GRASSLAND BYPASS PROJECT

QUARTERLY NARRATIVE AND GRAPHICAL SUMMARY

January - March 2000

July 5, 2000

A cooperative effort of:
U.S. Bureau of Reclamation
Central Valley Regional Water Quality Control Board
U.S. Fish and Wildlife Service
California Department of Fish and Game
San Luis & Delta-Mendota Water Authority
U.S. Environmental Protection Agency
U.S. Geological Survey

Report prepared by the San Francisco Estuary Institute

I. INTRODUCTION

The Grassland Bypass Project (GBP) intercepts agricultural subsurface drainage flows south of the Grassland Water District and conveys them through the northernmost 28 miles of the San Luis Drain to a discharge point in Mud Slough (North), a tributary of the San Joaquin River. The location of the GBP and the Grassland Drainage Service Area are shown in Figure 1. A schematic of the GBP showing the hydrology of the GBP and sampling locations is provided in Figure 2. The GBP has removed much of the agricultural subsurface drainage from wetland water supply channels in the Grassland Water District and from Salt Slough, but has increased quantities of agricultural subsurface drainage in the six miles of Mud Slough (North) that receive the re-routed water. The Grassland Bypass Project Compliance Monitoring Program (GBPCMP) has been in place since October 1996 and is designed to evaluate whether the terms and conditions of the GBP are being met. Specific conditions for the GBP include monthly and annual selenium load values from the San Luis Drain into Mud Slough (North), selenium load reductions over the long term, removal of subsurface agricultural drainage from the wetland water supply channels, the prevention of significant adverse environmental impacts, and the prevention of significant adverse effects on human health. Detailed background information on the GBP is documented in the "Finding of No Significant Impact and Supplemental Environmental Assessment (FONSI)" and the Interim Use Permit (USBR 1995). The comprehensive monitoring plan (USBR 1996) and the Quality Assurance Project Plan (Entrix 1997) contain detailed descriptions of the sampling and analytical methods employed in the GBPCMP.

The purpose of the Quarterly Narrative and Graphical Data Summary series is to provide an overview of the data collected in the most recent quarter of the GBP. Complete listings of the data are provided in Monthly Data Reports and Quarterly Data Reports (SFEI 1999). The data and detailed background information on the GBP are also available on the Internet at the following address:

http://www.mp.usbr.gov/mp150/grassland/HomePage/Homepage.html.

This report provides information for the fourth year of the GBP in the quarter including January through March 2000.

II. FLOW MONITORING

Flow data in the GBP are measured to allow computation of selenium load discharge, to establish seasonal flow patterns, and to determine the influence of the discharge from the San Luis Drain on the hydrology of Mud Slough (North). According to the Interim Use Permit, discharge into Mud Slough (North) from the San Luis Drain may not exceed 150 cfs (USBR 1995).

Daily mean flow data for Sites A, B, D, F, and N are shown in Figure 3. Flows near the inlet to the San Luis Drain (Site A) averaged 42 cfs for the quarter. At the point of discharge of the San Luis Drain into Mud Slough (North) (Site B), flows averaged 46 cfs (Figure 3). Maximum flows for this quarter were 74 cfs on March 1 and 6 at Site A and 75 cfs on March 2, 3, and 7 at Site B.

Of the two monitoring sites at Mud Slough (north) above and below the GBP discharge (Sites C and D, respectively), flow is measured only at Site D. The average flow at Site D for the quarter was 223 cfs. A maximum flow of 362 cfs occurred at Site D on February 18. Average discharge from the SLD (Site B) was 21% of the average total flow in Mud Slough (north) (Site D). Flows in Salt Slough (Site F) averaged 246 cfs for the quarter. The highest flow in Salt Slough (468 cfs) occurred on March 10.

At Site N in the San Joaquin River, flows averaged 2940 cfs this quarter. The maximum flow measured was 6610 cfs on March 3.

III. WATER QUALITY MONITORING

Water quality data in the GBP are collected to evaluate compliance with selenium load values given in the FONSI and the Interim Use Permit (USBR 1995), to evaluate compliance with the commitment to not discharge agricultural subsurface drainage to the wetland channels, and to evaluate potential adverse effects of the GBP discharge and of waters in Mud Slough (North) below the discharge on test organisms. Electrical conductivity, pH, boron, and selenium concentrations provided by the CVRWQCB are considered in draft from at the time of preparation for this report.

Selenium

Daily Selenium Measurements

Selenium concentrations are measured daily at Sites B and N using autosamplers (USBR 1996). Daily selenium load discharge is computed at Site B, and monthly totals are shown in Figure 4. Monthly total selenium load discharges were below the selenium load values in each month of this quarter.

Figure 5d shows daily selenium loads from the GBP (discharge from the terminus of the San Luis Drain as measured at Site B), which averaged 17.4 lbs/day for the quarter. The maximum daily selenium load discharge (29.6 lbs/day) occurred on February 29. Flow at Site B averaged 46 cfs for the quarter with a minimum of 20 cfs on January 5, 7-11 and a maximum of 75 cfs on March 2, 3, and 7 (Figure 5b). Selenium concentrations at Site B varied between a minimum of 43.2 µg/L on January 31 and a maximum of 104 µg/L on March 20 (Figure 5c). The cumulative selenium load discharge for the quarter was 1587 lbs. Cumulative load discharge for the sampling year to the end of the quarter was 2197 lbs. (Figure 5a).

Selenium concentrations at Site N (San Joaquin River at Crow's Landing) averaged 1.8 µg/L for the quarter (Figure 6b). The highest concentration for the quarter, 4.7 µg/L, was measured on February 11. The minimum concentration for the quarter, 0.8 µg/L, was measured on February 17 and 27. In this quarter, all months had complete sets of daily flow and selenium concentration data for both Sites B and N, and calculated monthly loads at Site B (285, 541, and 761 lbs, for January, February, and March,

respectively) account for much of the calculated loads at Site N (325, 699, and 950 lbs, respectively).

Weekly Selenium Measurements

Selenium concentrations are measured in weekly grab or composite samples collected at 12 sites. Concentrations in samples for the period beginning October 1999 are shown in Figures 7 through 9.

Selenium concentrations for Site A were previously measured in weekly grab samples, which have been replaced by weekly composite samples starting January 2000. Average selenium concentrations in weekly samples collected near the inlet to the San Luis Drain (Site A) were higher than those near the point of discharge into Mud Slough (Site B) (Figure 7). Site A averaged 82.2 µg/L as compared to 62.2 µg/L for Site B in this quarter.

Selenium concentrations in Mud Slough (North) upstream of the GBP discharge (Site C), averaged 0.6 µg/L, slightly above the detection limit of 0.4 µg/L, with a maximum measured concentration for the quarter of 1.1 µg/L on February 3 (Figure 7). Approximately a third of the samples were below the detection limit. Concentrations were much higher in Mud Slough (North) downstream of the GBP discharge (Site D) than upstream at Site C (note differences of scales in graphs). Concentrations at Site D averaged 17.2µg/L, with a maximum of 46.6 µg/L on March 30.

Selenium concentrations in Salt Slough (Site F) and the wetland water supply channels (Sites J, K, L2, M2) frequently have reached or exceeded 2 µg/L in the past. One objective of the GBP is monthly mean selenium concentrations below 2 µg/L at these locations. In this period, measurements exceeded 2 µg/L three times at Site J, six times at Site L2, and only once at Site M2 (Figure 8). Monthly mean concentrations exceeded the objective this quarter at Sites J and L2 for February (Table 1).

