SUMMARY OF SALINITY CONDITIONS IN SUISUN MARSH DURING WATER YEARS 1984-1992

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUMMARY OF SALINITY CONDITIONS IN SUISUN MARSH DURING WATER YEARS 1984-1992

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INTRODUCTION

This summary of salinity conditions in Suisun Marsh during water years 1984 - 1992 was prepared by the Department of Water Resources at the request of State Water Quality Control Board staff in support of the 1994 Draft Water Quality Control Program for the San Francisco Bay-Delta. This report includes a brief description of factors affecting salinity in Suisun Marsh during this period and a description of salinity trends, with emphasis on a comparison of conditions in the eastern versus western Marsh, specifically with respect to Decision 1485 standards and Suisun Marsh Preservation Agreement deficiency standards.

FACTORS AFFECTING SALINITY IN THE SUISUN MARSH

Factors affecting salinity in the Suisun Marsh during water years 1984-1992 include the following items and are discussed in the following sections.

- .... Decision 1485: the regulatory framework
- .... Suisun Marsh Preservation Agreement: the contractual framework
- .... Plan of Protection for the Suisun Marsh: facilities planning
- .... Delta Outflow Index and net Delta outflow
- .... Initial facilities operations
- .... Suisun Marsh Salinity Control Gates operation
- .... Creek inflows
- .... Managed wetland operations (private and State owned)
- .... Fairfield-Suisun Treatment Plant effluent inflows
- .... Precipitation/evaporation conditions during the control season
- .... Tidal variations; influence of wind, barometric pressure

Of these factors, facilities planning, the operation of facilities in the Marsh (the SMSCG, Roaring River Distribution System, Morrow Island Distribution System, and Goodyear Slough Outfall), and to an extent, Delta Outflow Index are controlled by DWR and the U.S. Bureau of Reclamation. Operations of the private managed wetlands in the marsh are controlled by 153 individual landowners and the public areas are managed by the California Department of Fish and Game. The ultimate destination and discharge of Fairfield-Suisun Treatment Plant effluent is controlled by Fairfield-Suisun Sewer District and the Solano Irrigation District, although permits are required by the Regional Water Quality Control Board, San Francisco Bay region. Precipitation, runoff, tidal variations, winds, barometric pressure and evaporation are natural factors that affect salinity conditions in the Marsh.

Suisun Marsh standards presented in D-1485, conditions of the SMPA, and specifics of the Plan of Protection are closely related, and were in part developed in conjunction with one another. For example, compliance station locations and implementation schedule in D-1485 and the SMPA reflect the staged planning program presented in the Plan of Protection.

SWRCB DECISION 1485

In 1978, the State Water Resources Control Board issued Water Rights Decision 1485 which set channel water salinity standards for Suisun Marsh from October through May to preserve the area as a brackish water tidal marsh and to provide optimum source water for waterfowl food plant production. Decision 1485 placed operational conditions on the water rights permits for the federal Central Valley Project (CVP) and the State Water Project (SWP), requiring that channel water salinity standards be met. Order 7 of Decision 1485 required the permittees to develop and fully implement a plan, in cooperation with other agencies. Suisun Marsh D-1485 standards were amended in 1985. D-1485 has been the regulatory framework for setting target salinities for Suisun Marsh, consequently affecting observed salinities.

D-1485 Compliance Monitoring Stations and Standards

The locations and effective dates of the compliance monitoring stations as described in Order 7 of D-1485 and amended in 1985, are shown on Figure 1 and listed below.

Station ID	Location	Effective Date
C-2	Sacramento River at Collinsville	October 1, 1988
S-49	Montezuma Slough near Beldons Landing	October 1, 1988
S-64	Montezuma Slough at National Steel	October 1, 1988
S-21	Chadbourne Slough at Chadbourne Road	October 1, 1993
S-97	Cordelia Slough at Ibis Club	October 1, 1993
S-75	Goodyear Slough	October 1, 1994
S-42	Suisun Slough at Volanti Club	October 1, 1997

A summary of station history and types of data collected is presented in Table 2.

With the implementation of D-1485, a salinity standard became effective at Chipps Island. The standard specifies that the maximum 28-day running average of mean daily specific conductance in the Sacramento River water at Chipps Island would remain at or below 12.5 milli-Siemens/cm during the Marsh control season, defined as October 1 through May 31. The standard is increased to 15.6 mS/cm during October through December in dry or critical water dry years when the water project users are taking deficiencies in scheduled water deliveries.

D-1485 also includes minimum Delta Outflow standards from January through May for Suisun Marsh. A minimum mean monthly DOI standard ranges from 6,600 cfs for all months in this

period during all water year types to 10,000 cfs during February through May of wet years (February through April if subnormal snowmelt). During above and below normal water years, a minimum daily DOI of 12,000 cfs is required for 60 consecutive days during January through April.

D-1485 standards for the "interior Marsh" are specified as monthly mean high tide salinity, reported on the last day of each month, and reset on the first day of each subsequent month. Monthly salinity standards vary throughout the Marsh control season as reported in Table 1.

The eastern Suisun Marsh compliance stations C-2, S-49, and S-64 were the first three "interior Marsh" compliance stations to become effective. The Collinsville station is located at the eastern boundary of the Suisun Marsh and provides information on Sacramento River source water to Montezuma Slough and the Suisun Marsh, and stations S-49 and S-64 are on the eastern end of Montezuma Slough. Compliance with salinity standards at these stations was scheduled in the 1985 amendment to D-1485 to coincide with the completion and operation of the Suisun Marsh Salinity Control Gates (Phase 2 of the Plan of Protection).

The northwestern Suisun Marsh compliance stations, S-21 and S-97, became effective on October 1, 1993. Compliance at these stations was scheduled to coincide with the implementation of Phase 3 of the Plan of Protection, identified as the construction of the Boynton-Cordelia Ditch or equivalent action.

The southwestern Suisun Marsh compliance station, S-75, became effective on October 1, 1994. Compliance at this station was scheduled to coincide with the implementation of Phase 4 of the Plan of Protection, identified as the construction of the Cordelia-Goodyear Ditch or equivalent action. In 1994, DWR and USBR petitioned and received approval from the SWRCB to report compliance for S-75 at monitoring station S-35. Salinity compliance in the southwestern Suisun Marsh will be reported at the S-35 monitoring station (Goodyear Slough at the Morrow Island Club) until a suitable action is implemented in the southwestern Marsh.

