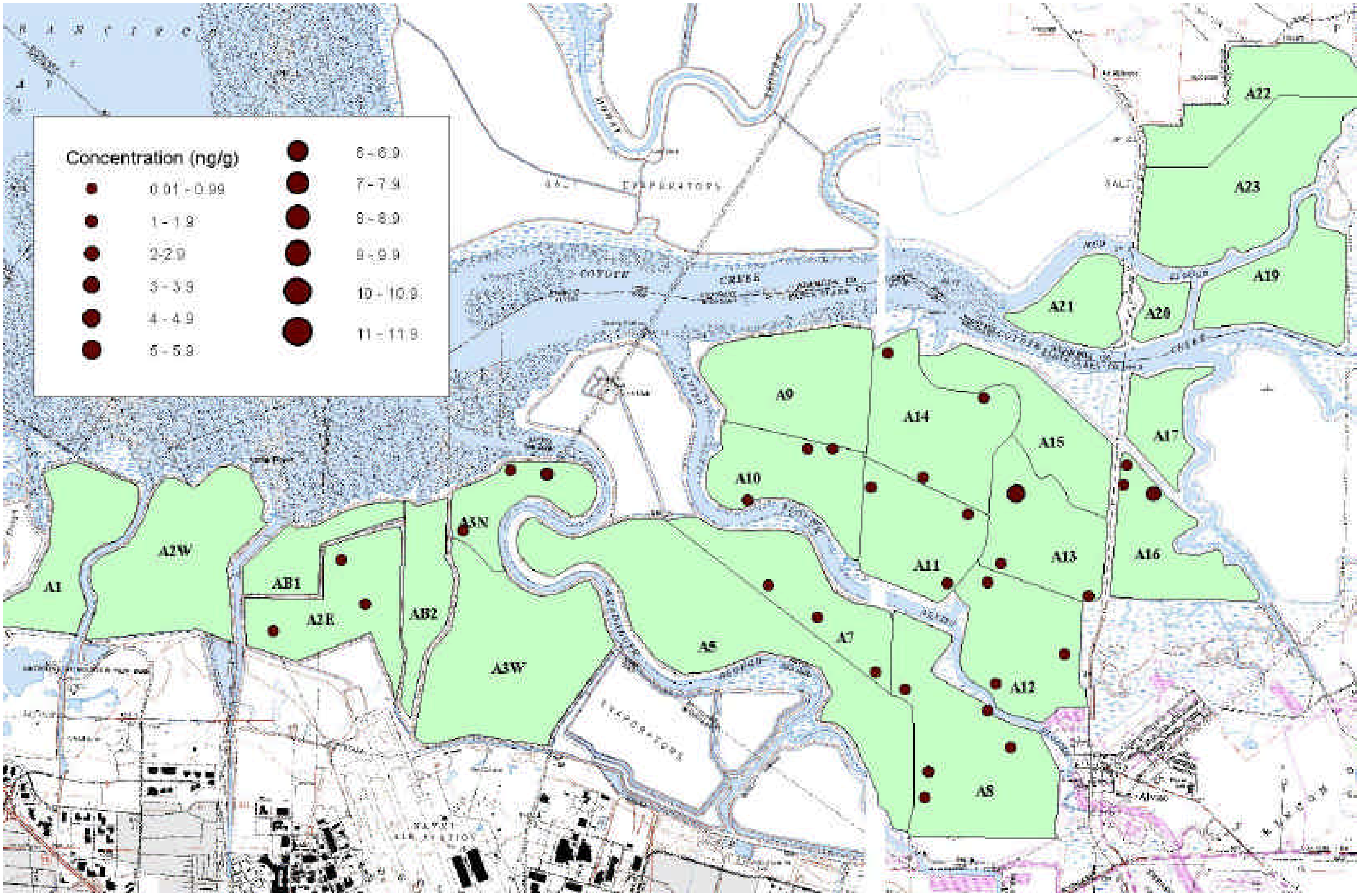
Appendix 1c. Sediment and Hg sampling locations for the Ravenswood Pond Complex, 2003