In the San Joaquin River, weekly selenium samples were collected at sites upstream of the GBP discharge (Site G), downstream of the discharge but above the Merced River (Site H), and downstream of the Merced River (Site N) (Figure 9). Selenium concentrations at Site G were low, averaging 0.6 µg/L and ranging from the detection limit (<0.4) to 1.0 µg/L. Site H was previously believed to be upstream of influence from the Merced River, but seasonal inflows from the Merced have been found upstream of Site H. Sampling at this site has therefore been discontinued. Weekly samples collected at Site N averaged 2.0 µg/L of selenium, ranging from 0.8 to 4.6 µg/L this quarter.

Specific conductance

Specific conductance is measured at 15 min intervals at Sites B, D, F, and N, and in weekly grab samples at Sites A, B, C, D, F, G, H, J, K, L, M, and N. These data are presented in Figures 10 and 11. Data for some dates at various sites were not available at

the time of preparation of this report. Sampling at Site H has been discontinued.

IV. SEDIMENT MONITORING

Sediment quality is measured in the San Luis Drain and in Mud and Salt Sloughs to assess whether selenium concentrations in Drain sediments are approaching the California Department of Health Services hazardous waste criterion (100 µg/g wet weight) and to provide information on the fate and transport of selenium within the Drain. Sites in Mud and Salt Sloughs are monitored to determine whether changes in sediment chemistry in these locations occur as a result of the GBP and to provide data that can be used in conjunction with biological data to assess accumulation or depletion of selenium in the aquatic food web.

Sediment selenium data were not yet available when this report was prepared.

V. BIOLOGICAL MONITORING

Biological monitoring is conducted throughout the GBP area on a quarterly basis (USBR 1996). Tissue sampling in the GBPCMP is performed to assess the potential for adverse impacts to fish and wildlife and to assess public health risks. Food web organisms (aquatic plants, invertebrates, and fish) are analyzed for selenium residues to assess impacts to fish and wildlife. Muscle fillets from gamefish are analyzed for selenium to assess human health risks. These data will be presented and discussed in the GBP Annual Report for this water year (October 1999 - September 2000).

VI. TOXICITY TESTING

The purpose of the GBP toxicity testing program is to evaluate the potential adverse effects of the GBP discharge and of waters in Mud Slough (North) below the discharge on test organisms. Monthly toxicity tests are conducted in the laboratory using water collected from Sites B, C, D, and F. Test results from these sites are compared to results obtained using water from the Delta-Mendota Canal. Monthly toxicity tests include: the 7-day chronic fathead minnow (*Pimephales promelas*) larvae survival and growth test; the 7-day chronic water flea (*Daphnia magna*) survival and reproduction test; and the 4-day chronic algal (*Selenastrum capricornutum*) growth test.

Water from Site B significantly reduced growth of *Selenastrum capricornutum* in January and February (Figure 12), but growth in laboratory controls failed the acceptability requirements in January. In January, water from Site C produced both chronic and acute toxic effects on fathead minnow (Figure 13). Acute toxicity was also seen for fathead minnow at Site D in January and February (Figure 14). Site F produced acute effects on fathead minnow only in February (Figure 15).

REFERENCES

Entrix, Inc. 1997. Final Draft Quality Assurance Plan for the Compliance Monitoring Program for the Use and Operation of the Grassland Bypass Project. Prepared for the U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

SFEI. 1999. Monthly and Quarterly Data Reports for the Grassland Bypass Project. Available from SFEI or on the Internet at http://www.sfei.org/grassland/reports/gbppdfs.htm.

USBR. 1995. Finding of No Significant Impact and Supplemental Environmental Assessment, Grassland Bypass Channel Project, Interim Use of a Portion of the San Luis Drain for Conveyance of Drainage Water through the Grassland Water District and Adjacent Grassland Areas. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

USBR. 1996. Compliance Monitoring Program for Use and Operation of the Grassland Bypass Project. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

Table 1. Monthly mean selenium concentrations (in µg/L) from weekly samples collected at Salt Slough (Site F) and the wetland water supply channels (Sites J, K, L2, M2) for water year 2000.

	F	J	K	L2	M2
October 1999	0.7	1.0	0.9	0.9	1.0
November 1999	0.8	1.5	1.3	1.5	0.8
December 1999	0.8	0.9	0.7	1.0	0.9
January 2000	0.6	1.1	0.9	1.1	0.6
February 2000	1.1	2.1	1.4	2.9	1.6
March 2000	1.2	1.4	1.1	1.8	1.3

Figure 1. Map of the Grassland Bypass Project. Locations of Sites D, F, G, H, and N are indicated.

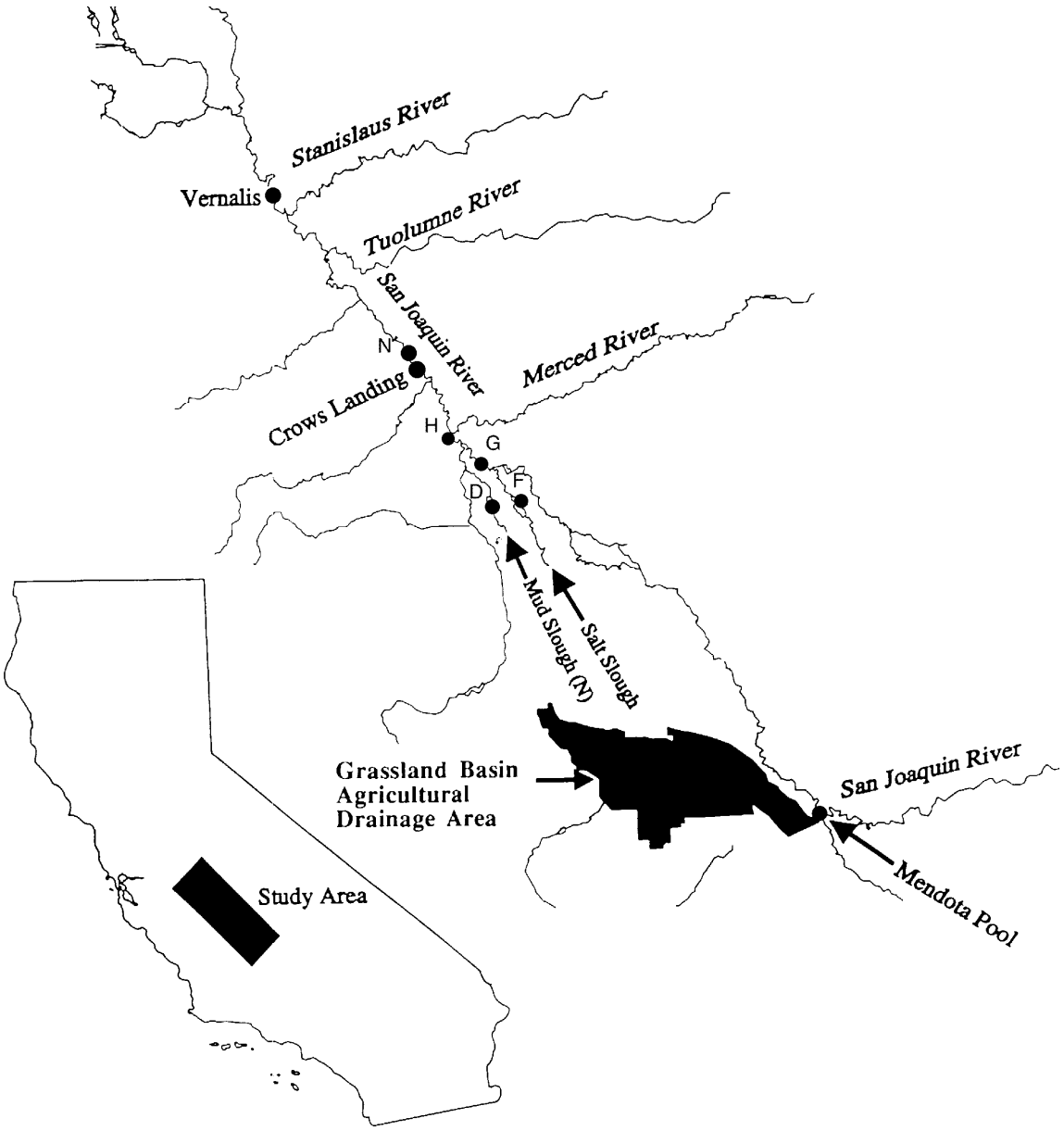


Figure 2. Schematic diagram showing locations of GBP monitoring sites relative to major hydrologic features of the study area.

