DATA EVALUATION

PROGRESS REPORT

Overview of available drinking water quality data in the Delta

by

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to

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Data Evaluation Progress Report

Most of the effort during this phase of work focused on the following steps:

1. Determining the best way to manage, edit, merge, translate, and re-format the various databases received.

2. Evaluation of several PC database software programs to act as the main database for this data.

3. Time series plots of water quality data at the key stations of interest for preliminary evaluation.

4. Conducting a preliminary assessment of the data with recommendations on the next step.

The data of the various water agencies were in a variety of PC software formats. Some were in spreadsheets (e.g., Excel, Lotus 123), others in databases (e.g., Rbase, dBase), and the remaining in ASCII formats. The method of record keeping also varied significantly. Some databases had separate columns for the results of each type of water analysis (e.g., THMFP, pH); others had only one column for listing the type of analysis made and another column for the results. The inconsistent formats required some editing, merging, and transformations of the data sets to become acceptable for use in this study.

Several PC database software programs were evaluated. These included Rbase, Paradox, Foxpro, Approach, and Access. Foxpro for Windows was selected on the basis of speed, functionality, and graphic output of data. Data from the various sources were kept within their own database tables instead of being merged under one table with data from other sources. This provided data integrity for each data set and ease in editing or updating data.

Time series plots were made as they are the best method to assess how much data are available. These plots show the period of record, frequency of collection, as well as the range of values for each of the water quality parameters at each station.

DWR daily flow data from the DAYFLOW model were also plotted. A comparison of significant changes in water quality to that of river flows during that same time period might explain the observations. A typical calendar of rice operations for growing rice in the Sacramento Valley is also included. The draining of rice fields in the spring and late summer might explain some water quality changes (e.g. TOC, DOC) in the Sacramento River (Table 1).

Table 1.
Typical calendar of Sacramento Valley rice operations

Date	Rice growth stage	Field activity
January 1 to 31	-	Repair, rebuild equipment; office work, management.
February 1 to 28	-	Same as above.
March 1 to 31	-	Seedbed preparation - plow and disc land.
April 1 to 19	-	Continue seedbed preparation - plow, disc, plane, and fertilize.
April 20 to 30	Seeded	Fertilize, preplant weed control, and water weevil control; "V"-groove roll. Flood; soak seed; sow late-maturing varieties.
May 1 to 15	Seedling emergence	Fertilize, preplant weed control and water weevil control; "V"-groove roll.
May 16 to 31	Tillering	Continue water management; tadpole shrimp, midge control; rice leaf-miner and late water weevil control; early postflood control; water holding for pesticide treatments.
June 1 to 30	Tillering; panicle initiation	Continue late postflood broadleaf weed control; rice leafminer and late water weevil control. Sample and analyze Y-leaf to determine N status, topdress if necessary.
July 1 to 31	Internode elongation; boot	Sample and analyze Y-leaf to determine N status, topdress if necessary, and raise water after panicle inititiation to protect pollen from cold-induced sterility. Prepare and check fallow fields.

August 1 to 31	Heading and flowering	Continue irrigation management; service and repair harvest equipment; prepare and check fallow fields. Drain fields.
September 1 to 20	Grain fill	Drain fields and open checks.
September 21 to 30	Maturity	Harvest, bankout, haul to dryer.
October 1 to 20	Maturity	Harvest, bankout, haul to dryer.
October 21 to 31	-	Continue harvest; residue disposal, disc.
November 1 to 30	-	Residue disposal; disc.
December 1 to 31	-	Repair, rebuild equipment; office work, management.

Reference: "Rice Production In California". Publication 21498. Cooperative Extension Univ. of California Division of Agriculture and Natural Resources. 1992.

Data Sources

Data files from the following sources included:

1. City of Sacramento Drinking Water Monitoring Program 1984-91 for station SR59.9, Sacramento River WTP intake

2. East Bay MUD Alternate Source Program data for Pardee Reservoir, and Greenes Landing

3. DWR Municipal Water Quality Investigations data for Greenes Landing, San Joaquin River near Vernalis, H. O. Banks Pumping Plant Headworks, and the DMC intake at Lindemann Road

4. Sacramento Regional Effluent and Receiving Water Program data for station R-1 Freeport Marina

5. DWR DAYFLO database for daily average flows

6. Sacramento Regional County Sanitation District Monitoring and Reporting Program Monthly Operations Data Summary (MODS) data for the Regional Wastewater Treatment Plant effluent

7. Sacramento Coordinated Water Quality Monitoring Program data for Folsom Dam, Nimbus Dam, American River at Discovery Park, Freeport Marina, and Sacramento River Mile 44

List of Figures

Time series plots for some of the available data were made.

The Figure 1 series are from the Sacramento Effluent Receiving Water Assessment Program (file: MRV503a). The data comprised of semi-monthly sampling data from the two-year period, 9/12/91-7/6/93.

Figure Number	Title
1A	Dissolved arsenic at Freeport Landing (9/12/91-7/6/93)
1B	Total arsenic at Freeport Landing (9/12/91-7/6/93)

The Figure 2 series are from the East Bay MUD Alternate Source Program (file:EB_GLMRV). There were eight years (8/83-8/91)of monthly sampling data for Greenes Landing.

Figure Number	Title
2A	Alkalinity at Greenes Landing (8/22/83-8/19/91)
2B	Ammonia at Greenes Landing (8/22/83-8/19/91)
2C	Bromide at Greenes Landing (9/19/83-8/19/91)
2D	Chlorophyll a concentrations at Greenes Landing (8/22/83-8/19/91)
2E	Fecal coliform at Greenes Landing (8/22/83-8/19/91)
2F	Fecal streptococci at Greenes Landing (8/22/83-8/19/91)
2G	Nitrate (NO3) at Greenes Landing (8/22/83-8/19/91)
2H	Phosphate (PO4) at Greenes Landing (8/22/83-8/19/91)
2I	TDS at Greenes Landing (8/22/83-8/19/91)
2J	THMFP at Greenes Landing (8/22/83-8/19/91)
2K	TOC at Greenes Landing (12/11/84-8/19/91)
2L	Turbidity at Greenes Landing (8/22/83-8/19/91)

The Figure 3 series are from the City of Sacramento Drinking Water Monitoring Program (file:CSACDWMP). Station SR59.9 is the Sacramento River water intake for the City's water treatment plant. The data represented monthly collections from July 1984 to June 1991.

Figure Number	Title
3A	Fecal coliform at SR59.9 (7/84-6/91)
3B	Total coliform at SR59.9 (7/84-6/91)
3C	Total alkalinity at SR59.9 (7/84-6/91)
3D	TDS at SR59.9 (7/84-6/91)
3E	Turbidity at SR59.9 (7/84-6/91)

The Figure 4 through 7 series are from the DWR Muncipal Water Quality Investigations (MWQI) Program (file: THMDAT). This data includes data from the former Interagency Delta Health Aspects Monitoring Program (IDHAMP) and former Delta Island Drainage Investigation (DIDI). These two program were unified into the MWQI Program. Data for Greenes Landing, San Joaquin River near Vernalis, H. O. Banks Pumping Plant Headworks, the Delta Mendota Canal intake at Lindemann Road, Barker Slough at North Bay Pumping Plant, and Natomas East Drain were plotted. Most of the data represent monthly sample collections. Sampling began as early as 1982 for some stations.

Figure Number	Title
4A	THMFP at Greenes Landing (7/21/83-6/23/92)
4B	THMFP at San Joaquin River near Vernalis (3/30/92-10/6/92)
4C	THMFP at H. O. Banks Pumping Plant Headworks (3/30/92-10/7/92)
4D	THMFP at DMC intake at Lindemann Road (7/26/83-10/7/92
4E	THMFP at Barker Sl. at N. Bay Pumping Plant (9/15/88-5/19/92)
4F	THMFP at Natomas East Drain (8/26/87-6/23/92)
5A	DOC at Greenes Landing (7/11/89-2/8/93)
5B	DOC at San Joaquin River near Vernalis (12/17/86-10/6/92)
5C	DOC at H. O. Banks Pumping Plant Headwork (7/5/89-10/7/92)
5D	DOC at DMC intake at Lindemann Road (7/5/89-10/7/92)
5E	DOC at Barker Sl. at N. Bay Pumping Plant (7/11/89-5/19/92)
5F	DOC at Natomas East Drain (9/24/87-6/23/92)
6A	Turbidity at Greenes Landing (7/21/83-6/23/92)
6B	Turbidity at San Joaquin River near Vernalis (3/30/92-10/6/92)
6C	Turbidity at H. O. Banks Pumping Plant Headworks (3/30/82-10/7/92)

6D	Turbidity at DMC intake at Lindemann Road (7/26/83-10/7/92)
6E	Turbidity at Barker Sl. at N. Bay Pumping Plant (9/25/88-5/19/92)
6F	Turbidity at Natomas East Drain (9/24/87-6/23/92)
7A	TFPC at Greenes Landing (7/21/83-6/23/92)
7B	TFPC at San Joaquin River near Vernalis (3/30/82-10/6/92)
7C	TFPC at H. O. Banks Pumping Plant Headworks (3/30/82-10/7/92)
7D	TFPC at DMC intake at Lindemann Road (7/26/83-10/7/92)
7E	TFPC at Barker Sl. at N. Bay Pumping Plant (9/15/88-5/19/92)
7F	TFPC at Natomas East Drain (8/26/87-6/23/92)

DWR DAYFLO data are shown in the Figure 8 series. The data were divided into two time periods, water years 1983-86 (October 1, 1982 - September 30, 1986) and water years 1987 - 1992 (October 1, 1986 - September 30, 1992). Note the difference in Y-axis scales between the two figures. Very wet years existed during the W.Y. 1983 - 1986 period so the daily flow (cfs) axis is ten times higher than the relatively drier W. Y. periods of 1987 - 1992.