Other Monitoring Stations

In addition to the SWRCB D-1485 compliance stations, the SWRCB also identified a network of water quality monitoring stations in channels throughout the Suisun Marsh. The monitoring stations and dates of data collection are listed in Table 2 and shown on Figure 1.

SUISUN MARSH PRESERVATION AGREEMENT

In 1987, DWR, USBR, DFG, and SRCD signed the Suisun Marsh Preservation Agreement. The Suisun Marsh Monitoring Agreement and Mitigation Agreement were also signed in 1987, as companion agreements to the SMPA. The SMPA is a comprehensive agreement intended to recognize the impacts on the Marsh of the Central Valley Project, the State Water Project, and a portion of other upstream diversions, as well as to identify actions to mitigate for these impacts to

improve Marsh wildlife habitat. The SMPA was written to implement portions of the Plan of Protection (described in the next section) and is the contractual framework for achieving the objectives of the Plan of Protection, including controlling channel water salinity in Suisun Marsh.

Channel water salinity standards outlined in the SMPA include initial , normal, and deficiency standards. The initial and normal standards are essentially the Marsh Chipps Island, minimum Delta Outflow Index, and interior Marsh standards specified in D-1485. The deficiency standards are not in D-1485 and take into account higher salinity experienced in the Marsh, particularly the western Marsh, during prolonged dry or critically dry conditions. The SMPA normal and deficiency standards are reported in Table 1.

During water years 1984-1992, the SMPA initial standards were in effect. Therefore, interior Marsh salinity standards were specified by D-1485.

STATUS OF THE PLAN OF PROTECTION FOR THE SUISUN MARSH

In response to Order 7 of D-1485, DWR in cooperation with the USBR, DFG, SRCD, and USFWS developed and presented the *Plan of Protection for the Suisun Marsh including Environmental Impact Report* to SWRCB in 1984. The Plan of Protection is a proposal for staged implementation of a combination of activities including physical facilities, monitoring, a wetlands management program for marsh landowners, and supplemental releases of water from CVP and SWP reservoirs. The purpose of staged implementation is to evaluate each implemented action to determine the need for subsequent actions.

DWR staff prepared a "program EIR" for the Plan of Protection in 1984 (State Clearinghouse No 80092322) recognizing the need for staged implementation. The program EIR covers each proposed action and its impacts in varying degrees of detail, based on the best available information at the time of preparation. While planning subsequent phases of the plan, it was intended that the lead agency would prepare supplemental environmental documentation.

Western Suisun Marsh Salinity Control Project

The planning and environmental review process for Phases 3 and 4 were combined as the Western Suisun Marsh Salinity Control Project and initiated in June 1990 because salinity control for both the northwestern and southwestern Marsh are interrelated, and implementation of actions were scheduled only one year apart. In November 1990, the Notice of Intent was published in the Federal Register and the Notice of Preparation was distributed to cooperating and responsible agencies, the State Clearinghouse, and others. A public scoping session was held in Fairfield on December 13, 1990, to receive public input on the scope and issues of the EIS/EIR for the proposed project. During the scoping process, 275 alternatives were identified for salinity control in the western Suisun Marsh. A *Scoping Report for the Proposed Western Suisun Marsh Salinity Control Project* was distributed in August 1991. As part of scoping, alternative actions were screened between September 1991 and October 1992 and a report, *Screening Alternative Actions*

and Describing Remaining Actions for the Proposed WSCP, was distributed in May 1993. Nine individual actions, comprising 18 combined actions, are now being evaluated and will be included in the draft WSCP EIR/EIS.

Western Suisun Marsh Salinity Control Test

DWR and USBR proposed and conducted the 1993-1994 Western Suisun Marsh Salinity Control Test. The WSCT is experimental field work designed to assist in evaluating alternatives of the Western Suisun Marsh Salinity Control Project EIS/EIR. The WSCT will help interpret model results, provide information on the viability of creek flow augmentation as a salinity control measure, and provide information to optimize real time operations to control salinity in this region. The WSCT included proposed creek flow augmentation, as needed during March through May 1994, to control salinity in the western Suisun Marsh, as well as water quality data collection from December 1993 through May 1994. As part of the 1993-1994 WSCT, DWR and USBR received a variance from the SWRCB in meeting salinity standards at compliance stations S-21 and S-97 for the 1994 control season.

During the 1994 control season, flow augmentation was not necessary because natural creek runoff, Delta outflow, and the operation of the Suisun Marsh Salinity Control Gates were sufficient to meet standards at all D-1485 compliance stations in Suisun Marsh. With the exception of the discharge of ten acre-feet on March 8, 1994, to rate the modified spillway at the Cordelia Forebay, no water was discharged into Suisun Marsh as part of the 1994 WSCT.

DWR and USBR are currently conducting the 1994-1995 Western Suisun Marsh Salinity Control Test. This test extends and expands the WSCT conducted from January through May 1994. The test began on September 1, 1994, and will continue through May 31, 1995. From September 1, 1994 through November 14, 1994, North Bay Aqueduct water was released at various flow rates from the Cordelia Forebay into Green Valley Creek to control salinity in the western Marsh. As needed for salinity control, creek flow augmentation will continue throughout the 1994 control season using Lake Berryessa water discharged from the Putah South Canal directly into Green Valley Creek. Another facet of the 1994-1995 WSCT is an extensive water quality monitoring program. Data collection began on September 1, 1994 and will continue throughout the test period.

As part of the 1994-95 WSCT, DWR and USBR received a variance of SWRCB D-1485 salinity standards at compliance stations S-21, S-35, and S-97 for December through May of the 1994-95 control season because of the uncertainty of controlling salinities in western Marsh sloughs with creek flow augmentation; Suisun Marsh Preservation Agreement standards will be met at these stations instead of D-1485 standards. Concurrently, a variance of SWRCB D-1485 standards at compliance monitoring stations S-49, S-64, S-21, S-35, and S-97 has been received for October and November 1994 as part of the adult salmon migration study, a separate unrelated study, developed by DWR and DFG. This salmon migration study is a condition of the USACE permit for SMSCG operations and will be conducted from September through November 1994.