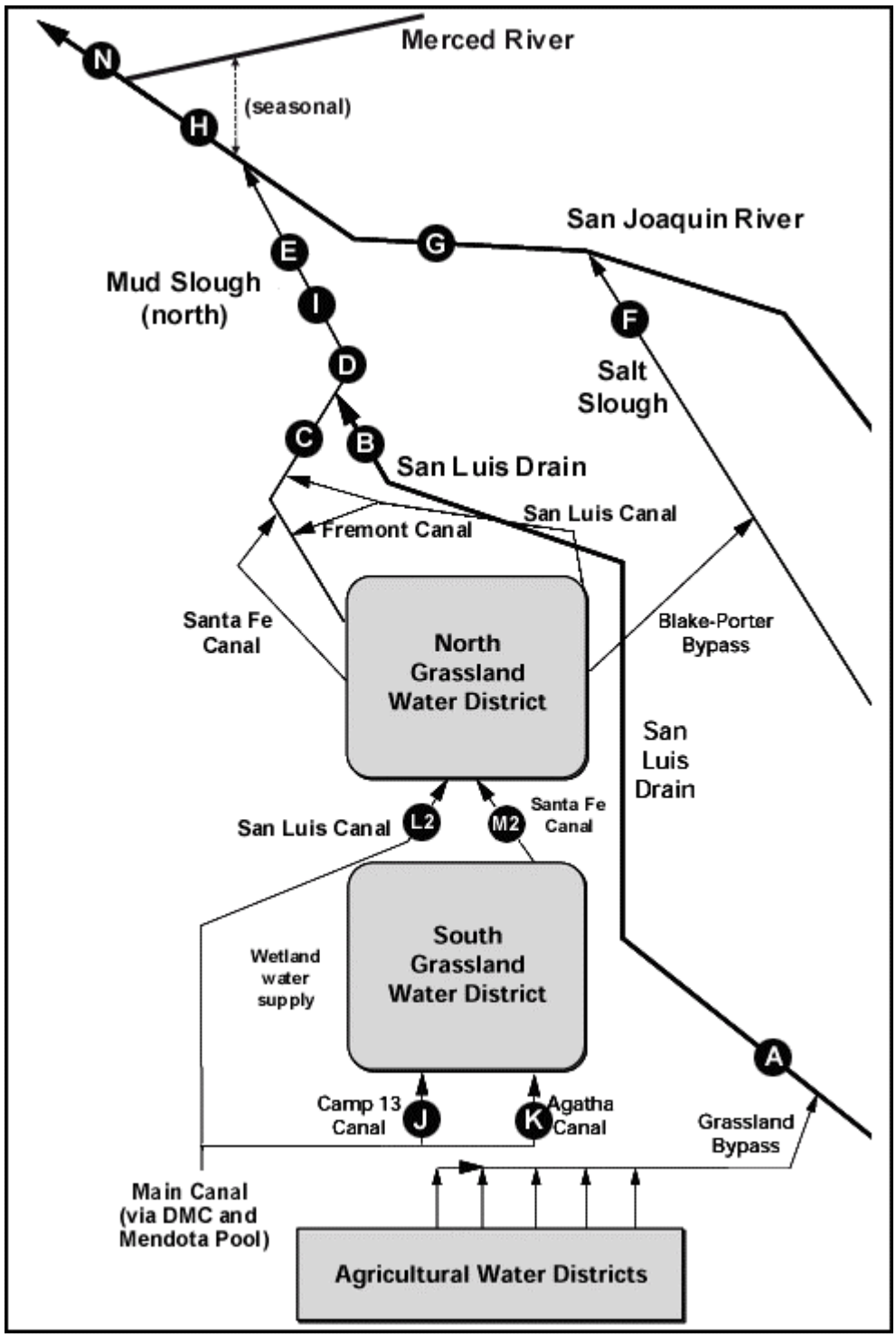


Figure 3. Daily mean flows (cfs) at GBPCMP sites. Flow at Site A is recorded as a daily mean. Flows at Sites B, D, F, and N are recorded at 15 min intervals. Note different scales of vertical axis.