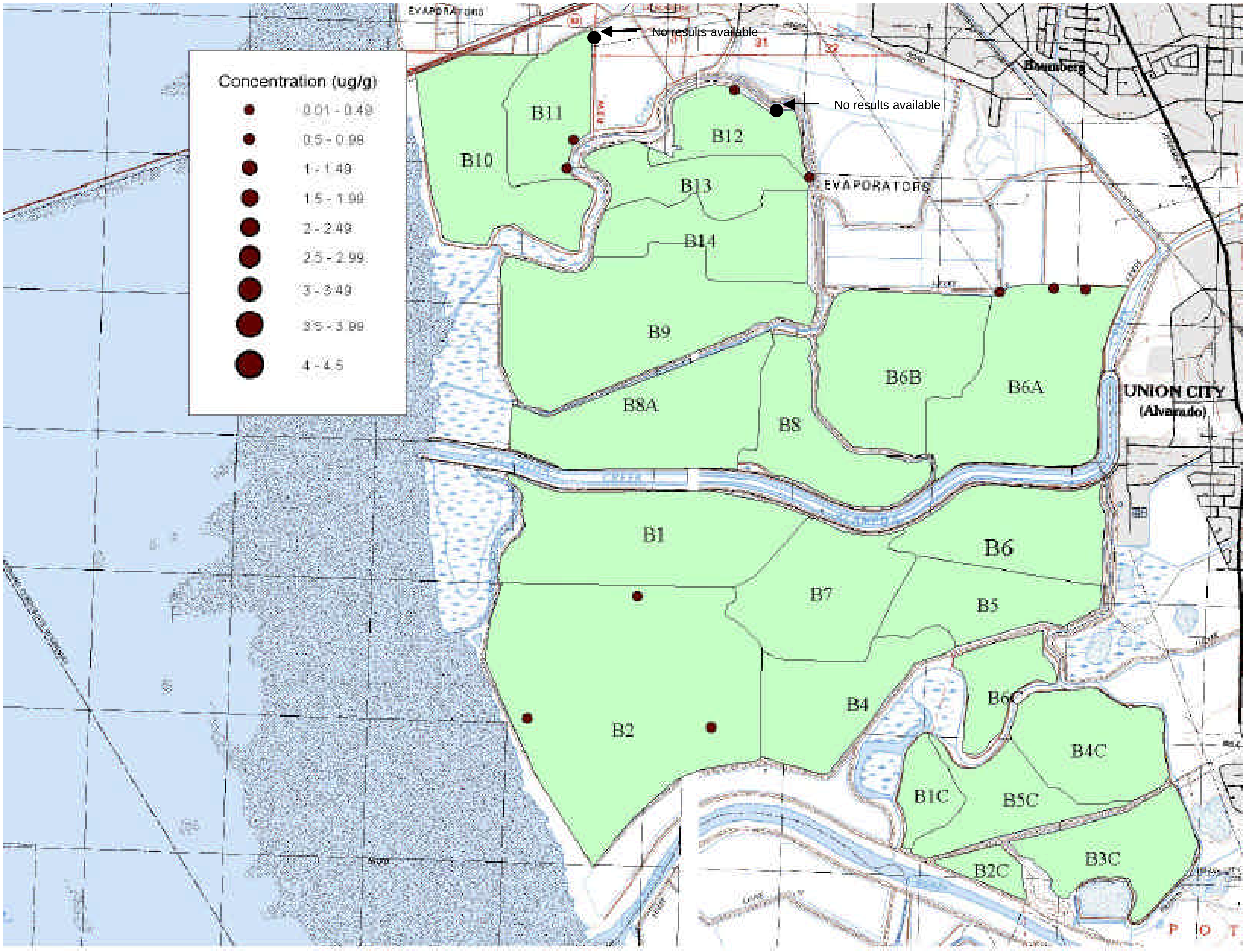
Appendix 2a. Spatial distribution of Hg concentrations in inner sediments (bottom 15-20 cm), Alviso Ponds, 2003



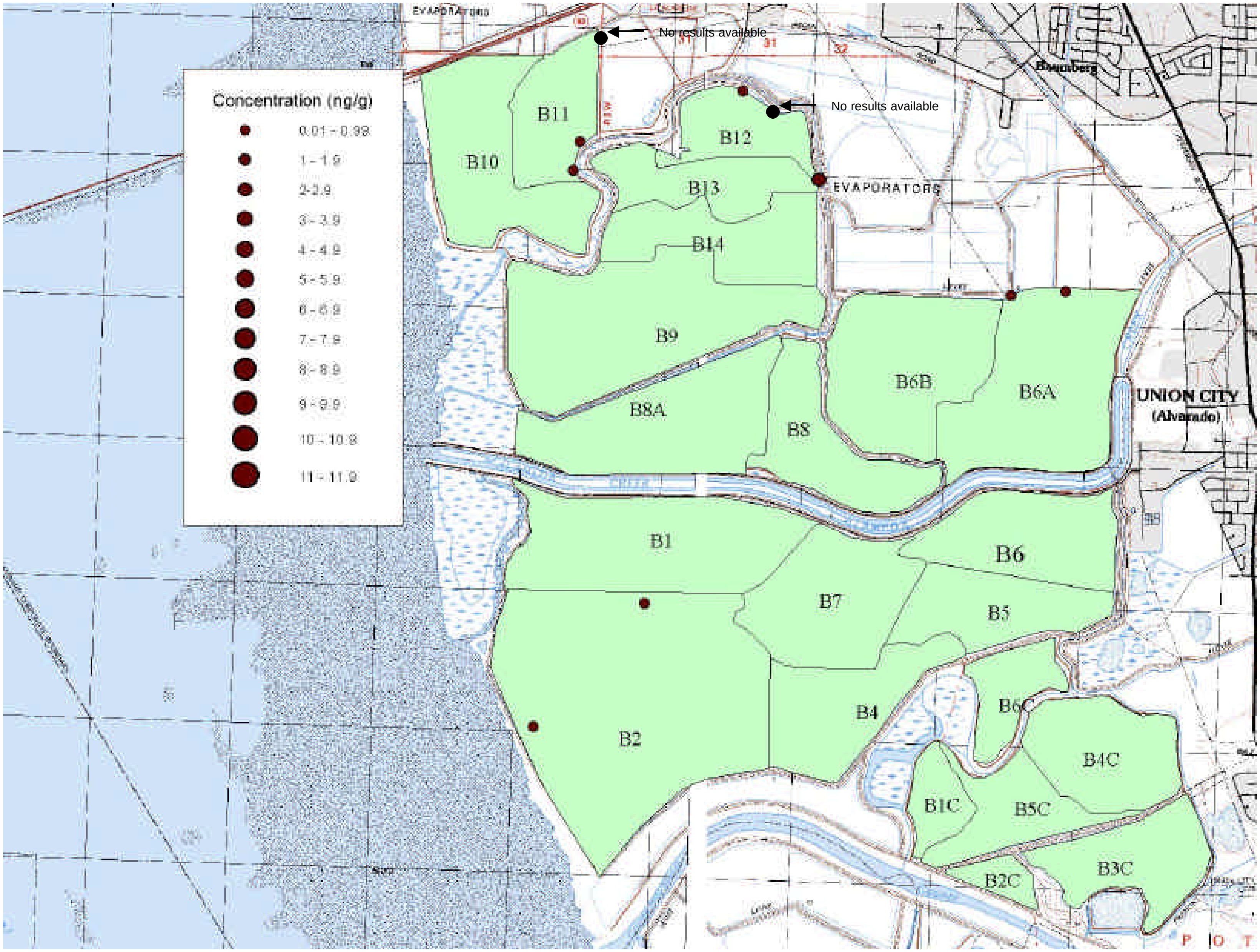
Appendix 2b. Spatial distribution of meHg concentrations in inner sediments (bottom 15-20 cm), Alviso Ponds, 2003