DELTA OUTFLOW INDEX AND NET DELTA OUTFLOW

The Delta Outflow Index is defined as the sum of all flows and precipitation runoff into the Delta minus all agricultural, municipal, and industrial depletions and exports from the Delta. DOI does not reflect daily tidal conditions and is, therefore, an inaccurate estimate of daily net outflow. Net Delta outflow is estimated with simulation models by incorporating daily tidal fluctuations with DOI. DWR and USBR affect the DOI with releases from upstream reservoirs and exports from the Delta, and upstream and in-Delta diverters affect DOI with consumptive use.

Salinity in the Suisun Bay and Marsh is affected by DOI and net Delta Outflow. A significant drop in salinity in the eastern and central Marsh is observed during moderate to high Delta outflows. Very high Delta outflows are required to lower salinities in the southwestern Marsh (as measured at S-35). It is also observed that channel water salinity in the northwestern marsh is not significantly affected by Delta outflow. Field data and simulation modeling indicate that the northwestern marsh (measured at S-97) is primarily affected by lower salinity surface and groundwater inflows from the north and northwest, and by local drainage from managed wetlands.

The DOI is also used, along with snow surveys and runoff predictions, to calculate and project the water year type on an annual basis. In D-1485, the water year classifications are determined by Sacramento Valley unimpaired runoff, in millions of acre-feet, for the current water year. Runoff is calculated as the sum total of runoff from specified locations on the Sacramento, Feather, Yuba, and American rivers. Preliminary classifications are made in February, March and April, and the final determination of water year classification is made in May. Water year classifications include wet, above normal, below normal, dry and critical. The water year classification effects which D-1485 salinity standard is to be met in the Delta and Suisun Marsh (at Chipps Island and minimum DOI).

Water year classifications for water years 1984 through 1992 as defined in Footnote 2 of Table II of SWRCB Decision 1485 and the SMPA are shown below.

Water Year	Runoff (1000's AF)	D-1485	SMPA
1984	22,351	WET	NORMAL
1985	11,041	DRY	NORMAL
1986	25,716	WET	NORMAL
1987	9,202	CRITICAL	NORMAL
1988	9,190	CRITICAL	DEFICIENCY
1989	14,792	DRY	DEFICIENCY
1990	9,232	CRITICAL	DEFICIENCY
1991	8,436	CRITICAL	DEFICIENCY
1992	8,890	CRITICAL	DEFICIENCY

As indicated above, water years 1984 through 1992 were primarily classified as dry or critical. The exceptions to this were water years 1984 and 1986 which were classified as wet. The SMPA provides for deficiency period standards to account for higher salinities observed during prolonged dry and critical conditions. SMPA normal standards are essentially the D-1485 standards (see Table 1).

The water year designations help to explain salinity trends within the Marsh during the control season and provide insight on salinity conditions at the beginning of the following control season. However, the year end classification may not accurately reflect what the salinity conditions were like on a month by month basis during the control season. An example of this is water year 1986 when there was very little precipitation from October through January prior to heavy rainfall in February 1986 resulting in extensive flooding in the Sacramento Valley and a wet year classification.

INITIAL FACILITIES OPERATIONS

The Suisun Marsh initial facilities were completed in 1980 including the Roaring River Distribution System, the Morrow Island Distribution System, and the Goodyear Slough Outfall.

The Roaring River Distribution System was constructed to provide water to State and private managed wetlands on Grizzly Island (eastern Marsh). The distribution system is primarily used during the control season. Water is diverted from Montezuma Slough just north of the Suisun Marsh Salinity Control Gates, but the system is not used for drainage and no water is directly returned to Marsh channels from the distribution system. Consequently, this system has minimal impact on local channel water salinity.

The Morrow Island Distribution System was constructed to provide water to private managed wetlands on Morrow Island (western Marsh adjacent to Goodyear Slough), as well as to collect and discharge drainage water into Grizzly Bay rather than Goodyear Slough. The distribution system is primarily used during the control season. Water is diverted from Goodyear Slough just south of Pierce Harbor when managed wetlands are filling. Water is collected from Morrow Island and discharged into Grizzly Bay and the mouth of Suisun Slough. Consequently, the system helps to lower salinity in Goodyear Slough by rerouting drainage water. Unfortunately, not all private owners use the distribution system for drainage, and continue to drain high salinity water into Goodyear Slough.

The Goodyear Slough Outfall was constructed on the southern end of Goodyear Slough (western Marsh) to provide through flow in Goodyear Slough from north to south and prevent stagnant water conditions on the southern end of Goodyear Slough. The system is used the entire year. Water in Goodyear Slough drains into Suisun Bay near the "mothball fleet" during low tides. Consequently, the outfall lowers channel water salinity in southern Goodyear Slough by removing high salinity drainage water.

SUISUN MARSH SALINITY CONTROL GATE OPERATIONS

The Suisun Marsh Salinity Control Gates were completed and began operating in October 1988. This facility was implemented as Phase II of the Plan of Protection for the Suisun Marsh. The primary objective of the gates is to tidally pump lower salinity water through Montezuma Slough into the central Marsh to help meet D-1485 channel water salinity standards. The SMSCG is essential for maintaining D-1485 standards in the eastern and central Suisun Marsh and lowering salinity in the western Marsh.

When the SMSCG operate, salinity is observed to increase in the Sacramento River near Chipps Island because of the net movement of Sacramento River water into Montezuma Slough. DWR operations has estimated that about 300 cfs of additional DOI is required when the SMSCG are operating to maintain the D-1485 Chipps Island salinity standard.

Salinities at control stations S-49 and S-64 are most directly influenced by operation of the SMSCG, although salinity reductions at S-21 and S -35 can be attributed to gate operations, as well. The proximity to the SMSCG has a direct relationship to the time and magnitude of salinity response seen at compliance stations. When the gates begin operating, it only takes 2-3 days for salinities to decrease at S-64, about a week to influence S-49, 2-3 weeks to reach S-21 and S-42, and about a month to see significant changes at S-35 (These durations are approximate and depend on other factors in the Marsh). Although the S-35 and S-21 stations are a significant distance from the SMSCG, initial salinity reductions are observed soon after SMSCG operations begin. This is thought to be a result of the reduced tidal prism that occurs as a result of gate operation; the high tides cannot move as far into the western Marsh sloughs from Grizzly Bay.

The following is a brief description of SMSCG operations from the time the gates began operating in October 1988 through the 1992 control season. A summary of SMSCG operations is presented in Table 3.