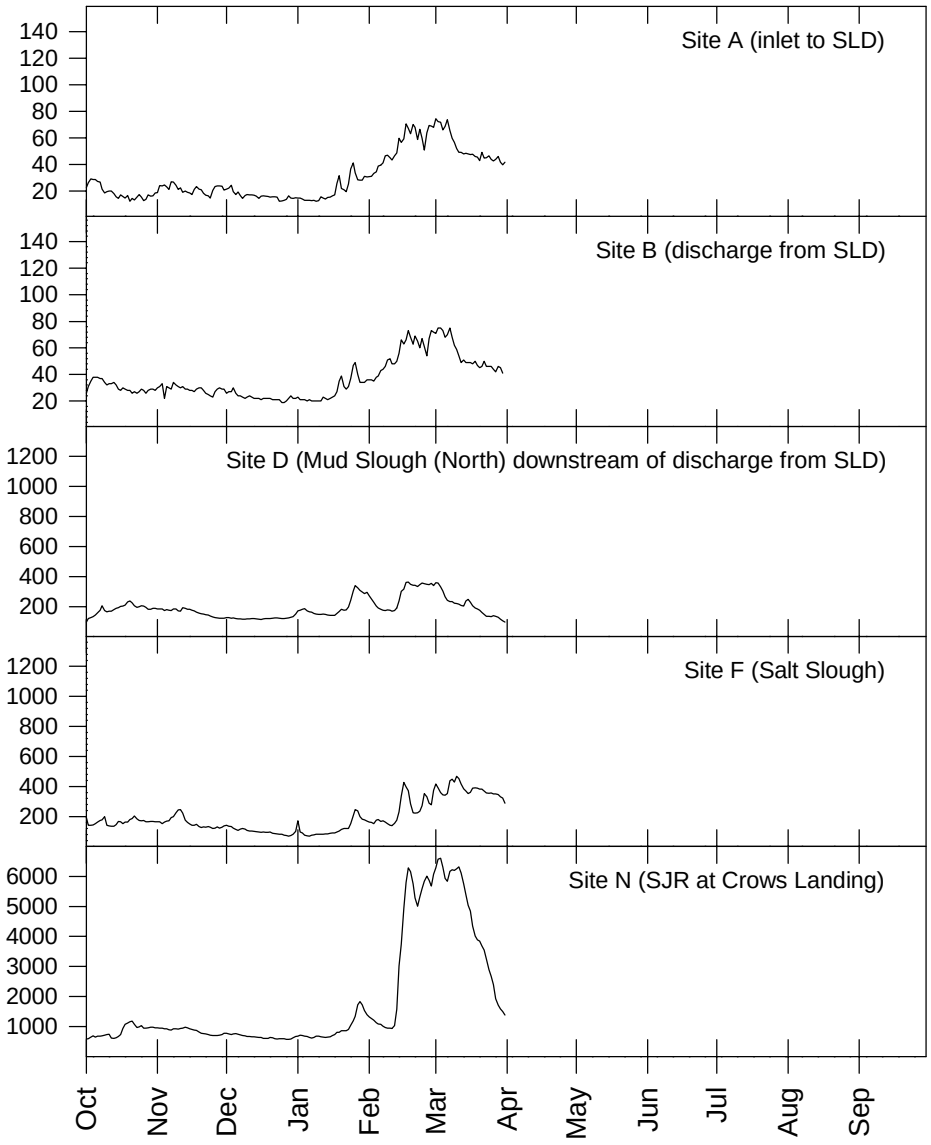
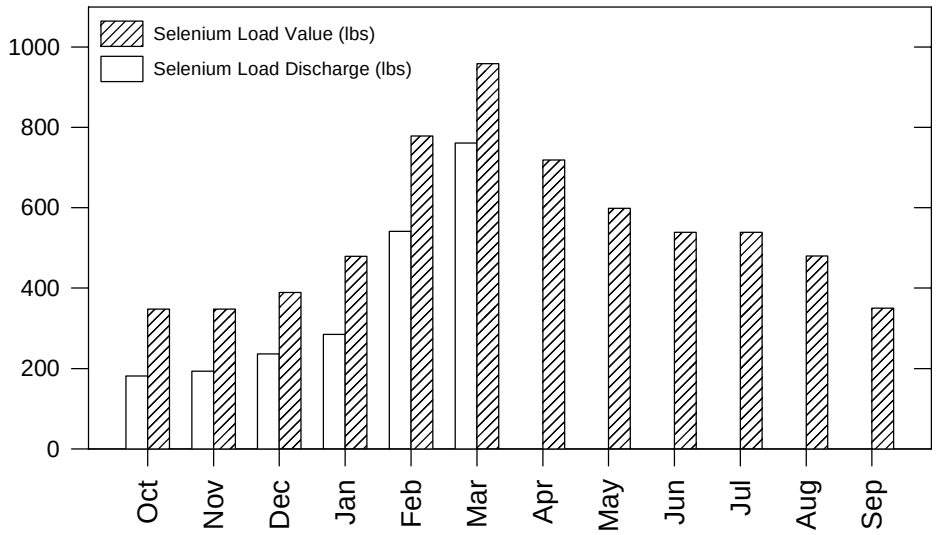


Figure 4. Comparison of monthly selenium load discharge from the terminus of the San Luis Drain (Site B) with the monthly load values in the Interim Use Permit for the 4th year of the GBP (USBR 1995).



Water Year 2000	Load value (lbs)	Selenium load discharge (lbs)	Amount over load value (lbs)
Oct 1999	348	181	NA
Nov 1999	348	193	NA
Dec 1999	389	236	NA
Jan 2000	479	285	NA
Feb 2000	779	541	NA
Mar 2000	959	761	NA

NA: not applicable (load discharge was less than load value)

Figures 5. Selenium concentrations and selenium load discharge at Site B (discharge from SLD): a) comparison of cumulative load discharge and load values; b) daily average flows; c) daily average selenium concentrations; and d) calculated daily average load discharge.

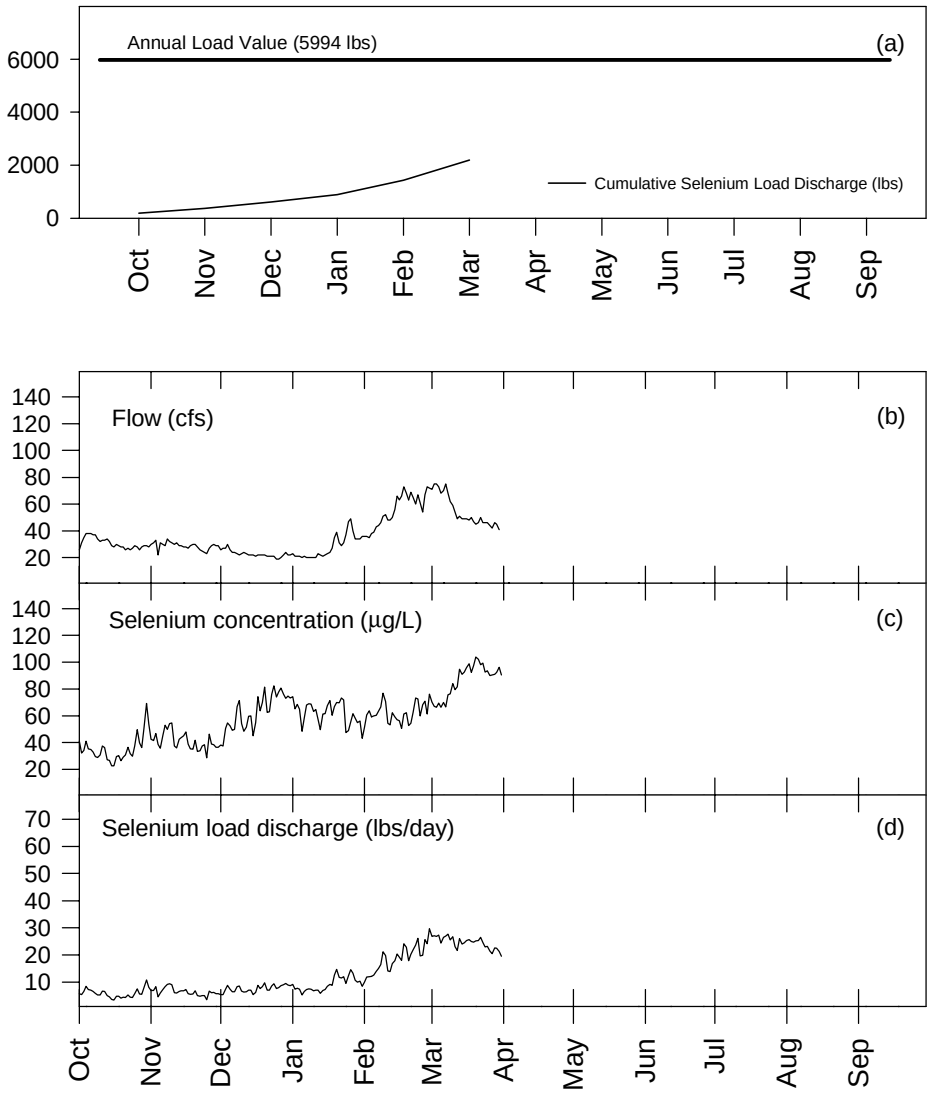


Figure 6. Daily average flows and selenium concentrations at Site N (San Joaquin River at Crow's Landing).