Preliminary Analysis and Summary

Greenes Landing on the Sacramento River has been monitored extensively for nearly ten years by EBMUD and DWR for drinking water constituents of concern. THMFP data from the two monitoring studies are not comparable due to different methodologies. Other data such as DOC, alkalinity, etc. however, should be comparable.

The most extensive data source for other Delta stations (e.g., Vernalis, DMC intake, Banks Headworks) is DWR's Municipal Water Quality Investigations Program.

An overall summary of the availability of data for contaminants of concern is presented in Table 2.

Table 2.
Contaminants of Concern Data

1. DBP, Surrogates, & Control Parameters

THMFP or TFPC	Different THMFP methods used. Incomparable results.
TOC or DOC	Both available but DOC predominant from DWR data set.
Humic and fulvic acids	Limited to Gary Amy study in 1989.
UVA 254nm	Limited to DWR data since 1991.
Bromide	Limited to DWR data since 1991 but more extensive Br data at Greenes Landing from EBMUD (1983 - 1991).
Chlorophyll a	Limited to EBMUD at Greenes Landing data.
pH and alkalinity	Generally readily available.
2. Microbes	
Coliforms	Limited to Greenes Landing area.
Giardia	Not extensive if available.
Cryptosporidium	Not extensive if available.
Viruses	Not available.
Turbidity	Generally available.
3. Nutrients	
Ammonia	Limited to Greenes Landing area.
Nitrate	Limited to Greenes Landing area.
Phosphate	Limited to Greenes Landing area.
Arsenic	Limited to Greenes Landing area.
TDS	More EC data available than TDS.

It is difficult to assess the reliability of the data because the data are from different sources. Quality control data for method blanks and spiked samples were not in the databases received. Under these circumstances, it is assumed that internal quality control and quality assurance practices were followed during sample collection and in the laboratory.

In this study, identifying possible anomalous data was limited to examining the time series plots. Suspicious data were flagged for later confirmation with the data sources. For example, a high ammonia concentration of 77 mg/L at station R-1 Freeport Marina on July 6, 1993 was flagged for later verification (source: Sacramento Effluent Receiving Water Assessment Program).