On August 30, 1988, DWR and USBR petitioned the SWRCB to adopt the Suisun Marsh Preservation Agreement channel water salinity standards as interim standards until new water quality standards are established through the Bay-Delta Hearing process. The petition described a program to test the effectiveness of the SMSCG to meet SMPA standards during dry and critically dry years. Because of rain in March 1989, a full control season response for a dry year type was not available and further testing was recommended.

During the 1988-89 control season, the gates were operated for 157 days from October 31, 1988 through April 7, 1989. Operation was "full bore" when possible to test gate operation and help determine the maximum effectiveness of the system to lower channel water salinity in Suisun Marsh. Because of intermittent equipment problems, operations were recorded for 132 of the 157 days. During the recorded period, nearly 480,000 acre-feet of water was tidally pumped past the structure. On a calendar day basis, average flow through the gates during this period was 1,830 cfs.

On December 8, 1989, DWR and USBR submitted another petition to the SWRCB to continue evaluating the effectiveness of the SMSCG to lower channel water salinity throughout the internal channels of the Marsh and to test the SMPA. The State Board approved the petition on January 24, 1994, and authorized testing of the SMSCG through the end of the control season. Two gate tests were performed during this control season. The gates were left open between December 8 and December 16 and were kept closed between December 17 and December 22. The test was conducted to monitor the Marsh's response to possible gate failures and to gather information on gate loss coefficients for model calibration and verification. Another gate test was conducted between July 16, 1990, and September 25, 1990. The test was conducted to observe gate operations and the subsequent impact on channel water salinity with the stoplogs removed from the maintenance channel. Results from testing indicated that channel water salinities were significantly reduced as far as the S-54 monitoring station during the 1989-90 control season. However, results from two years of testing indicated that D-1485 target salinities were not always maintained at western Marsh stations and additional actions would be required.

During the 1989-90 control season, the gates were operated "full bore" when possible to further test and evaluate operations. The gates were operated 248 days between September 26, 1989, and May 31, 1990. During the recorded period, nearly 490,000 acre-feet of water was tidally pumped through the system. On a calendar day basis, average flow through the gates during this period was 1,430 cfs.

During the 1990-91 control season, the salinity control structure was operated intermittently from October through mid-December and "full-bore" during the remainder of the control season. The structure was not operated from November 1, through November 16, 1990, to allow for repairs of a broken shackle on the center gate. Between November 17 and November 20, two gates were operating while repairs were completed on the middle gate. The gate was repaired on November 20 and the gates were operated full bore through November 28. The flashboards were removed from November 28 through December 5 to allow for passage of a barge and dredge for emergency levee repair; however, the gates were still operated during this period. Between December 11 and December 24, 1990, the gates were kept open to help meet the D-1485 standard at Rock Slough. Full bore gate operations began again on December 25, 1990, and continued through the remainder of the control season. The flashboards were removed at the end of the control season on May 31, 1991. The gates remained in the open position until July 17, 1991. From July 18, 1991, through September 16, 1991, the gates were operated without the flashboards on an experimental basis resulting in a measurable reduction in channel water salinity in the Marsh. The gates were closed on September 16, 1991 and remained closed until October 18, 1991. In summary, the gates were operated for 191 days during the 1991 control season.

During the 1991-1992 control season, flashboards were installed and the SMSCG began full bore operation on October 19, 1991. Gate operation was delayed due to material and construction delays in preparing the gates for operation. Full-bore operation continued until December 11, 1991. In an effort to conserve water and minimize potential impacts on winter run salmon, the SMSCG were on a reduced operational schedule from December 13, 1991, through January 9,

1992. The gates were open only four hours a day during the daylight low tide. From January 9, through March 1, 1992, the gates were operated full bore. The gates were closed again between March 1 and March 24, 1992 at the request of the National Marine Fisheries Service. In its biological opinion issued for winter-run salmon, NMFS stated that closure of the control gates would reduce the diversion of juvenile winter-run salmon into the interior Marsh. The document mandated the closure of the gates from March 1 through April 15. However, the document allowed for continued gate operations if all unscreened diversions along Montezuma Slough were temporarily postponed. DFG, DWR, and representatives from SRCD developed a comprehensive surveillance plan to ensure that no unscreened diversions occurred prior to April 15. "Full bore" operations resumed on March 24, 1992 when the Montezuma Slough Diversion Monitoring Program went into effect and continued to the end of May 1992. The flashboards were removed between May 27, 1992 and the gates were fully opened.

CREEK INFLOWS

Several creeks flow directly into the Suisun Marsh including Green Valley, Suisun, Dan Wilson, Ledgewood, McCoy and Denverton. The influence of creek inflows is most significant in the northwestern Marsh. The sloughs in this area are smaller and out of the influence of Delta Outflow or SMSCG operations.

A stage and flow monitoring station on Suisun Creek was established in 1991 and data from this station indicates that while the creek flows year round, the baseflow is minimal (about one cfs). During a significant rainfall event, Suisun Creek responds quickly with significant flow for a short period of time. Green Valley Creek also has minimal flow for the majority of the year and is also a flashy system. The source of baseflow in Green Valley Creek is runoff from land use practices in the developed portion of the watershed and intermittent operational spills from the Putah South Canal. It is estimated that the Green Valley Creek watershed must receive approximately ten inches of rainfall before sustained flow occurs in Green Valley Creek. A stage and flow monitoring station (S-10) was installed on Green Valley Creek in September 1994.

The other creeks into Suisun Marsh are often dry except during the rainy season. Very little data, if any, is available on the inflow from these creeks. There are also several small drainages along the eastern side of Highway 680 which flow under the highway and directly into the western Suisun Marsh during rainfall events.

MANAGED WETLAND OPERATIONS (PRIVATE AND STATE OWNED)

Approximately 52,000 acres (90 percent) of the wetlands in Suisun Marsh are diked, managed wetlands. Diked marshes are seasonally filled and drained with the brackish tides to provide wintering habitat for migratory ducks and geese. The California Department of Fish and Game manages over 8,000 acres while the remaining acres are apportioned into 153 privately owned waterfowl clubs. As defined in the Plan of Protection, each club is required to follow its Individual Ownership Water Management Plans to encourage appropriate wetlands management

on private lands. The Suisun Resource Conservation District has the responsibility to oversee compliance with the water management plans.