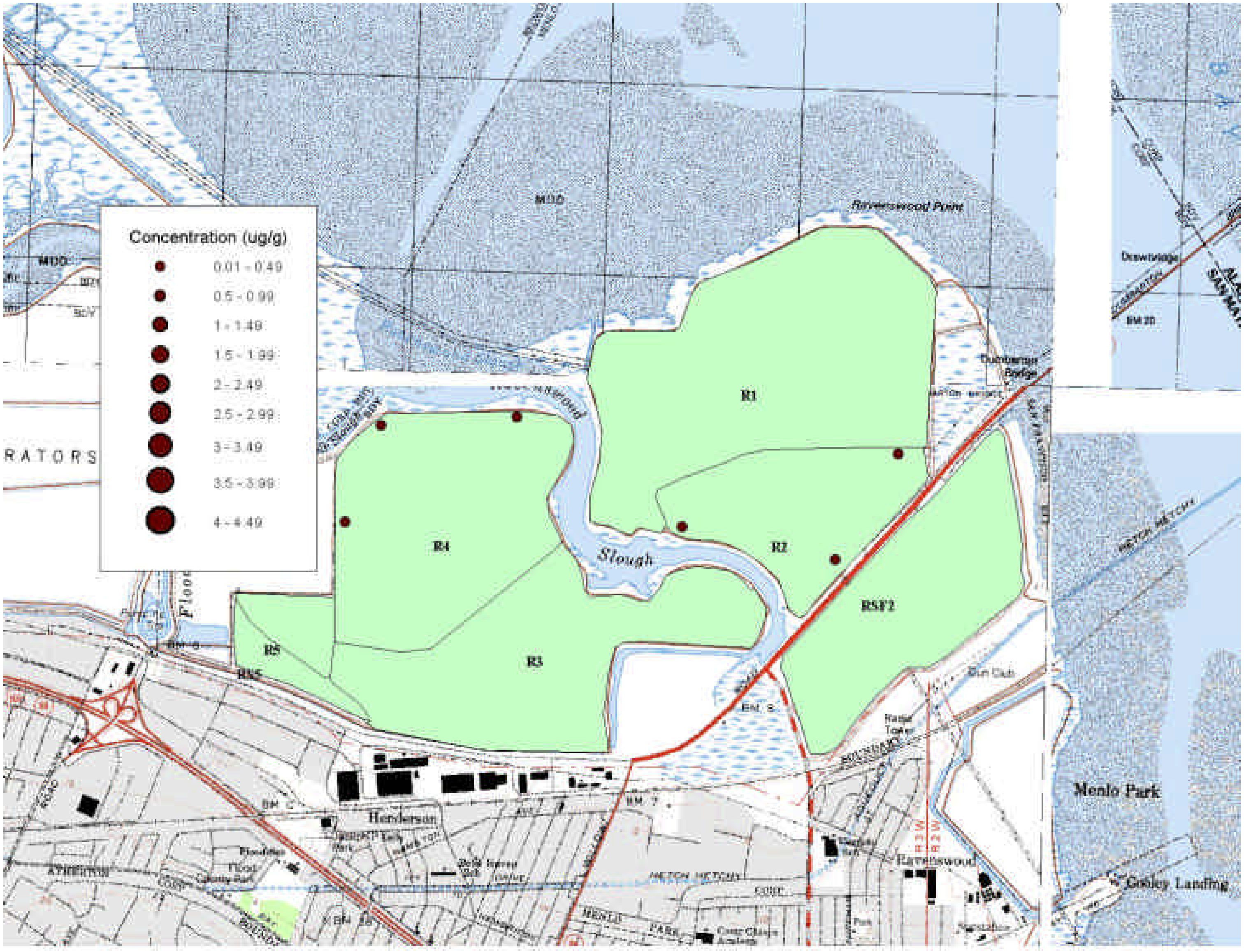
Appendix 2c. Spatial distribution of Hg concentrations in inner sediments (bottom 15-20 cm), Eden Landing Ponds, 2003



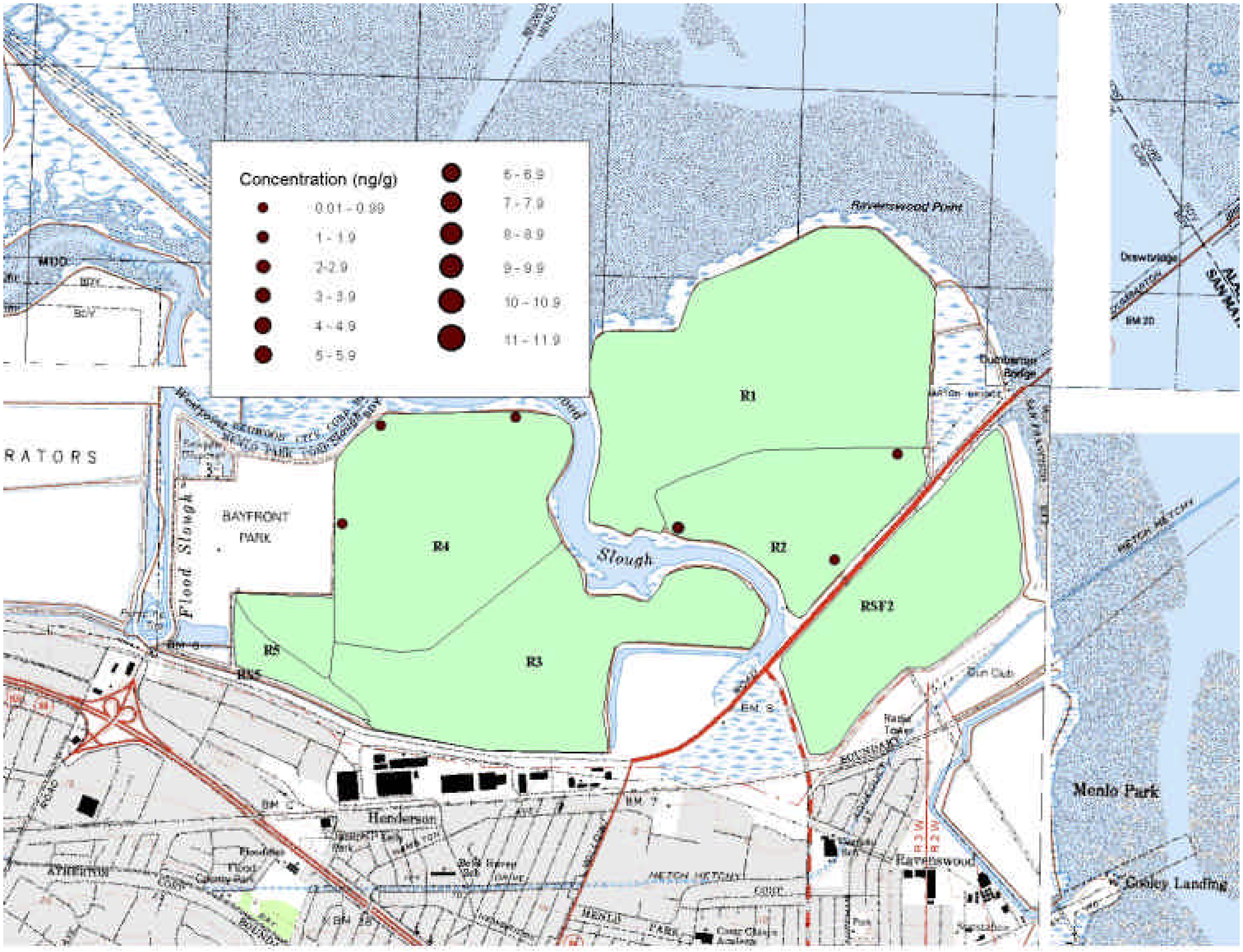
Appendix 2d. Spatial distribution of meHg concentrations in inner sediments (bottom 15-20 cm), Eden Landing Ponds, 2003