Figure 1A.
Sacramento Effluent Receiving Water Assessment Program
File:MRV503a

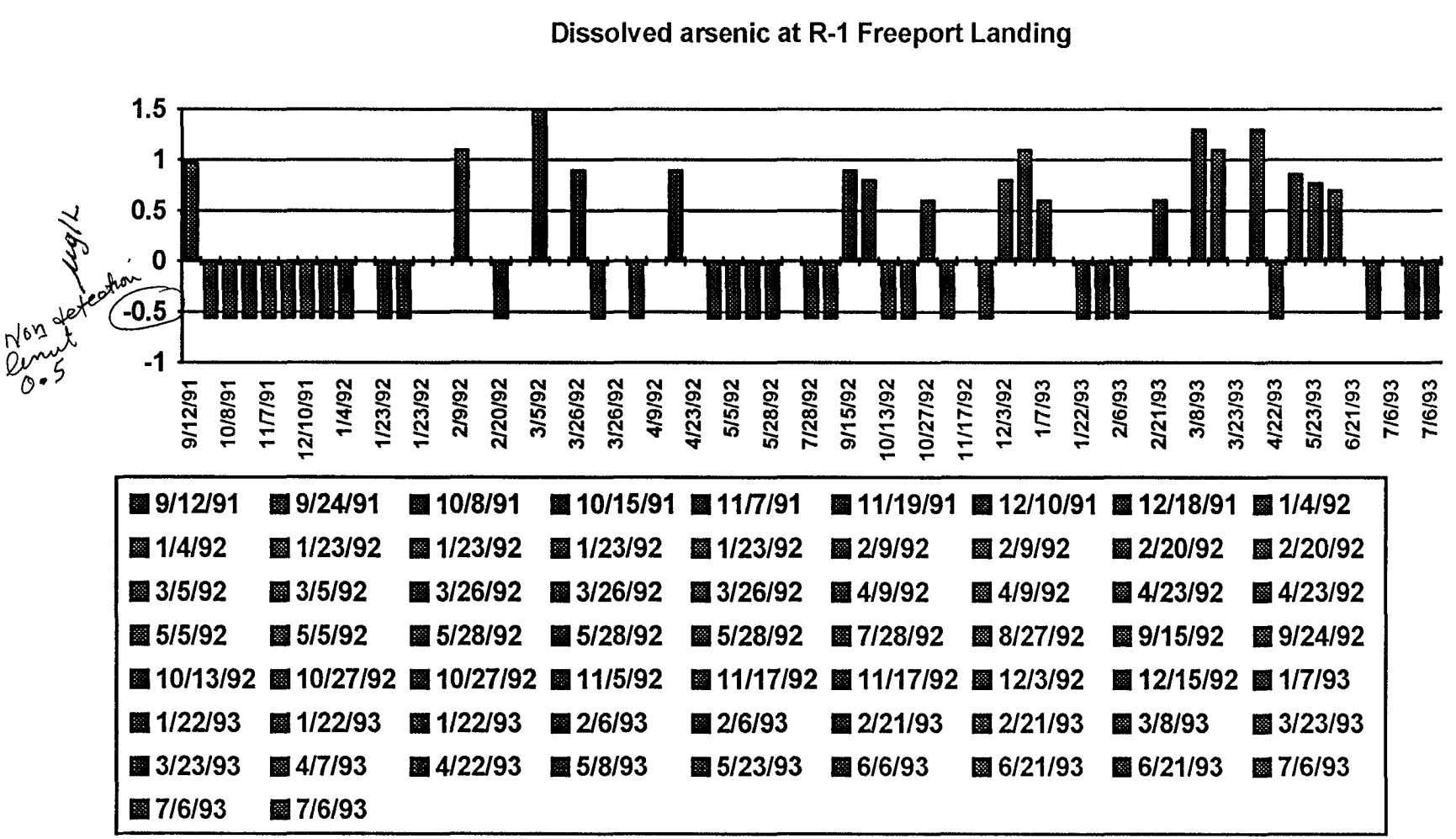


Figure 1B.
Sacramento Effluent Receiving Water Assessment Program
File:MRV503a

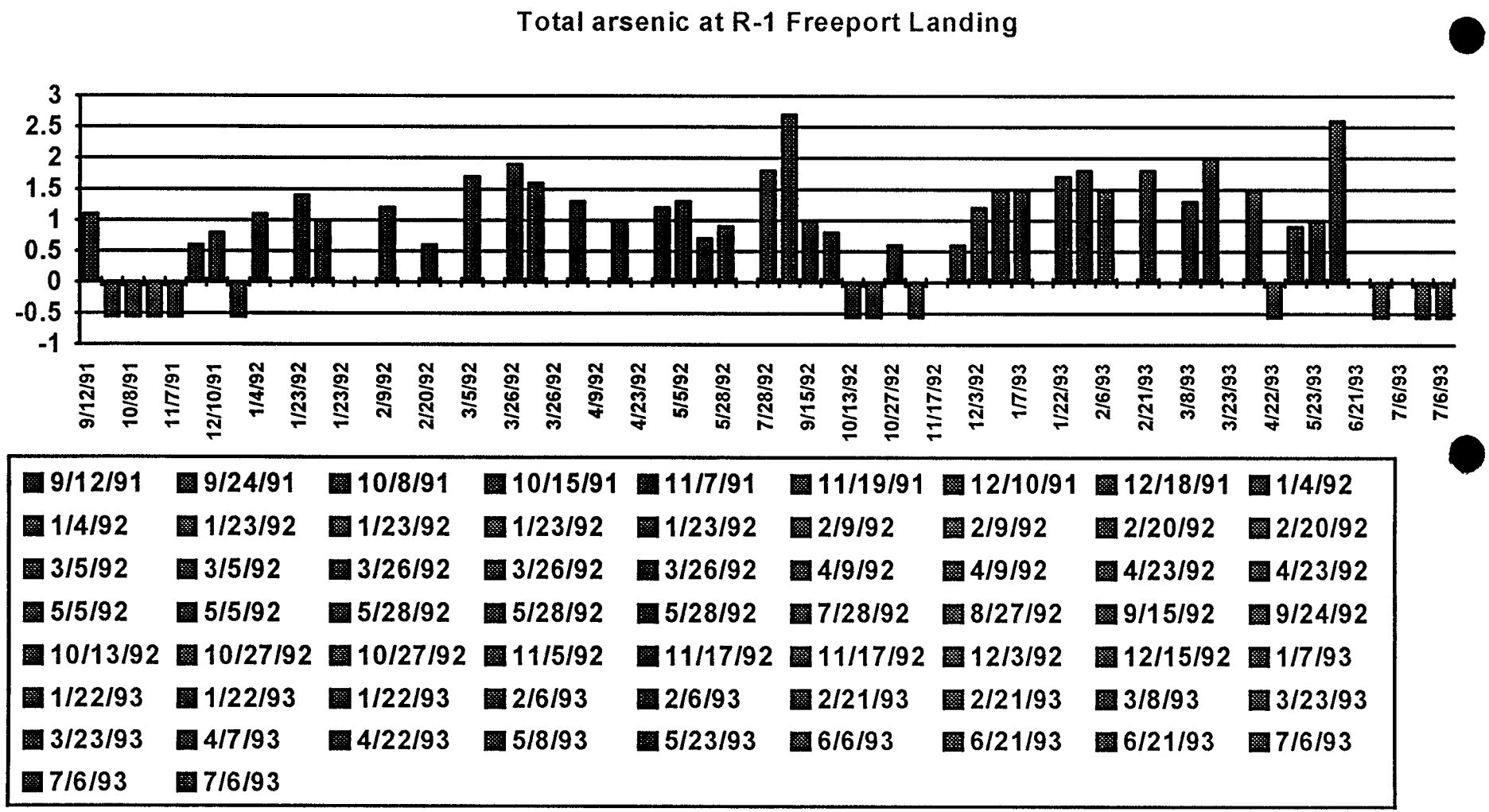