The diked marshes are initially filled with the brackish tides in October to attract migratory birds resulting in large volumes of water diverted from the channels. Most of the private ownerships fill during the same period in October (some State and private managed wetlands fill in September with approval from the Solano County Mosquito Abatement District). During this 21 day period, over 55,000 acre-feet of water are diverted out of the channels and onto the seasonal ponds. This results in a net inflow from Grizzly Bay and increased salinity in Marsh sloughs, particularly in the western Marsh. Once the initial fill is completed, the clubs continually circulate water with the tides until January when the clubs are drained at the conclusion of the waterfowl season. Approximately 5 percent of the pond water is circulated at any one time. From February through April, the clubs fill and drain to specified levels to leach salts from the soil. Throughout the control season, the clubs fill during high tide and drain during low tide, avoiding the use of pumps when possible. Data collected by DWR over several years indicates that drain water from the managed wetlands is highly saline and has a significant effect on channel water salinity, especially in the smaller sloughs of the western Marsh.

FAIRFIELD-SUISUN TREATMENT PLANT EFFLUENT INFLOWS

The Fairfield-Suisun Treatment Plant discharges tertiary treated effluent into the Suisun Marsh. The majority of the effluent is discharged into Boynton Slough from late September through March of each year. During these months, a portion of the effluent is diverted directly onto a few privately owned managed wetlands in the vicinity. The treatment plant effluent is a consistent and reliable source of lower salinity water into Boynton Slough during most of the control season. Daily flows average 12 million gallons per day during dry weather with higher average flows during rainy weather. From April 1 through mid-September, most of the effluent is diverted for agricultural irrigation and is not discharged into Boynton Slough.

PRECIPITATION/EVAPORATION CONDITIONS DURING THE CONTROL SEASON

Precipitation and evaporation have been identified as factors that affect salinity in the Suisun Marsh although the resultant channel salinity changes seem to be minimal. No data have been collected to substantiate any direct effects. The greatest effect is thought to be evaporation on the managed wetlands, which concentrates salinity in pond waters that are later returned to channels.

TIDAL VARIATIONS, INFLUENCE OF WIND, AND BAROMETRIC PRESSURE

Tidal variations influence salinity in the Marsh on a daily basis as water is pushed up into the Marsh sloughs during a flood tide and recedes during the ebb tide. The most significant hydrodynamic effects occur during periods of extremely high tides (spring tides) as the tidal prism increases. However, it is observed that channel salinity increases during neap tides when ebb flows are reduced because of higher water levels at low tide. Overall, the effect of tidal

variations is minimal as high and low tides balance out on a monthly, or yearly basis.

Wind and barometric pressure may have a minimal influence on salinity conditions in the Marsh although any effects of these natural factors have not been quantified.

SUISUN MARSH SALINITY CONDITIONS

Suisun Marsh salinity conditions monitored for the period October 1, 1983 through September 30, 1992, are presented in the following sections.

- .... 28-day running average salinity at Chipps Island
- .... Monthly mean high tide salinity at eastern Suisun Marsh compliance stations
- .... Monthly mean high tide salinity at western Suisun Marsh compliance stations
- .... Monthly mean high tide salinity at monitoring station S-42
- .... Frequency of measured salinity above and below D-1485 and SMPA standards

28-DAY RUNNING AVERAGE SALINITY AT CHIPPS ISLAND

The 28-day running average salinity at Chipps Island for the period of interest is presented in Figure 2 (water years 1984-1988) and Figure 3 (water years 1989-1992). The running average is presented for the entire water year and the D-1485 standard lines for 12.5 mS/cm and 15.6 mS/cm are shown when applicable (i.e., the Marsh control season). The 15.6 mS/cm standard was in effect during critical and dry water years 1987-1992. When the 15.6 standard is in effect from October through December, the 12.5 standard begins on January 28 to allow for ramping from the higher to lower standard value. Consequently, a gap is presented in the D-1485 standard line from January 1-27.

For the period of record, salinity at Chipps Island was below the D-1485 standard, except during February and March, 1992, when the 28-day running average salinity exceeded the 12.5 mS/cm standard by less than 2 mS/cm. This exceedence was discussed at a SWRCB hearing, and the SWRCB concluded that no adverse impacts resulted because of its short duration.

MONTHLY MEAN HIGH TIDE SALINITY AT EASTERN MARSH STATIONS

Mean monthly high tide salinity for water years 1984-1994 for eastern Marsh compliance stations C-2, S-64, and S-49 are presented in Figure 4 (two pages). If data are not shown for a station in a particular year, it is because either the station was not established or because the data did not meet QA/QC criteria. The station history presented in Table 2 indicates when stations were established.

Each page of Figure 4 contains six bar charts, one per water year. On each bar chart, mean monthly high tide salinities are presented for up to three stations, one bar per station as indicated

on the legend in the upper left-hand corner of Figure 4. The monthly D-1485 (solid line) and SMPA deficiency (dashed line) standard lines are also shown on each of the six bar charts per page. When data are available for a given year, salinity at the three eastern Marsh compliance stations can be compared month by month with respect to the respective D-1485 and SMPA deficiency standards. Water years when deficiency standards could have been in effect are reported in the table shown in the section above, Delta Outflow Index and Net Delta Outflow.

The SMSCG began operating on October 31 of water year 1989. After gate operation began and D-1485 interior Marsh standards became effective in water year 1989, salinity at the eastern Marsh stations were generally below D-1485 and always below SMPA deficiency standards. A summary of months when eastern Marsh salinity was higher than D-1485 and/or SMPA deficiency target salinities is presented in Table 4. **It is noted that except for water year 1992 when S-49 salinity exceeded the D-1485 standard, all other occurrences were during times when the SWRCB had authorized variances to salinity standards.**

Comparing S-49 salinities during water years 1988 (pre SMSCG) and 1989 (post SMSCG), the effectiveness of SMSCG operations on reducing salinity in the eastern and central Marsh is apparent.

MONTHLY MEAN HIGH TIDE SALINITY AT WESTERN MARSH STATIONS

Mean monthly high tide salinity for water years 1984-1994 for western Marsh compliance stations S-21, S-97, and S-35 are presented in Figure 5 (two pages). If data are not shown for a station in a particular year, it is because either the station was not established or because the data did not meet QA/QC criteria. The station history presented in Table 2 indicates when stations were established. Also, data for station S-33 is used to provide a better history of salinity in Cordelia Slough near S-97 because station S-97 was not established until water year 1991.