Appendix 2e. Spatial distribution of Hg concentrations in inner sediments (bottom 15-20 cm), Ravenswood Ponds, 2003



Appendix 2f. Spatial distribution of meHg concentrations in inner sediments (bottom 15-20 cm), Ravenswood Ponds, 2003



Appendix E

Benthic Invertebrate Sampling

Methods

USGS collected benthic slough samples at Alviso and Guadalupe Slough receiving water sampling locations concurrently with receiving water quality samples on three occasions during July and August 2004. The required sampling schedule for pond A7 was 7 days prior to pond release, 14 days following pond release, and 28 days following pond release, followed by a sample late the following summer (August 2005). Due to a communication error, samples were not taken 7 days before release of either pond A7 (Alviso Slough) or A3W (Guadalupe Slough), but were taken immediately upon discovery of the error. For pond A3W, for which the benthic sampling was elective, the first sample was taken 10 days following the 19 July release; for pond A7, for which the sampling was required, the first sample was taken 3 days following the 26 July release. The subsequent sampling was conducted on schedule relative to the release dates. Although samples were not collected the week before the initial release of the ponds, pre-release invertebrate samples were collected in April 2004 and provide a comparison to post-release data. USGS conducted invertebrate sampling in Guadalupe and Alviso Slough in April 2004 following identical protocols to those used in July and August. Samples were collected at 3 upstream, 3 midstream, and 3 downstream sites, locations that are comparable to the summer sampling locations.

Benthic macroinvertebrates were sampled from the boat using a standard Eckman grab sampler (15.2 cm x 15.2 cm x 15.2 cm). Samples were collected by lowering the dredge into the water slowly, holding it level on the substrate, and releasing the “jaws.” Soft substrates consistently produced samples that filled the dredge, whereas on harder substrates only a portion of the dredge was filled (the dredge cannot as deeply penetrate a hard surface). Sampling locations with vegetative debris on the substrate produced samples with high concentrations of vegetation. Grab samples were washed in the field using a 0.5mm mesh sieve and preserved in 70% ethanol and rose bengal dye.

Samples were sorted and invertebrates enumerated using dissecting microscopes and appropriate taxonomic keys (Usinger 1956, Merritt and Cummins 1996, Pennak 1989, Smith and Johnson 1996). Identifications were confirmed, when necessary, by comparison to confirmed identification voucher specimens at the USGS Davis Field Station, Davis, CA. Sorted samples and associated sample debris were stored at USGS San Francisco Bay Estuary Field Station, Vallejo, CA.

We used the Shannon-Weiner index (Krebs 1999) to assess invertebrate taxa diversity for each sampling event. On all four dates, samples were taken with approximately equal frequency along a gradient from the mouth to the upstream portion of the slough. We computed means from repeated invertebrate measurements for each slough and examined differences in *Capitella* sp., *Streblospio* sp., total abundance, and diversity between sample dates with analysis of variance tests (ANOVA; SAS Institute, 1990). Abundance values were log-transformed prior to analysis. We similarly tested for differences in dissolved oxygen, salinity, temperature, and pH measured at the time of summer sample collection. We tested for equal variances using Levene's test and then used the multiple variance mixed procedure (SAS Institute, 1990) if data violated the equal variance assumption. Significant ANOVA results ($\alpha = 0.05$) were investigated with the Tukey-Kramer procedure (SAS Institute, 1990) to make multiple comparisons among pairs of means (Sokal and Rohlf 1995).

Differences in taxa composition may exist when overall abundance and diversity indices are similar, and these differences may be ecologically important. To examine differences in taxa composition among sample dates, we used CANOCO 4 (ter Braak and Smilauer 1998) to perform detrended correspondence analysis (DCA) with downweighting of rare species. DCA is an indirect gradient analysis technique that reveals gradients in taxa composition independent of measured environmental variables. Although water quality was measured at the time of sample collection, point sampling may not account for the extent of variability in those parameters that could have affected the benthic community. The DCA axes are measured in units of constant beta diversity; therefore, it is useful for examining data for potential environmental patterns, regardless of whether the gradient displayed represents a measured environmental variable (Gauch 1982).