Figure 2A.
East Bay MUD Alternate Source Program
File:EB_GLMRV

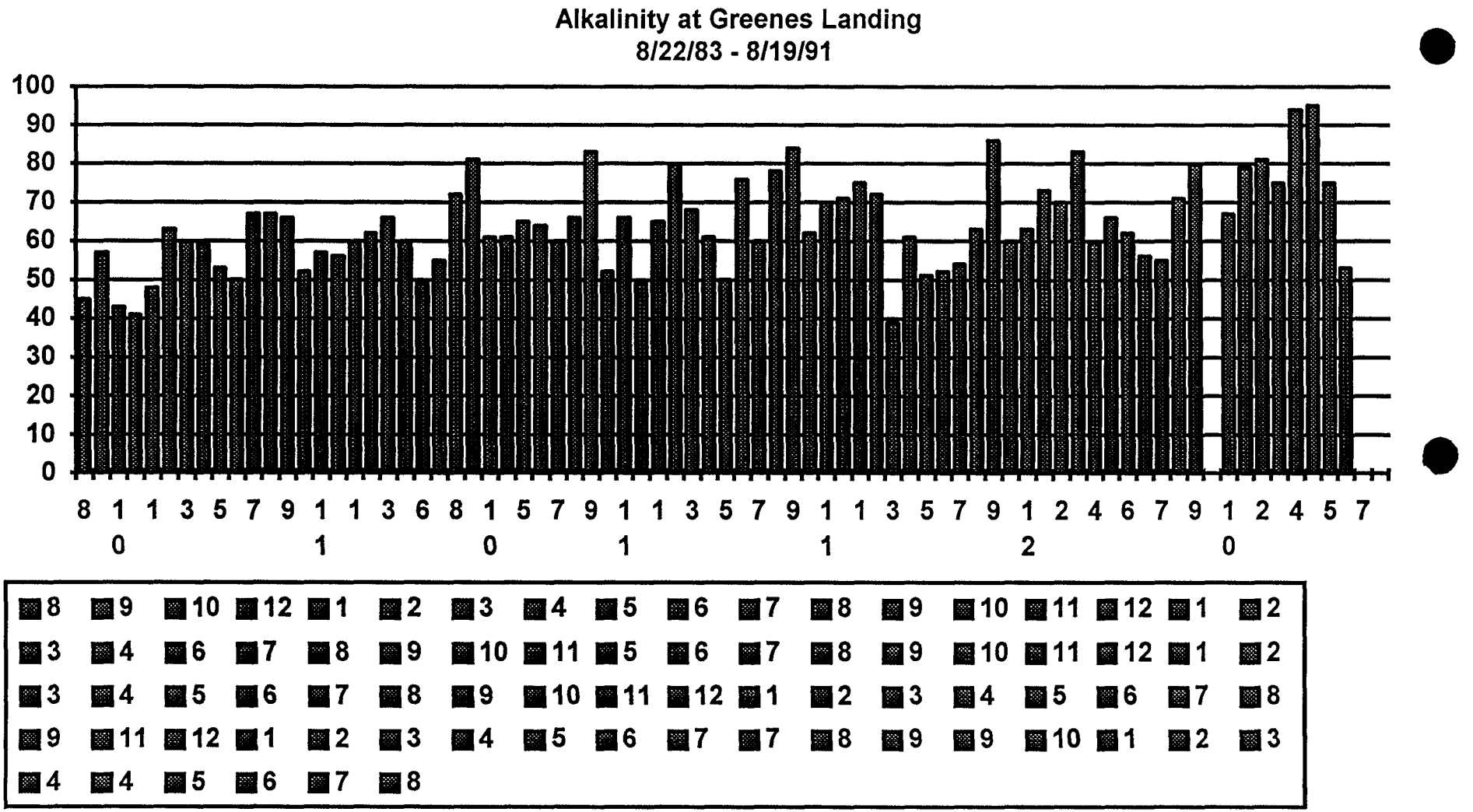


Figure 2B.
East Bay MUD Alternate Source Program
File:EB_GLMRV

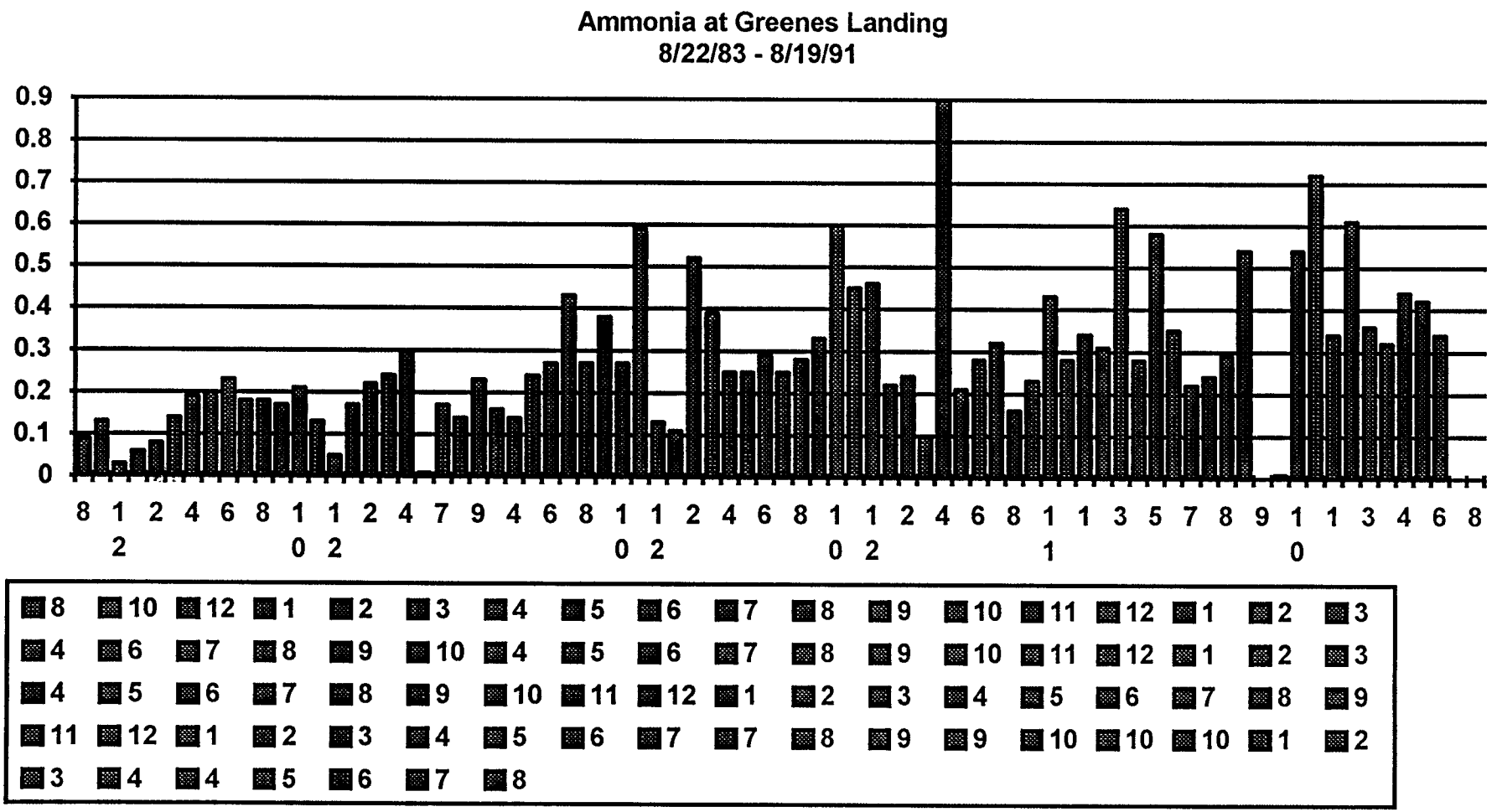
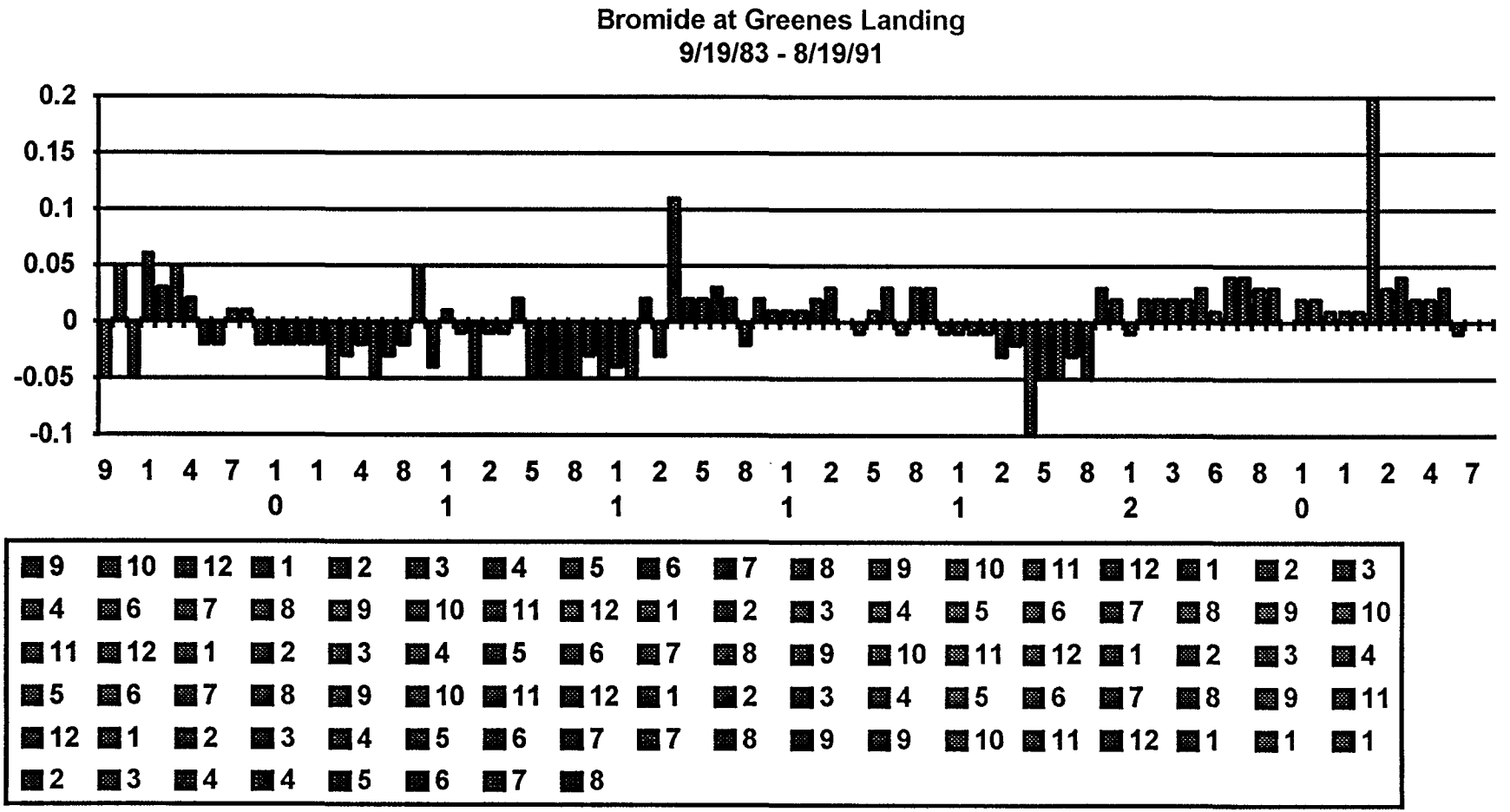