Each page of Figure 5 contains six bar charts, one per water year. On each bar chart, mean monthly high tide salinities are presented for up to three stations, one bar per station as indicated on the legend in the upper left-hand corner of Figure 5. The monthly D-1485 (solid line) and SMPA deficiency (dashed line) standard lines are also shown on each of the six bar charts per page. When data are available for a given year, salinities at the three western Marsh compliance stations can be compared month by month with respect to the respective D-1485 and SMPA deficiency standards. Water years when deficiency standards could have been in effect are reported in the table shown in the section above, Delta Outflow Index and Net Delta Outflow.

Salinities at the western Marsh stations were generally below D-1485 and SMPA deficiency standards in wetter water years or water years following wet periods, such as 1985, 1986, 1987, and 1994. However, during prolonged dry or critically dry periods, salinity in the western Marsh is often above D-1485 standards and even SMPA deficiency standards. A summary of months when western Marsh salinity was higher than D-1485 and/or SMPA deficiency target salinities is presented in Table 5. **During this period, however, D-1485 was not in effect at western**

Marsh stations.

It is important to note that during this period, D-1485 and SMPA standards were met in the eastern Marsh, but salinities in the western Marsh were much higher and often above target salinities evident of the salinity gradient existing across Suisun Bay.

MONTHLY MEAN HIGH TIDE SALINITY AT STATION S-42

Mean monthly high tide salinities for water years 1984-1994 for stations S-42, S-21, and S-49 are presented in Figure 6 (two pages). If data are not shown for a station in a particular year, it is because either the station was not established or because the data did not meet QA/QC criteria. The station history presented in Table 2 indicates when stations were established.

Each page of Figure 6 contains six bar charts, one per water year. On each bar chart, mean monthly high tide salinities are presented for up to three stations, one bar per station as indicated on the legend in the upper left-hand corner of Figure 6. The monthly D-1485 (solid line) and SMPA deficiency (dashed line) standard lines are also shown on each of the six bar charts per page. When data are available for a given year, salinities at stations S-42, S-21, and S-49 can be compared month by month with respect to the respective D-1485 and SMPA deficiency standards. Water years when deficiency standards could have been in effect are reported in the table shown in the section above, Delta Outflow Index and Net Delta Outflow.

Salinity at S-42 was plotted against data from S-49 (eastern/central Marsh) and S-21 (northwestern Marsh) to determine if salinity trends at S-42 tracks more closely with the eastern or western Marsh. Since SMSCG operations in water year 1989, salinity at S-42 tracked closely with salinity at S-21, and was usually higher than S-49. Based on this comparison, it is concluded that station S-42 is representative of salinity conditions is the western Marsh.

FREQUENCY OF SALINITY ABOVE AND BELOW D-1485 AND SMPA TARGETS

The number of monthly occurrences of salinities above the D-1485 and SMPA target salinities are reported in Tables 4 and 5 and were discussed in the prior section. However, that tabulation fails to present information on how often and to what extent salinity at a particular station was either above or below the D-1485 and SMPA target salinities. Frequency-area plots were prepared for each Marsh compliance station and several monitoring stations to present an overall history of salinity with respect to the target standards. These plots are presented in Figures 7 through 15. Each figure is for one station and includes two plots, one for comparison with D-1485 standards (top plot) and one for comparison with the SMPA standards (bottom plot).

To prepare the frequency-area plots for each location, the D-1485 and appropriate SMPA (normal or deficiency) standards were subtracted from the respective mean monthly high tide salinity for the control season. The differences were then assigned to every day of the month and sorted from the largest positive difference (above the target standard) to the greatest negative

difference (below the target standard). The sorted differences were then normalized from 1 to 100 percent and plotted.

The areas above and below the zero line were calculated to indicate the relative "occurrence" (i.e., duration and extent) of salinity below and above the target standard. These areas are reported on Figures 7-15.

The areas for eastern Marsh compliance stations C-2, S-64, and S-49 below the target standard are significantly larger than the areas above. The areas for western Marsh compliance stations below and above the target standard are either evenly balanced or greater above the target standards. For western stations, the area below the SMPA target is significantly greater than the area below the D-1485 target.

Table 1: SWRCB D-1485 and Suisun Marsh Preservation Agreement Salinity Standards

Mean Monthly High Tide Electrical Conductivity (mmhos/cm)			
Month	D1485 Standards	SMPA Normal	SMPA Deficiency
October	19.0	19.0	19.0
November	15.5	16.5	16.5
December	15.5	15.5	15.6
January	12.5	12.5	15.6
February	8.0	8.0	15.6
March	8.0	8.0	15.6
April	11.0	11.0	14.0
May	11.0	11.0	12.5

SMPA - Suisun Marsh Preservation Agreement

TABLE 2

Suisun Marsh Compliance and Monitoring Stations

Station No.	Name	Start date	End date	Data type
C-2	Collinsville	5/13/85		STG & EC
S04	Suisun Slough @ Mouth	1/26/82		EC
S-10	Green Valley Creek @ Green Valley Rd	9/21/94		STG
S-15	Sunrise Creek @ Cordelia Road	3/1/91		Flow
S-21	Sunrise Club @ Chadbourne Slough	2/1/89		*STG & *EC
S-28	Frank Horan @ Teal	10/1/81		EC
S-33	Cordelia Slough @ Cygnus	1/20/83		STG & EC
S-35	Goodyear Slough @ Morrow Island	3/15/83		STG & EC
S-36	Godfather	2/16/83	7/15/87	EC & STG
S-40	Boynton Slough @ Bullsprig Club	2/1/92		EC & STG
S-42	Sunrise Club @ Volanti Slough	1/20/83		STG & EC
S-49	Montezuma Slough @ Beldons	1/13/83		*STG & *EC
S-54	Montezuma Slough @ Hunter Cut	12/7/82		STG & EC
S-64	Montezuma Slough @ National Steel	1/21/83		STG & EC
S-71	Montezuma Slough @ Roaring River	7/15/85		*STG & *EC
S-72	Roaring River @ Montezuma Slough	7/23/85		*STG & *EC
S-90	Roaring River @ Sprig Club	10/1/82		EC
S-97	Cordelia Slough @ Ibis	12/1/90		*STG & *EC