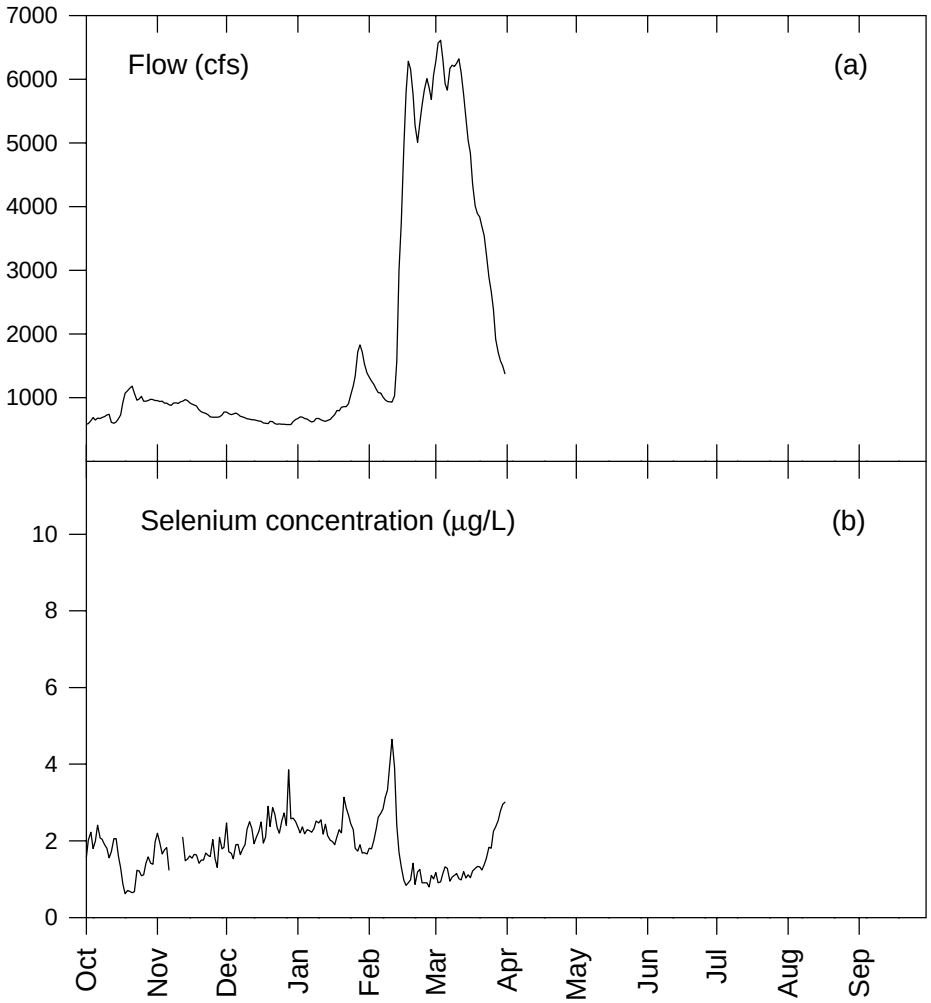


Figure 7. Selenium concentrations (µg/L) at Site A (near the inlet to the San Luis Drain), Site B (discharge from the San Luis Drain), Site C (Mud Slough (North) upstream of the GBP discharge), and Site D (Mud Slough (North) downstream of the GBP discharge). Data from weekly grab samples.

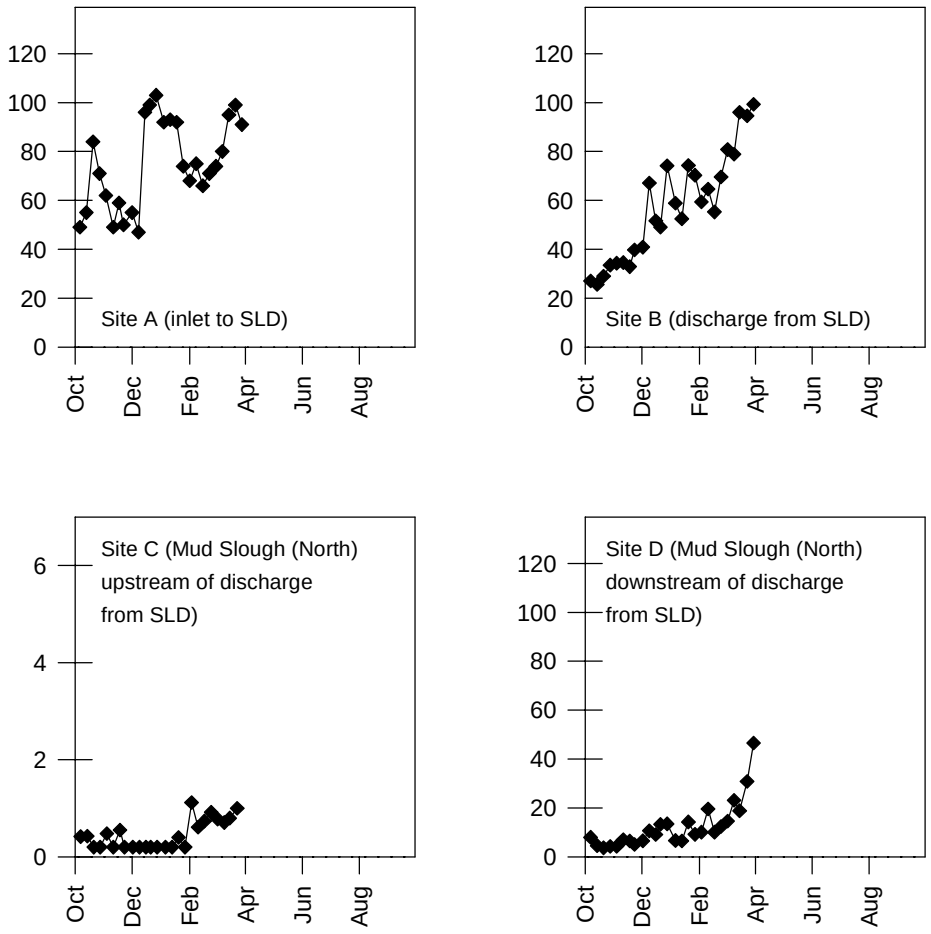


Figure 8. Selenium concentrations (µg/L) at Site F (Salt Slough) and in the wetland water supply channels at Site J, Site K, Site L2, and Site M2. Data from weekly grab samples.