Figure 2C.
East Bay MUD Alternate Source Program
File:EB_GLMRV



Fiigure 2D.
East Bay MUD Alternate Source Porgram
File:EB_GLMRV

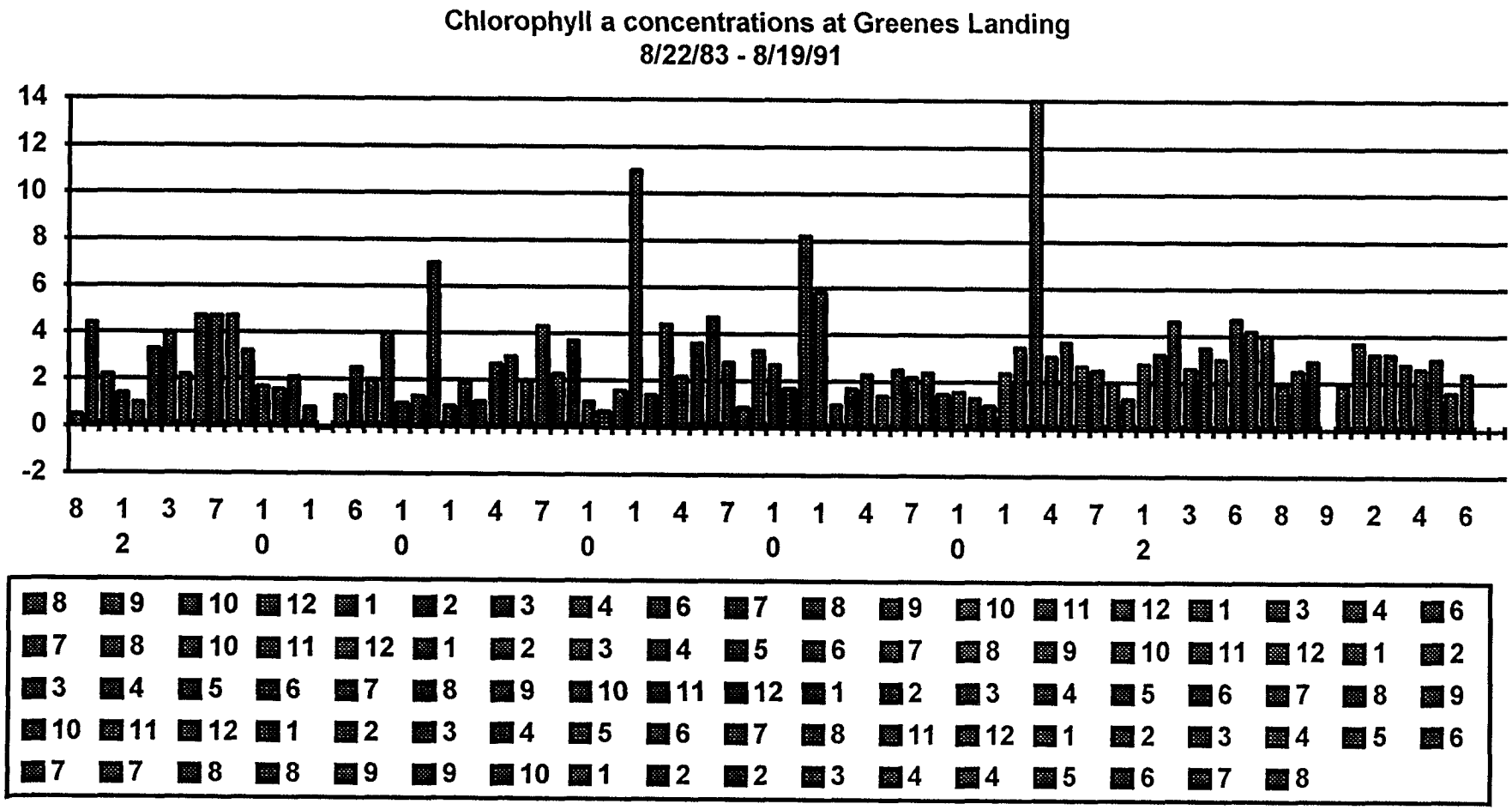


Figure 2E.
East Bay MUD Alternate Source Program
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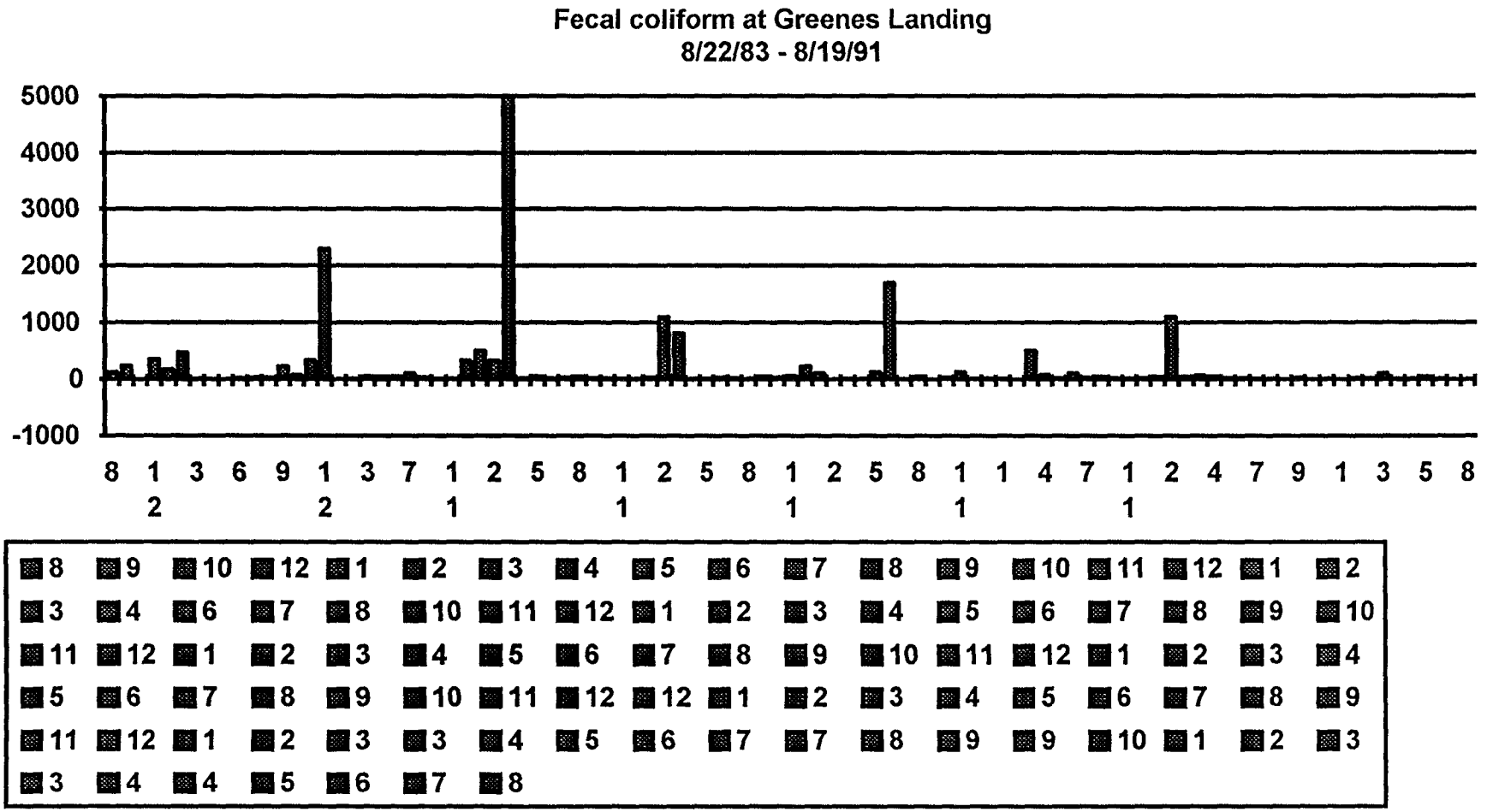

Figure 2F.
East Bay MUD Alternate Source Program
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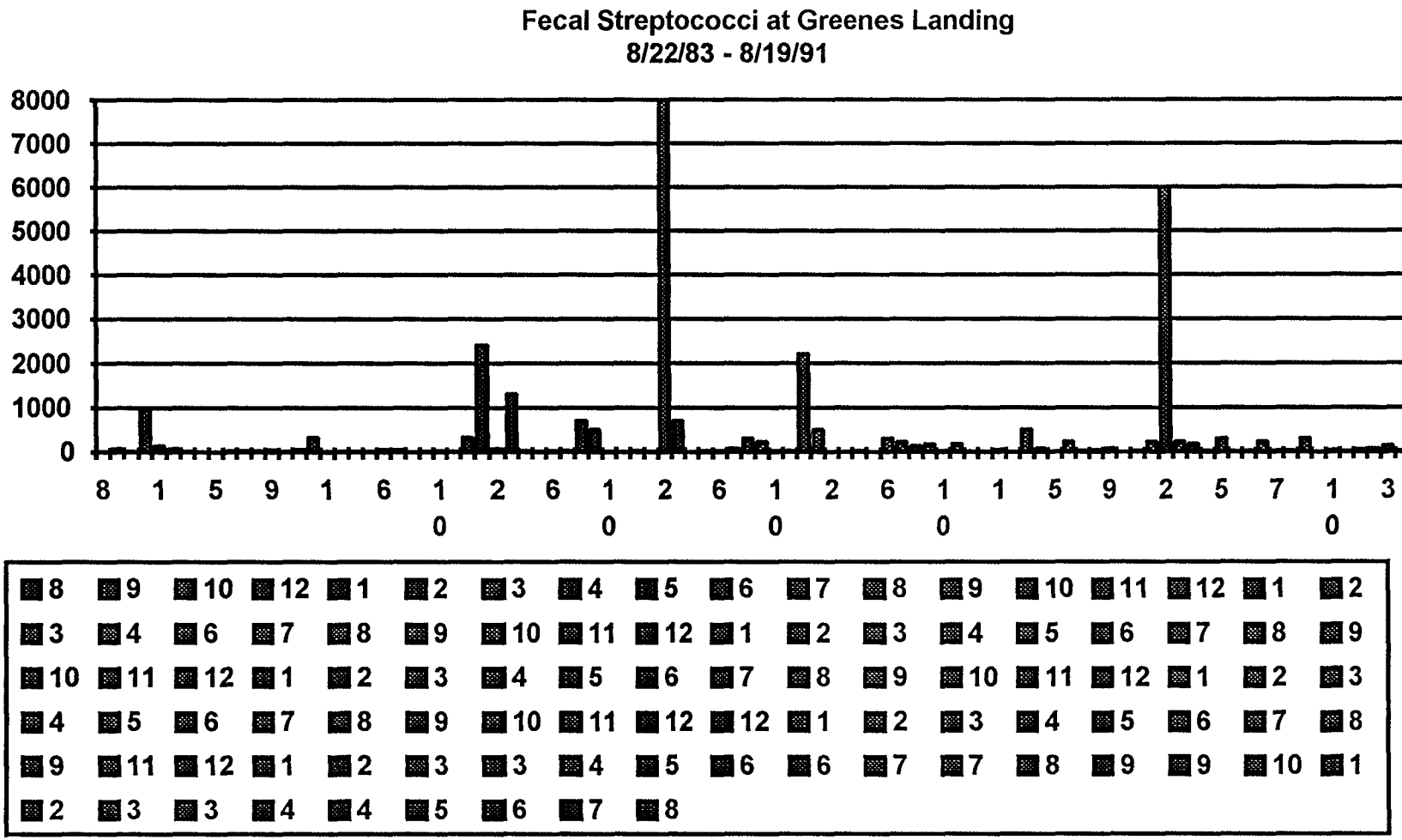