Note:

* = Telemetered by radio

TABLE 3

SMSCG SCHEDULE FOR YEARS 1988-1992

YEAR	FROM	TO	STOPLOGS		GATE		REMARKS
				1	2	3	
1988/89	NOV. 1	APR. 7	IN	Op	Op	Op	Operate Full Bore
1989	APR.7	SEPT.26	OUT	O	O	O	Held Open
1989	SEPT. 26	DEC. 8	IN	Op	Op	Op	Operate Full Bore
1989	DEC. 8	DEC. 15	IN	O	O	O	Held Open for Gate Test #5
1989	DEC. 17	DEC. 22	IN	C	C	C	Closed for Gate Test #5
1989/90	DEC.22	MAY.31	IN	Op	Op	Op	Operate Full Bore
1990	MAY.31	JUL. 15	OUT	O	O	O	Held Open
1990	JUL. 16	SEPT. 27	OUT	Op	Op	Op	Gate Test #1
1990	SEPT.28	SEPT.30	IN	Op	Op	Op	Operate Full Bore
1990	OCT. 1	OCT. 30	IN	Op	Op	Op	Operating Daylight Hours Only
1990		22:45					
1990	OCT. 30	NOV. 16	IN	C	C	C	MIDDLE GATE BROKEN
1990	22:45	15:30					
1990	NOV. 16	NOV. 20	IN	Op	C	Op	MIDDLE GATE BROKEN
1990	NOV.20	NOV.28	IN	Op	Op	Op	Operate Full Bore
1990	NOV.28	DEC.5	OUT	Op	Op	Op	Remove stop logs to pass barge
1990	DEC.5	DEC. 10	IN	Op	Op	Op	Operate Full Bore
1990	DEC. 11	DEC. 24	IN	O	O	O	Rock Slough Standard
1990/91	DEC. 25	MAY. 30	IN	Op	Op	Op	Operate Full Bore
1991	MAY.31	JUL. 17	OUT	O	O	O	Held Open
1991	JUL. 18	SEPT. 16	OUT	Op	Op	Op	Gate Testing #2
1991	SEPT. 16	OCT.18	OUT	C	C	C	Maintenance work
1991	12:00 (noon)						
1991	OCT.18	DEC.11	IN	Op	Op	Op	Operate Full Bore
1991/92	DEC.12	JAN.9	IN	Op	Op	Op	Daylight operations for WR Salmon
1992	JAN.9	MAR.1	IN	Op	Op	Op	Operate Full Bore
1992	MAR.1	MAR.24	IN	C	C	C	Winter Run Salmon
1992	MAR.24	MAY.27	IN	Op	Op	Op	Operate Full Bore
1992	MAY.27	OCT. 1	OUT	O	O	O	Held Open
1992	OCT.1	OCT. 5	IN	Op	Op	Op	Operate with 1/3 Partial Opening
1992	OCT. 6	OCT. 8	IN	Op	Op	Op	Operate with 2/3 Partial Opening
1992	OCT. 9	OCT. 14	IN	Op	Op	Op	Full Bore
1992	OCT. 15	OCT. 18	IN	Op	Op	Op	Operate with 1/3 Partial Opening
1992	OCT. 19	OCT. 26	IN	Op	Op	Op	Operate with 2/3 Partial Opening
1992	OCT. 27	OCT. 27	IN	Op	Op	Op	Operate with 1/3 Partial Opening
1992	OCT. 28	OCT. 31	IN	Op	Op	Op	Gates Oper. Manually b/c AVM Broken
1992	NOV. 1	NOV. 2	IN	Op	Op	Op	Operate with 1/3 Partial Opening
1992	NOV. 3	NOV. 8	IN	Op	Op	Op	Operate Full Bore
1992/93	NOV. 9	JAN. 4	IN	Op	Op	Op	Operate with 1/3 Partial Opening

LEGEND:

C = closed

O = Open

Op = Operating

DWR Suisun Marsh Planning

11/28/94

Table 4: Eastern Marsh Stations Above Target Salinities

Station	Month	Year	End of Month (PDM)	D-1485 Standard	SMPA Deficiency
			(Sp. Conductance in milliSiemens/centimenter)		
C-2	February	1989	10.25 *	8.0	15.6
C-2	February	1991	11.04	8.0	15.6
S-64	February	1989	8.43 *	8.0	15.6
S-64	February	1991	9.47	8.0	15.6
S-49	November	1987	19.04 *	15.5	16.5
S-49	December	1987	16.93 *	15.5	15.6
S-49	February	1988	9.80 *	8.0	15.6
S-49	February	1989	9.51 *	8.0	15.6
S-49	November	1990	15.60	15.5	16.5
S-49	January	1991	12.58	12.5	15.6
S-49	February	1991	10.08	8.0	15.6
Total months higher than target :				**11**	**2**

*The SWRCB authorized variances to salinity standards during this period to test the SMPA and evaluate the effectiveness of the SMSCG.