Results

Collected data were compiled according to sample date and location within each slough (upstream, midstream near discharge point, and mouth; tables 1 and 2).

Guadalupe Slough (Pond A3W receiving water)

Water quality parameters differed among summer sampling dates, with the first sample date most different from the other two (Fig. 1). Dissolved oxygen differed among sampling dates ($F_{2,18} = 11.69$, $P = 0.0006$), and the 29 July (first) sample differed from the second (2 August) and third (16 August) samples (Tukey-Kramer, $P = 0.0027$), which did not differ from each other ($P = 0.9827$). Salinity differed among sampling dates ($F_{2,18} = 3.57$, $P = 0.0494$), with the first sample different from the second (Tukey-Kramer, $P = 0.0434$), but not the third ($P = 0.6752$). This was also true for temperature, which differed ($F_{2,19} = 21.13$, $P < 0.0001$) between the second sample and the first and third (Tukey-Kramer, $P < 0.0001$), which did not differ from each other ($P = 0.4511$). pH differed ($F_{2,19} = 6.14$, $P = 0.0088$), with the first sample different from the second (Tukey-Kramer, $P = 0.0067$), but not the third ($P = 0.1106$).

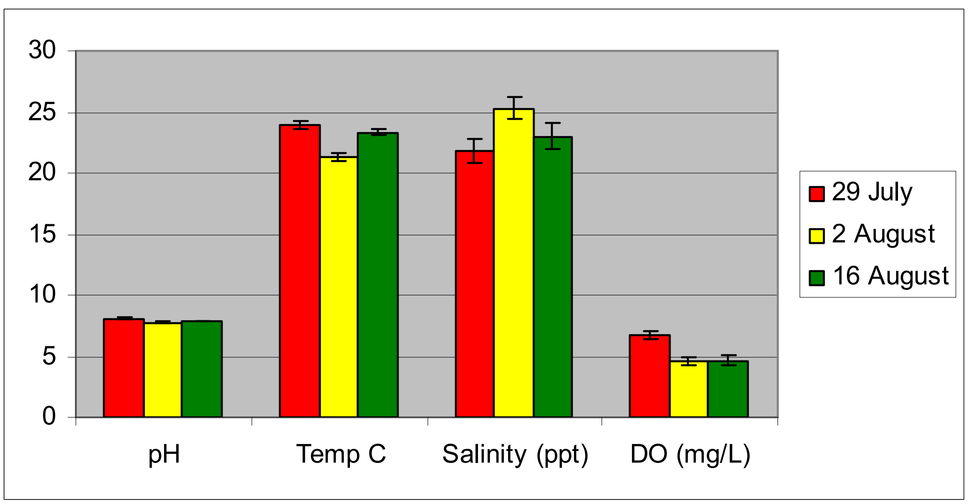


Figure 1. Comparison of pH, temperature, salinity, and dissolved oxygen among three summer 2004 sampling dates when benthic invertebrates were collected in Pond A3W receiving waters, Guadalupe Slough, Alviso, CA.

Taxa diversity did not differ among the four sample dates (Fig. 2), including the April 2004 pre-release sample ($F_{3,27} = 0.93$, $P = 0.4378$). Total abundance did not differ ($F_{3,27} = 2.23$, $P = 0.1078$), and neither did abundance of *Capitella* sp. ($F_{3,22} = 3.01$, $P = 0.0520$), although *Capitella* sp. was not present in any samples in April (Fig.2, Table 1). Abundance of *Streblospio* sp. differed among sample dates ($F_{3,28} = 4.74$, $P = 0.0085$), with the April (pre-release) sample different from all summer samples (Tukey-Kramer, P = 0.0310). *Streblospio* sp. was found at Guadalupe Slough only during April and only in the midstream and mouth samples (Table 1).

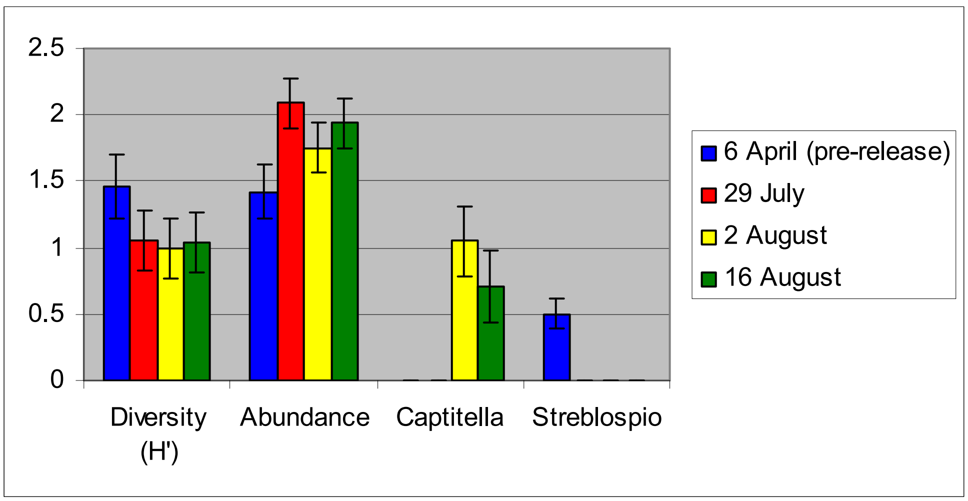


Figure 2. Comparison of taxa diverity, mean (log-transformed) total abundance, *Capitella* sp. abundance, and *Streblospio* sp. abundance among three summer 2004 sampling dates in Pond A3W receiving waters, Guadalupe Slough, Alviso, CA.