Figure 2G.
East Bay MUD Alternate Source Program
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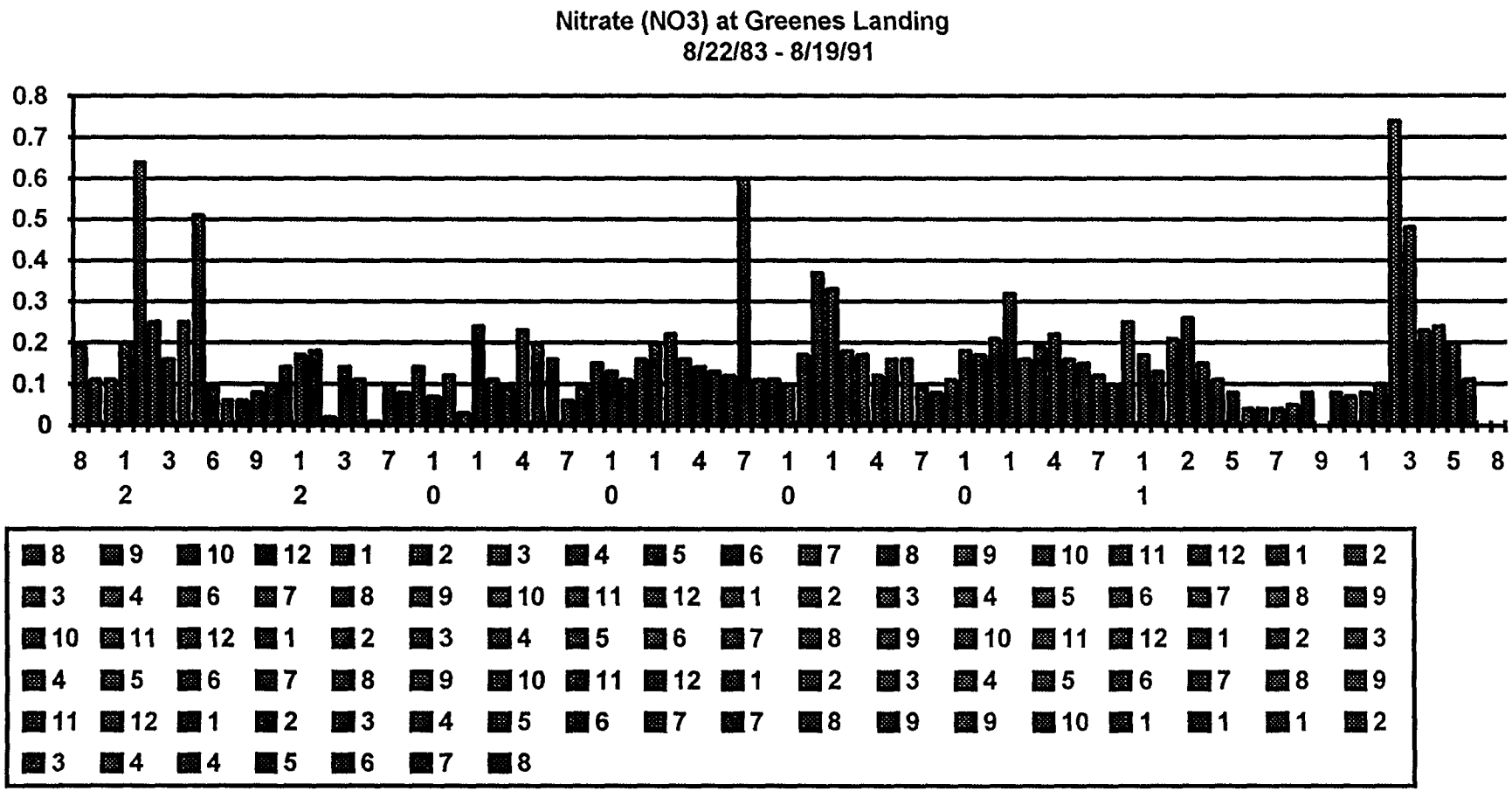