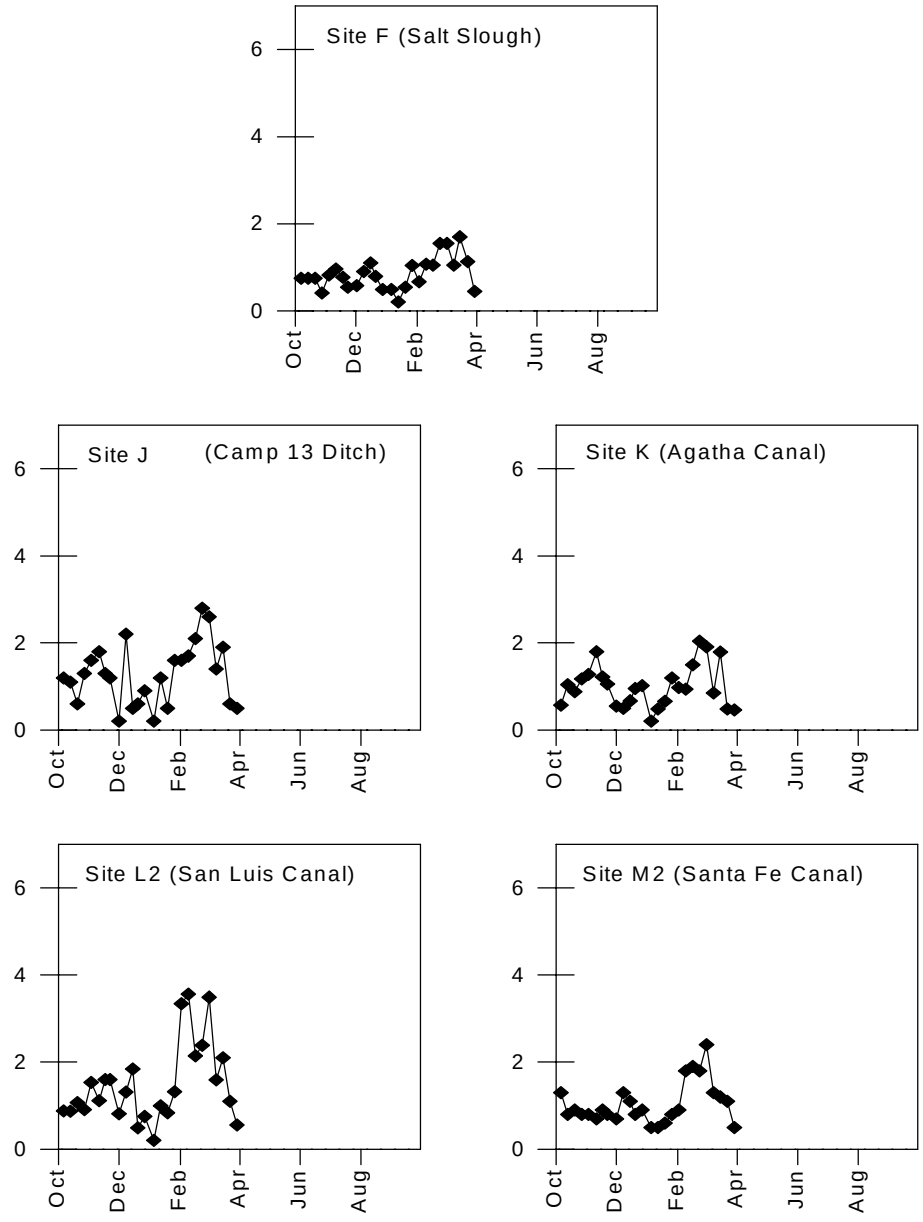


Figure 9. Selenium concentrations (µg/L) at San Joaquin River Sites G (San Joaquin River upstream of Mud Slough (North) confluence), H (San Joaquin River downstream of Mud Slough (North) confluence), and N (at Crow's Landing, downstream of Merced River confluence). Data from weekly grab samples.

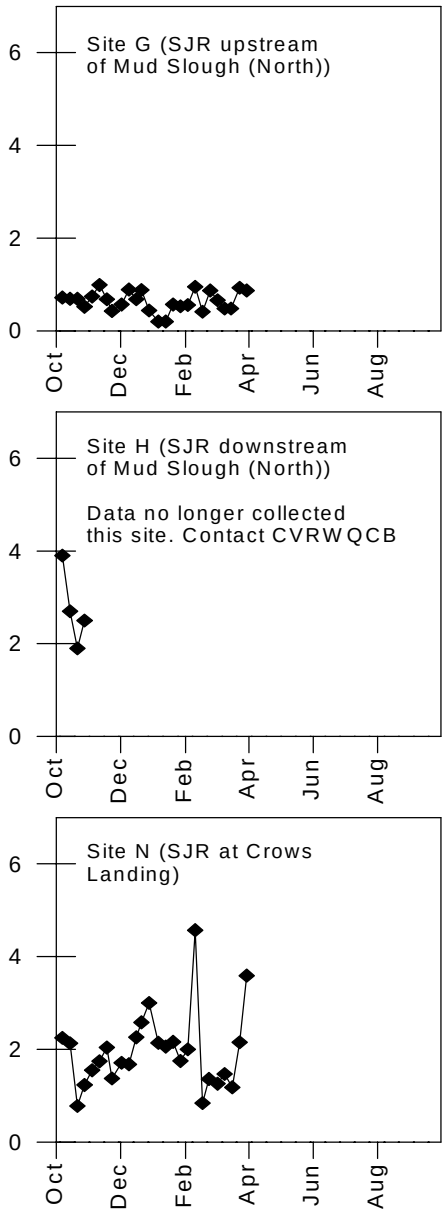


Figure 10. Daily average specific conductance (µS/cm) derived from measurements at 15 min intervals at Sites B (discharge from the SLD), D (Mud Slough (North) downstream of the GBP discharge), F (Salt Slough), and N (San Joaquin River at Crow's Landing).

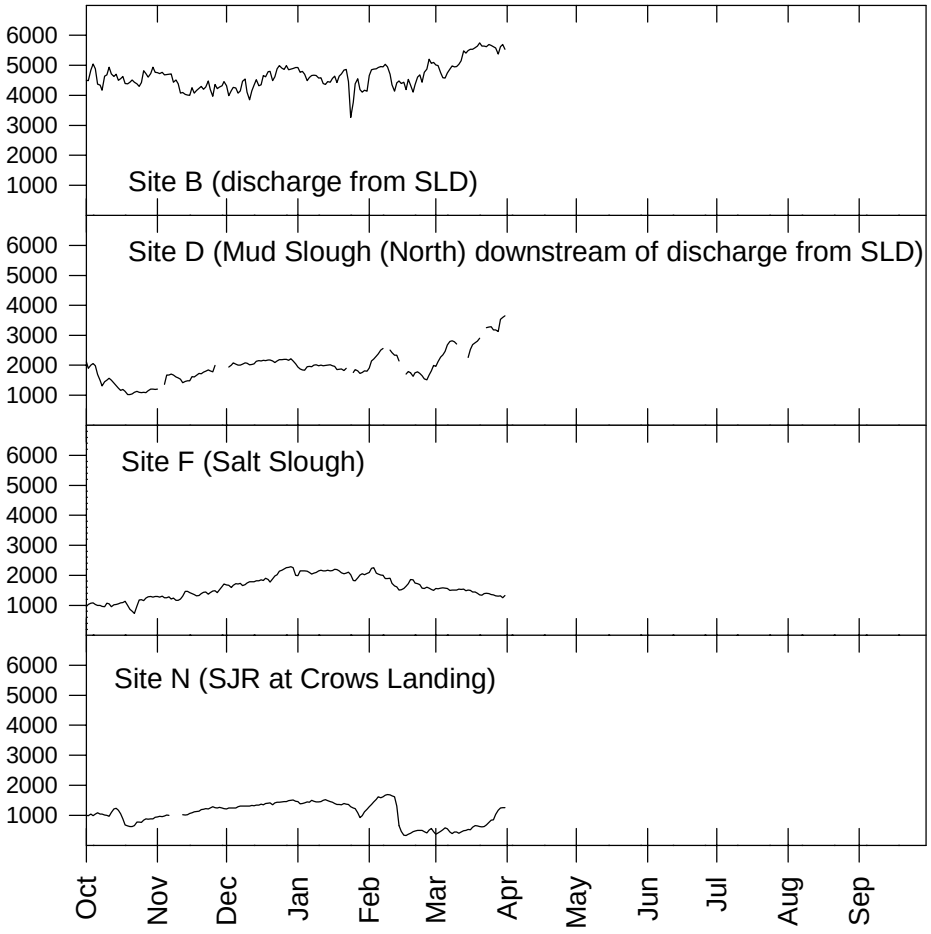


Figure 11. Specific conductance (µS/cm) in weekly grab samples. Letters indicate sites.