DCA Axis 1 had an eigenvalue of 0.531 and explained 27.2% of the explainable variance, and DCA Axis 2 had an eigenvalue of 0.235; together, they explain 39.3% of the explainable variance (Fig. 3). The length of DCA Axis 1 was 3.586 and represents constant beta diversity, indicating that a gradient exists relative to taxa composition. It is the perpendicular distance of a sample point relative to an axis that determines its position along that gradient; samples from 2 August and 6 April had the least variability in taxa composition within samples relative to DCA Axis 1, and the 16 August sample had the most. The samples from 6 April were most dissimilar in taxa composition and fall farthest along the gradient; this gradient could be related to seasonal changes or other environmental differences between April and late July-August. These 6 April samples were also those with the least variability in taxa composition relative to DCA Axis 2, which was a 3.065-unit axis with high variability and little differentiation among all July and August samples, but the April samples did not differ from the summer samples relative to DCA Axis 2.

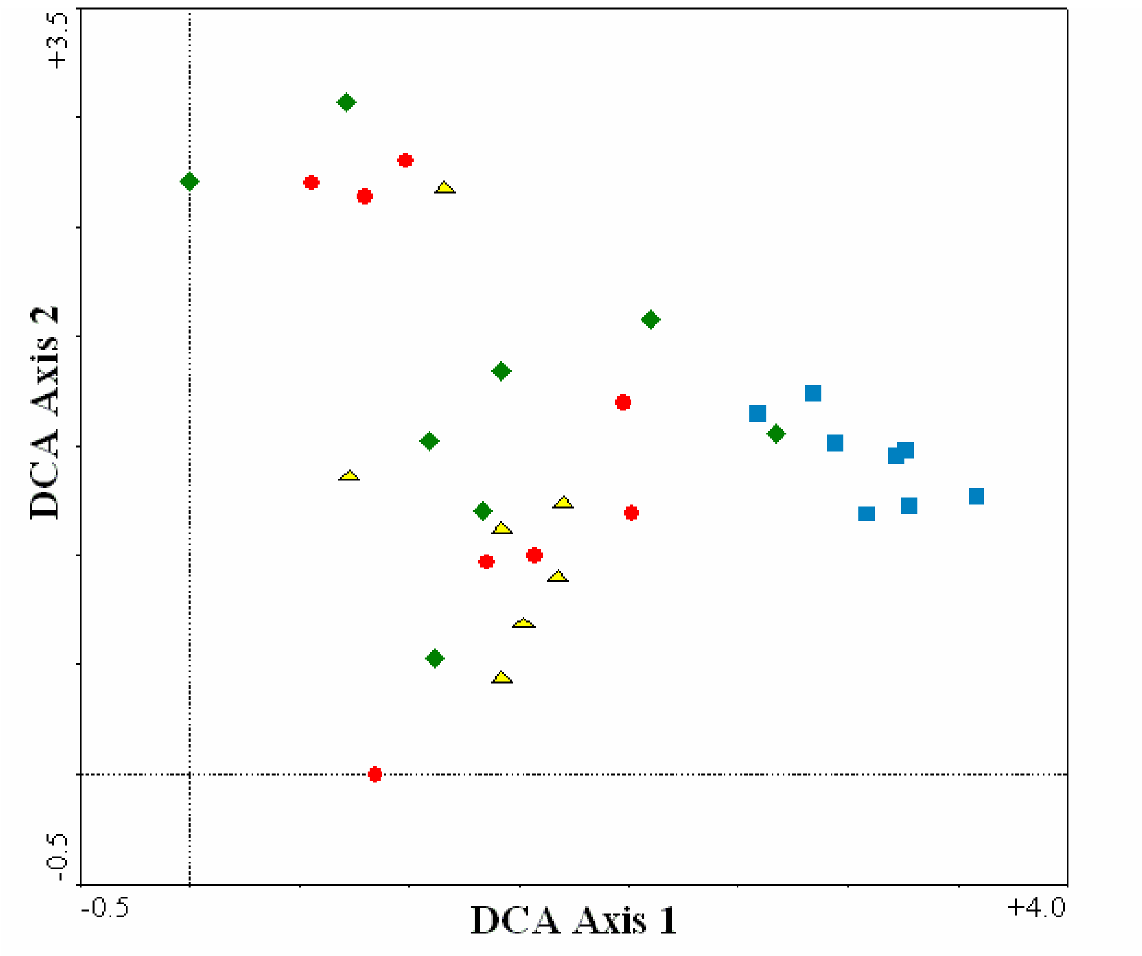


Figure 3. Results of DCA analysis showing 2004 Pond A3W receiving water Guadalupe Slough benthic invertebrate samples in ordination space. Blue squares = 6 April, red circles = 29 July, yellow triangles = 2 August, and green diamonds = 16 August.

Alviso Slough (Pond A7 receiving water)

Some differences were detected in water quality between sample dates (Fig. 4). There was no difference detected in dissolved oxygen ($F_{2,16} = 0.40$, $P = 0.6739$) or salinity ($F_{2,17} = 1.33$, $P = 0.2907$) in Alviso Slough among summer sampling dates. There was a difference in temperature ($F_{2,16} = 17.77$, $P < 0.0001$), and the 29 July (first) sample differed from the second (9 August) and third (23 August) samples (Tukey-Kramer, $P = 0.0063$), which did not differ from each other ($P = 0.0532$). pH differed ($F_{2,17} = 6.73$, $P = 0.0070$), with the third sample different from the first and second (Tukey-Kramer, $P = 0.0310$).