Figure 2H.
East Bay MUD Alternate Source Program
File:EB_GLMRV

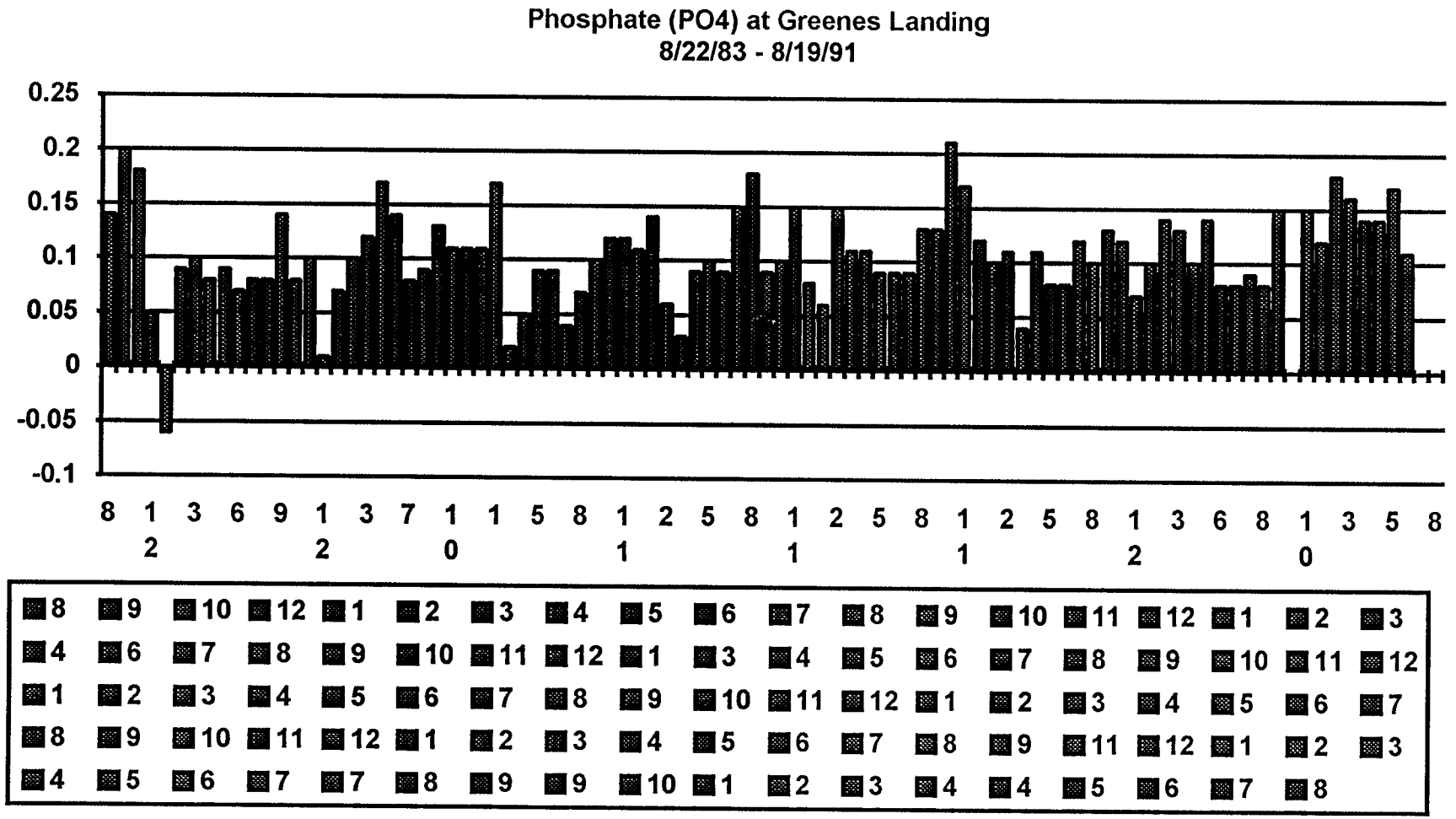

Figure 2I.
East Bay MUD Alternate Source Program
File:EB_GLMRV

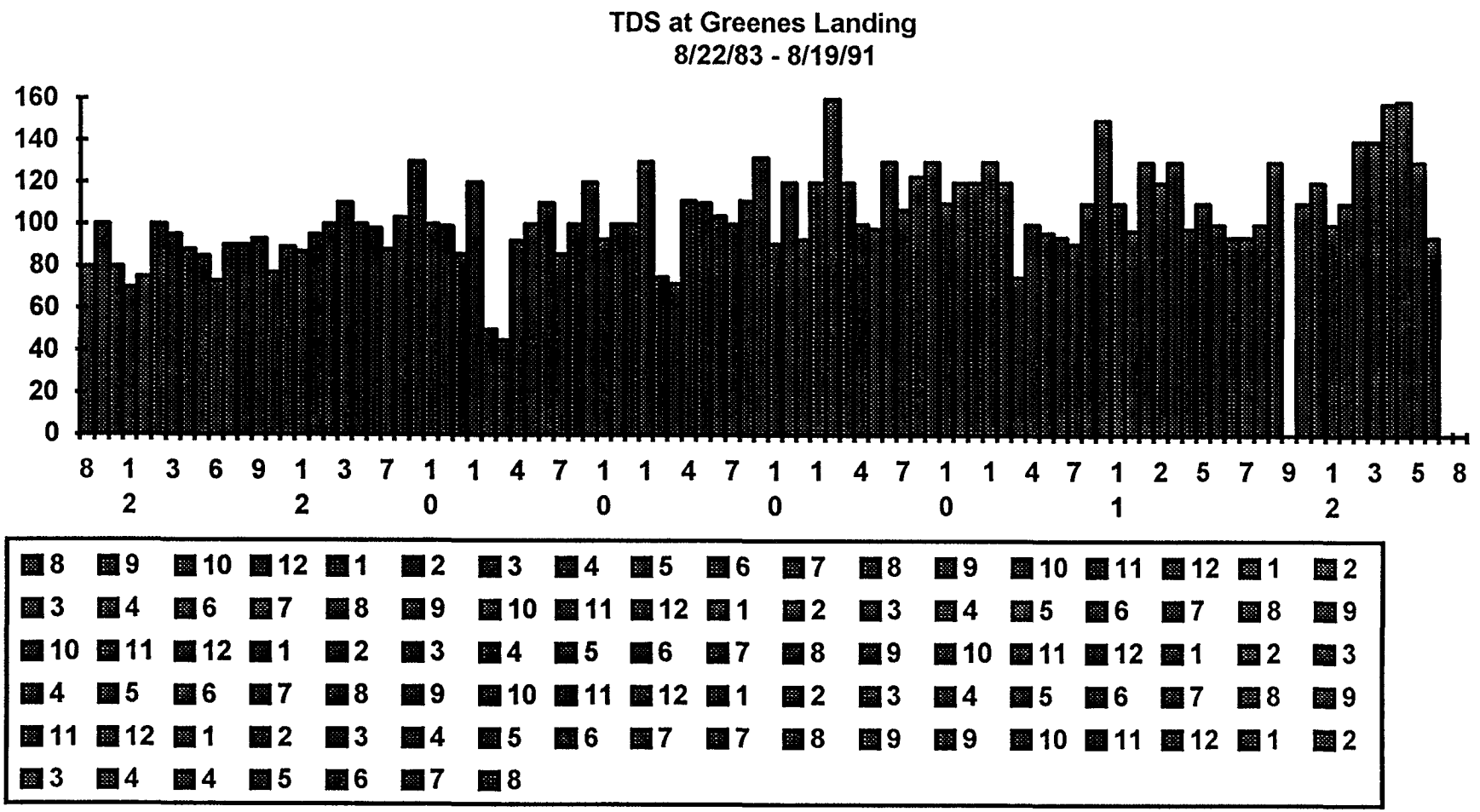

Figure 2J.
East Bay MUD Alternate Source Program
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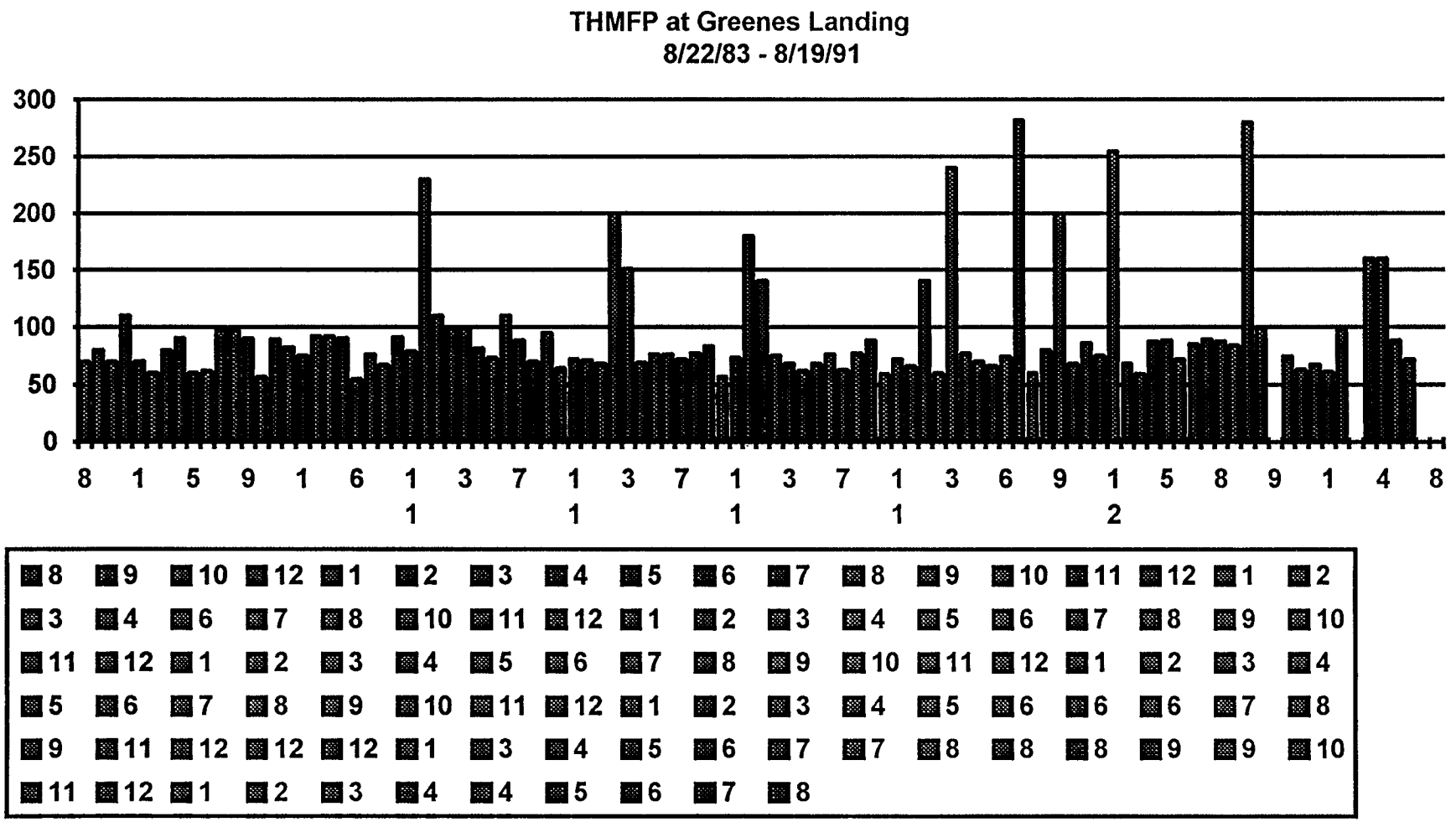

Fig 2K.
East Bay MUD Alternate Source Program
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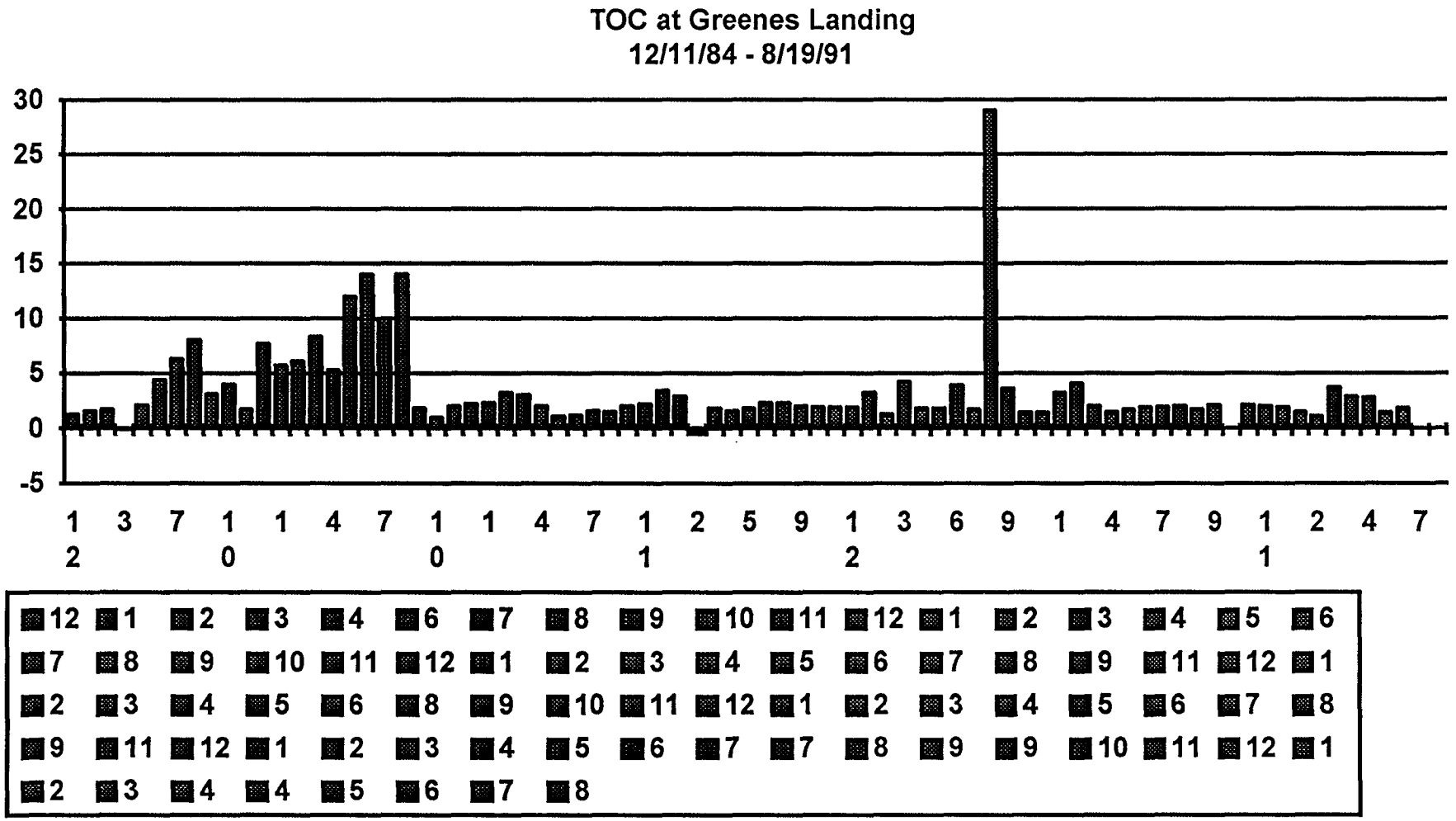