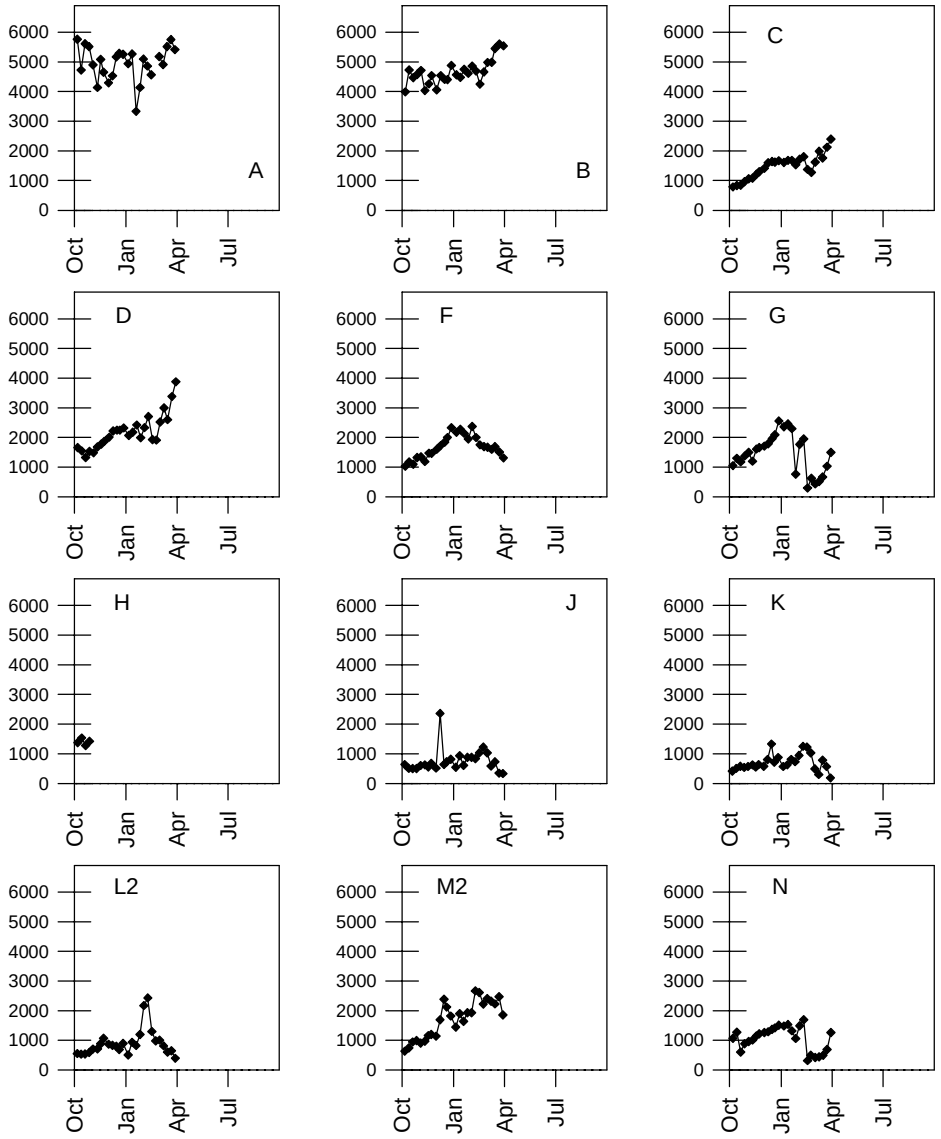


Figure 12. Comparison of toxicity test results from Site B with results from the Delta Mendota Canal reference location. The different tests are described in the text.

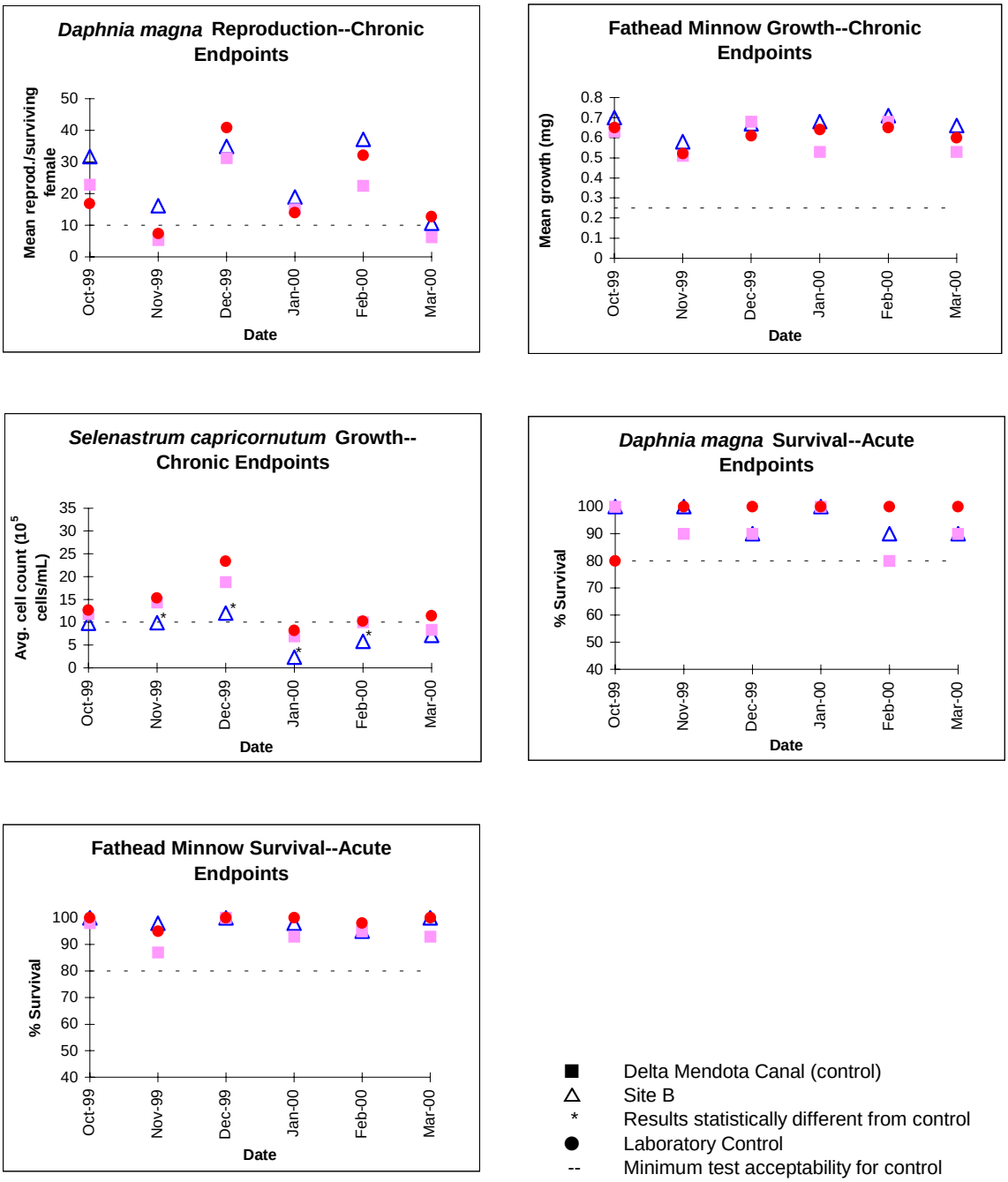


Figure 13. Comparison of toxicity test results from Site C with results from the Delta Mendota Canal reference location. The different tests are described in the text.