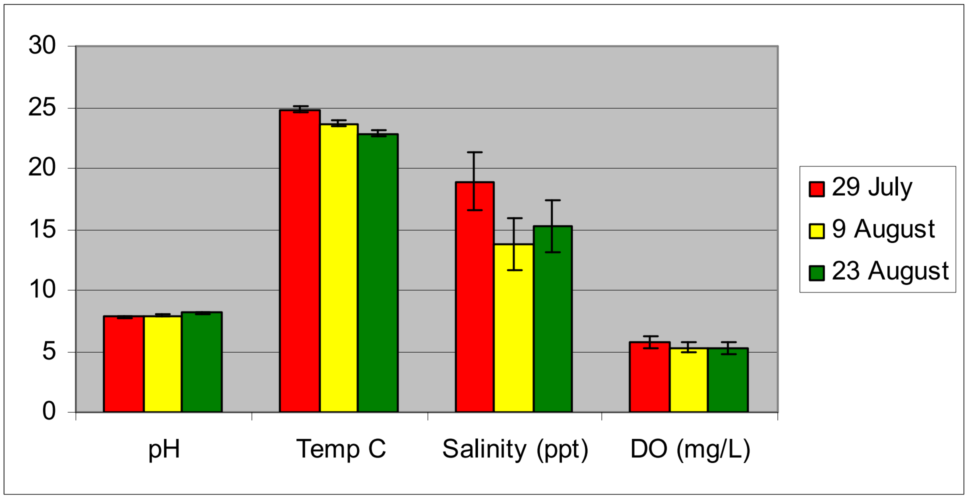


Figure 4. Comparison of pH, temperature, salinity, and dissolved oxygen among three summer 2004 sampling dates when benthic invertebrates were collected in Pond A7 receiving waters, Alviso Slough, Alviso, CA.

Taxa diversity did not differ among the four sample dates, including the April 2004 pre-release sample ($F_{3,24} = 2.35$, $P = 0.0979$). Total abundance did not differ ($F_{3,24} = 0.16$, $P = 0.9235$), and neither did abundance of *Capitella* sp. ($F_{3,25} = 1.87$, $P = 0.1597$), although only 1 individual *Capitella* sp. was present in all April samples (Fig. 5, Table 2). Abundance of *Streblospio* sp. differed among sample dates ($F_{3,25} = 3.56$, $P = 0.0286$), with the April (pre-release) sample different from the two latest summer samples (Tukey-Kramer, $P = 0.0493$, but not the first ($P = 0.5466$). *Streblospio* sp. was found at Alviso Slough during April, but after April, most individuals were detected in the upstream 29 July sample (Table 2).

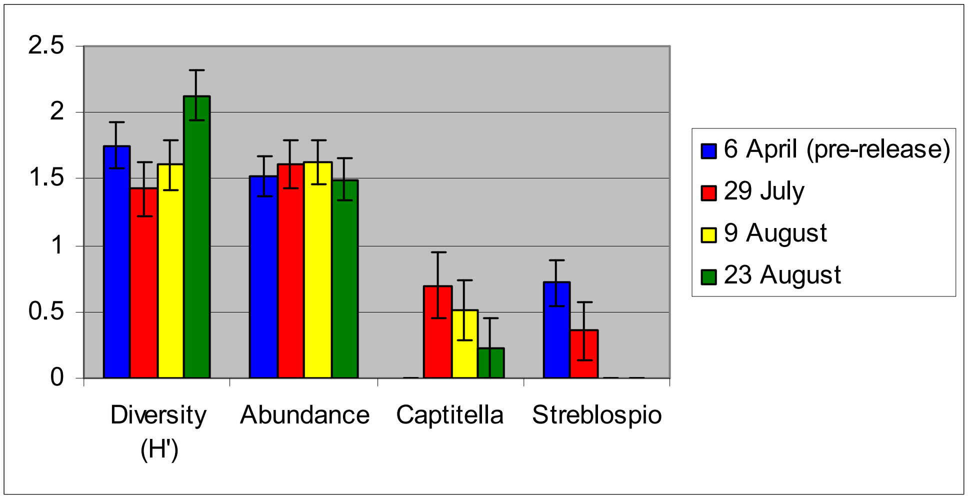


Figure 5. Comparison of taxa diverity, mean (log-transformed) total abundance, *Capitella* sp. abundance, and *Streblospio* sp. abundance among three summer 2004 sampling dates in Pond A7 receiving waters, Alviso Slough, Alviso, CA.

DCA Axis 1 had an eigenvalue of 0.433 and explained 19.5% of the explainable variance, and DCA Axis 2 had an eigenvalue of 0.267; together, they explain 31.5% of the explainable variance (Fig. 6). The length of DCA Axis 1 was 2.241 and represents constant beta diversity, indicating that a gradient exists relative to taxa composition, but the first DCA Axis is not as important for defining taxa composition in Alviso Slough as it was in Guadalupe Slough. It is the perpendicular distance of a sample point relative to an axis that determines its position along that gradient; samples from 29 July had the least variability in taxa composition within samples relative to DCA Axis 1, and the 7 April sample had the most. The samples from 7 April were most dissimilar in taxa composition and fall farthest along the gradient, but were not as distinct in Alviso Slough as in Guadalupe Slough; this could indicate that environmental changes across time were less pronounced in Alviso Slough. The 29 July samples were also those with the least variability in taxa composition relative to DCA Axis 2, which was a 2.922-unit axis with high variability and little differentiation among all samples, including those from April.