Figure 2L.
East Bay MUD Alternate Source Program
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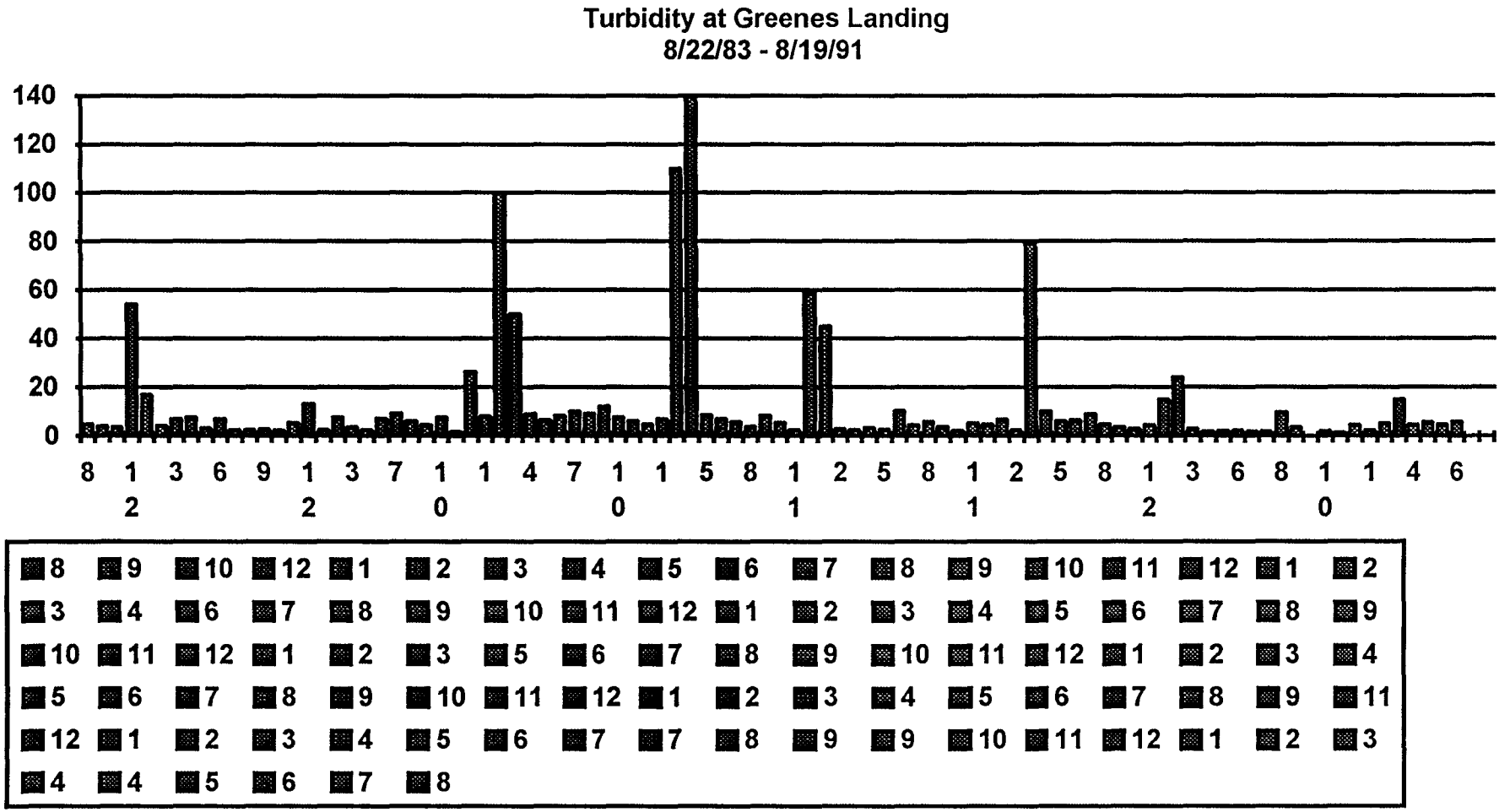

Figure 8A. DWR DAYLO daily flow W.Y. 1983 - 86

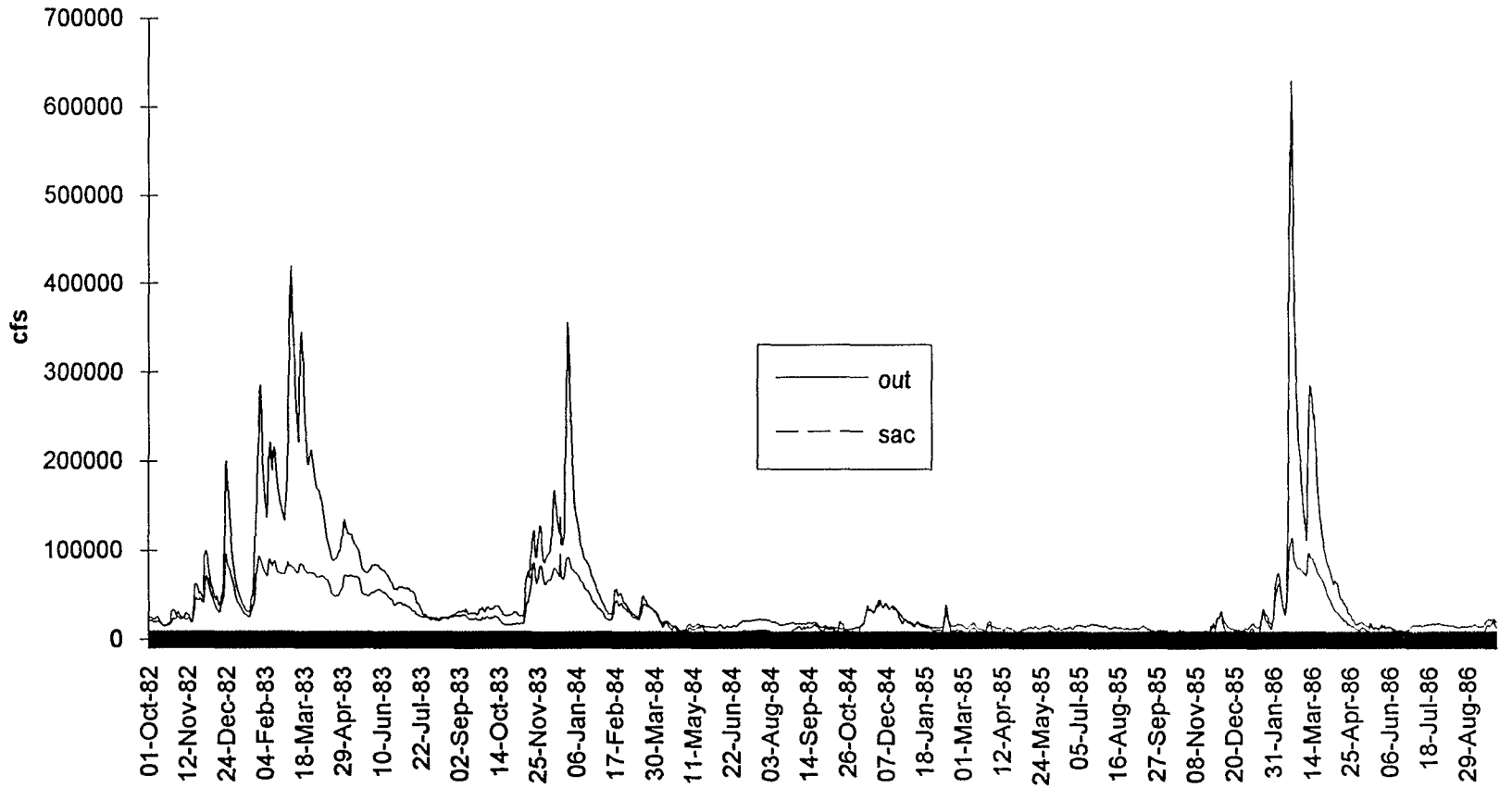

Figure 8B. DWR DAYFLO daily values W.Y. 1987 - 92