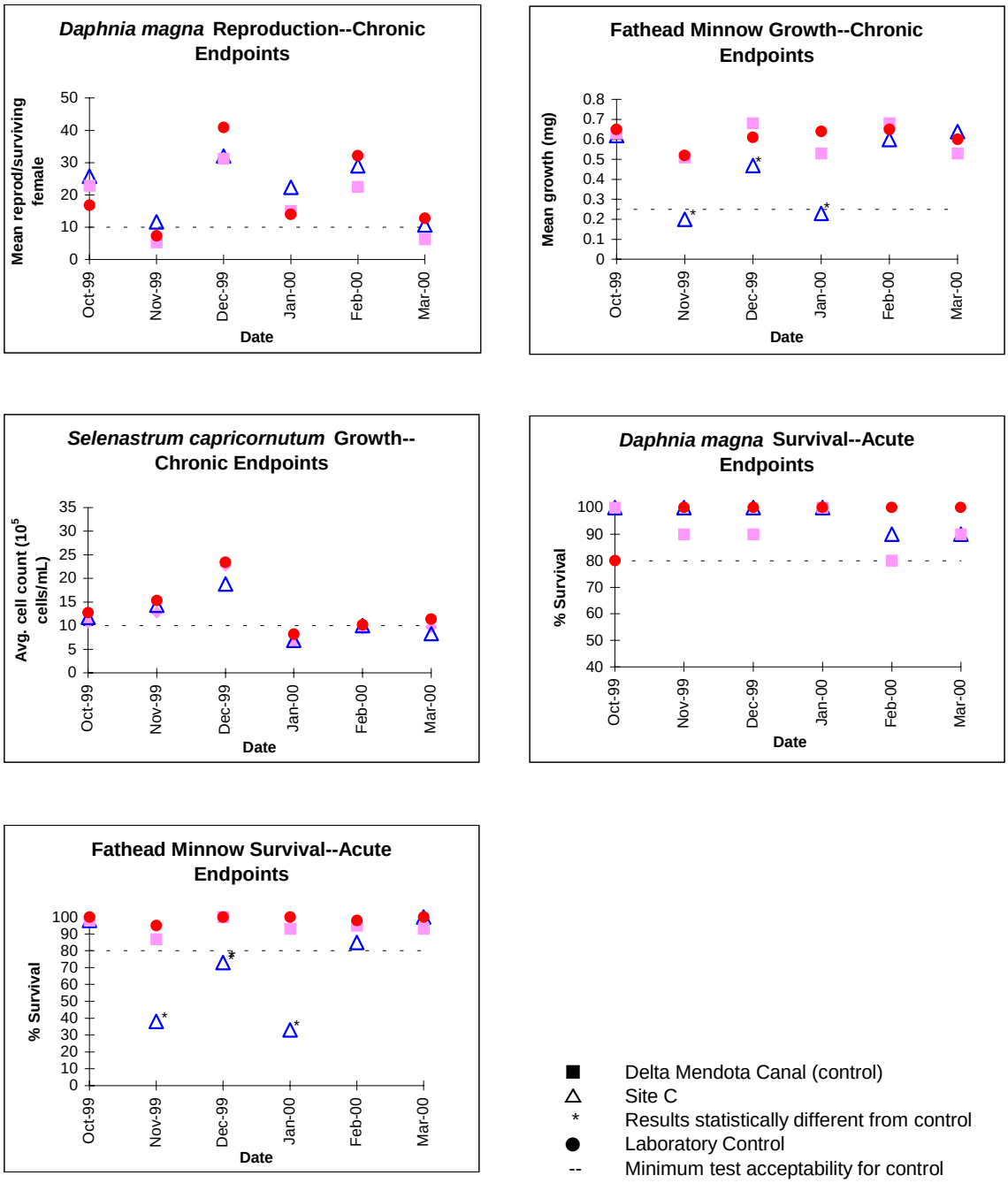


Figure 14. Comparison of toxicity test results from Site D with results from the Delta Mendota Canal reference location. The different tests are described in the text.

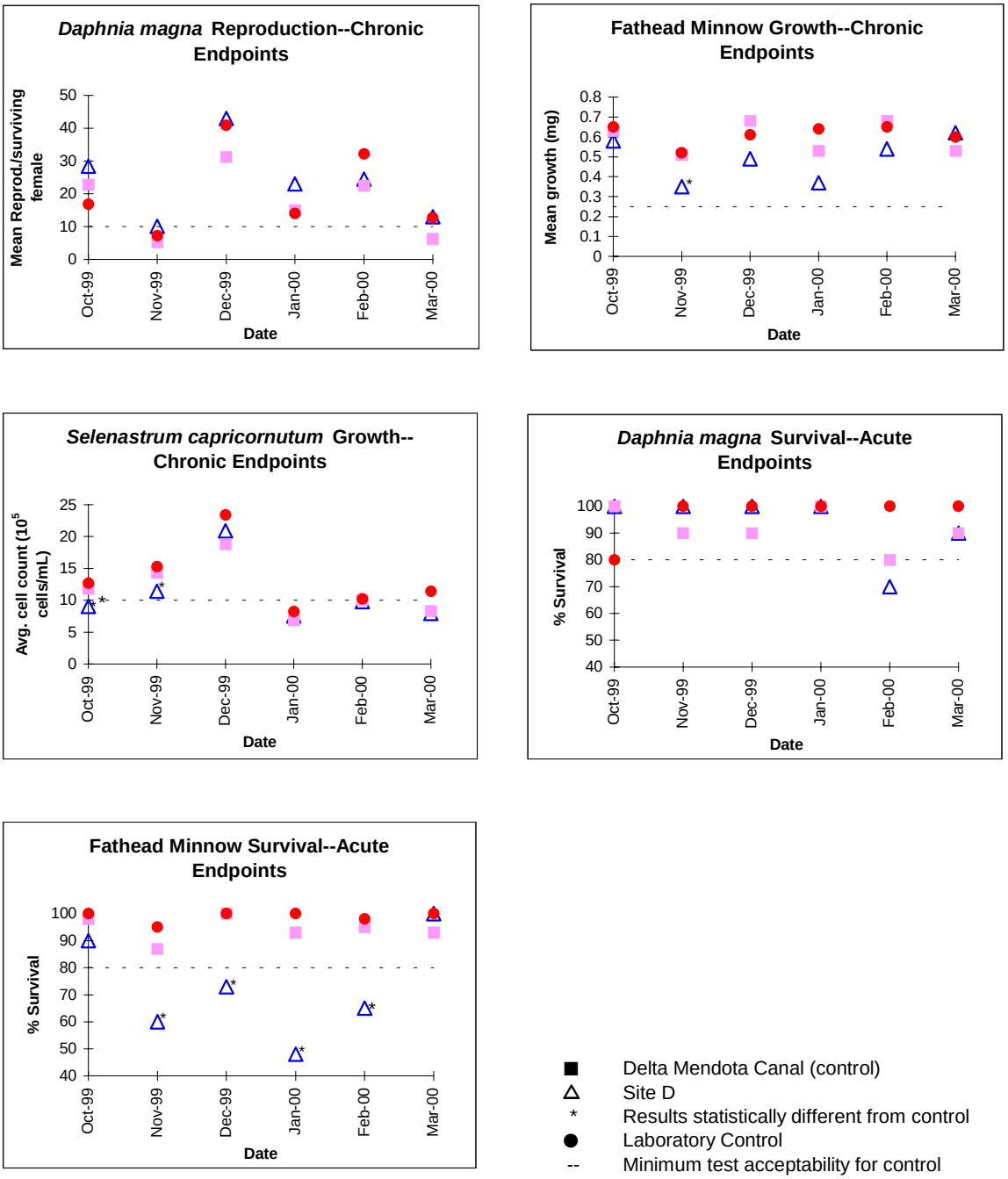


Figure 15. Comparison of toxicity test results from Site F with results from the Delta Mendota Canal reference location. The different tests are described in the text.