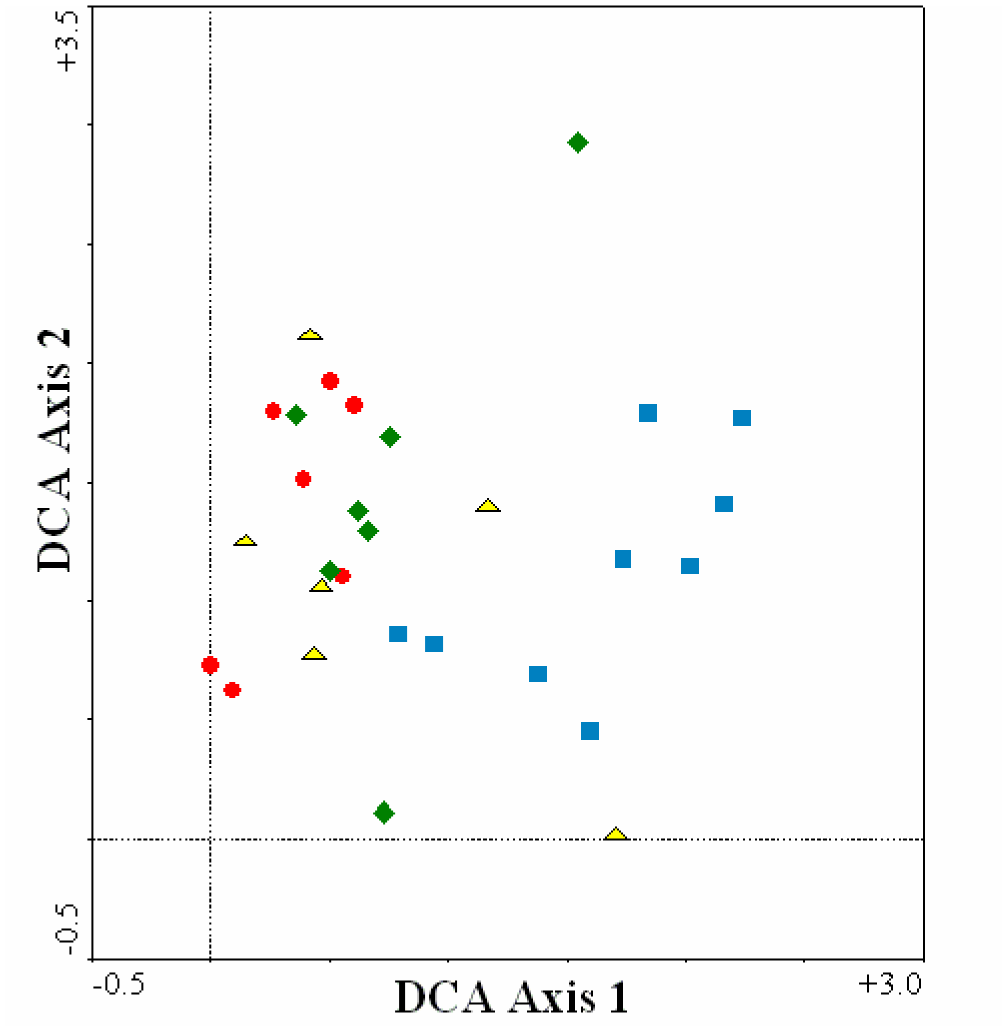


Figure 6. Results of DCA analysis showing 2004 Pond A7 receiving water Alviso Slough benthic invertebrate samples in ordination space. Blue squares = 7 April, red circles = 29 July, yellow triangles = 9 August, and green diamonds = 23 August.

Discussion

Ecological monitoring of benthic invertebrates can be a useful tool for detecting the impacts of water quality changes over time (Summers et al. 1991, Christman and Dauer 2003), as they can provide consistent responses to environmental stressors (Weisberg et al. 1997). Benthic samples were taken on three occasions following late July 2004 salt pond discharges into Guadalupe Slough and Alviso Slough, CA, to assess the effects of these discharges on the benthic community within the receiving waters. Additional samples collected in April 2004 are representative of pre-discharge conditions.

Comparisons were made between all four sampling events to assess community changes over time, and to relate them to water quality changes in the slough.

In addition to taxa diversity and total abundance, two indicator taxa were chosen for abundance comparison among sampling dates. *Capitella* sp. and *Streblospio* sp. are both recognized as taxa that are tolerant of stressful environmental conditions, which may include low dissolved oxygen and contaminants (Thompson and Lowe 2004, Thompson and Shouse 2004, Gaston et al. 1998). Higher relative abundances of these taxa could be indicative of degraded conditions. Although neither slough showed differences in *Capitella* sp. across the four sampling dates, including the pre-release (April) date, high sample variability and low sample size may make differences difficult to detect. *Capitella* sp. was not found in April. In Guadalupe Slough, *Capitella* sp. was found in the highest number in the second summer sample and slightly lower in the third sample. In Alviso Slough, *Capitella* sp. was found in the highest number in the first summer sample and each subsequent sample contained fewer individuals, although high sample variability made these differences insignificant. These results suggest that more data could show an increase in *Capitella* sp. immediately after pond release, followed by a decline. However, the water quality implications are contradicted because *Streblospio* sp. was present in pre-discharge samples but only rarely in post-discharge samples. In Guadalupe Slough, the April sample differed from all summer samples (which contained no *Streblospio* sp.), whereas in Alviso Slough, the April sample and the first summer sample were not different, while the later summer samples contained few *Streblospio* sp. Although there are too few data to draw conclusions, this may be a seasonal effect (*Streblospio* sp. was present during spring and declined through summer).

Although abundance and diversity comparisons showed no differences among sample dates, DCA revealed a shift in taxa composition between April samples and summer samples in both sloughs, especially Guadalupe Slough. In Guadalupe Slough, the three summer samples were similar relative to the ecological gradient represented by DCA Axis 1, whereas the April sample was distinct. April samples contained few or no *Capitella* sp., *Potamacorbula* sp., or *Heteromastus* sp., although these genera were abundant in summer samples. In contrast, April samples contained Nematoda, which was not represented in summer samples. In Alviso Slough, trends were similar but Tubificoides was present in April samples and not in summer samples, while Cumacea was more abundant in April samples than in summer samples. Differences in taxa composition may be useful for evaluating water quality changes if evaluated carefully with respect to known environmental tolerances of individual taxa. Because over three months passed between the pre-discharge sample and the post-discharge samples, many of the differences in taxa composition may be attributable to seasonal shifts rather than effects of the discharge. Such shifts in invertebrate taxa have been noted to occur seasonally in Alviso salt ponds (Miles et al. 2004).

Management Implications

The results of the 2004 benthic invertebrate sampling did not detect impacts from the Alviso Salt Pond discharges. Some trends were observed during sampling; however, the results of the sampling could have been more definitive if more data was obtained and the pre-release samples were taken closer to the post-release samples. It is possible that the results were confounded by the difference in the sampling seasons rather than the difference in the water quality coming from the ponds. To improve on the 2004 benthic invertebrate sampling, in 2005 we have included pre-release samples taken just 7 days before the first release from the Phase 2 ponds. The results from the 2005 sampling should provide us with a more appropriate comparison between pre-release and post-release benthic populations.

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