Table 5: Western Marsh Stations Above Target Salinities

Station	Month	Year	End of Month (PDM)	D-1485 Standard	SMPA Deficiency
			(Sp. Conductance in milliSiemens/centimenter)		
S-21	November	1990	17.28	15.5	16.5
S-21	December	1990	15.8	15.5	15.6
S-21	January	1991	14.67	12.5	15.6
S-21	February	1991	12.13	8	15.6
S-42	May	1987	11.66	11	12.5
S-42	November	1987	18.61	15.5	16.5
S-42	December	1987	15.74	15.5	15.6
S-42	February	1988	9.2	8	15.6
S-42	April	1988	13.31	11	14
S-42	May	1988	11.77	11	12.5
S-42	February	1989	11.29	8	15.6
S-42	January	1991	14.73	12.5	15.6
S-42	February	1991	11.85	8	15.6
S-42	February	1992	8.24	8	15.6
S-33 /1	November	1985	18.41	15.5	16.5
S-33 /1	November	1987	18.49	15.5	16.5
S-33 /1	March	1988	15.85	8	15.6
S-33 /1	April	1988	12.95	11	14
S-33 /1	May	1988	12.34	11	12.5
S-33 /1	October	1988	19.39	19	19
S-33 /1	November	1988	18.43	15.5	16.5
S-33 /1	January	1989	13.5	12.5	15.6
S-33 /1	February	1989	14.67	8	15.6
S-33 /1	February	1990	10.14	8	15.6
S-33 /1	March	1990	10.72	8	15.6
S-33 /1	April	1990	13.32	11	14
S-33 /1	May	1990	13.84	11	12.5
S-97	December	1990	19.53	15.5	15.6
S-97	January	1991	18.7	12.5	15.6
S-97	February	1991	16.01	8	15.6
S-97	March	1991	10.57	8	15.6
S-97	May	1991	12.95	11	12.5
S-97	November	1991	18.44	15.5	16.5
S-97	December	1991	18.79	15.5	15.6
S-97	January	1992	16.49	12.5	15.6
S-97	February	1992	11.55	8	15.6
S-97	May	1992	12.19	11	12.5
S-35	April	1985	11.23	11	14
S-35	February	1987	9.11	8	15.6
S-35	November	1987	18.39	15.5	16.5
S-35	February	1988	10.7	8	15.6
S-35	March	1988	15.4	8	15.6
S-35	October	1988	20.16	19	19
S-35	December	1988	16.22	15.5	15.6
S-35	January	1989	14.23	12.5	15.6
S-35	February	1989	15.9	8	15.6
S-35	December	1989	15.78	15.5	15.6
S-35	February	1990	10.16	8	15.6
S-35	March	1990	10.75	8	15.6
S-35	April	1990	12.86	11	14
S-35	May	1990	14.37	11	12.5
S-35	October	1990	19.95	19	19
S-35	November	1990	19.72	15.5	16.5
S-35	December	1990	18.89	15.5	15.6
S-35	January	1991	17.97	12.5	15.6
S-35	February	1991	16.36	8	15.6
S-35	March	1991	9.5	8	15.6
S-35	May	1991	13.85	11	12.5
S-35	November	1991	17.51	15.5	15.6
S-35	December	1991	17.78	15.5	15.6
S-35	January	1992	16.1	12.5	15.6
S-35	February	1992	11.67	8	15.6
S-35	May	1992	13.39	11	12.5
Total months higher than target:				**63**	**31**

1/ S-33 data used for S-97 control station

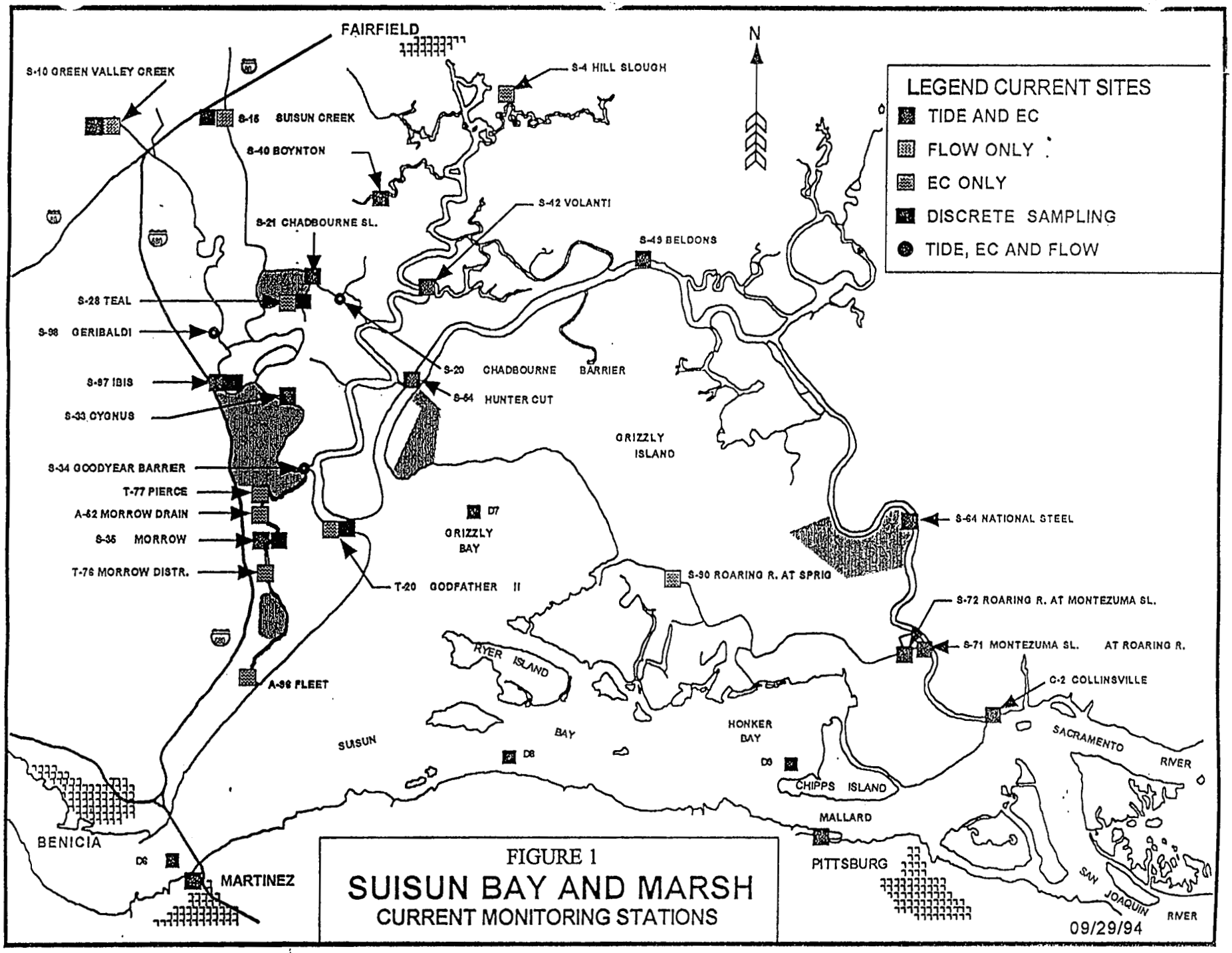

FAIRFIELD
S-10 GREEN VALLEY CREEK
S-16 SUISUN CREEK
S-40 BOYNTON
S-4 HILL SLOUGH
S-42 VOLANTI
S-21 CHADBOURNE SL.
S-49 BELDONS
S-28 TEAL
S-98 GERIBALDI
S-97 IBIS
S-33 CYGNUS
S-34 GOODYEAR BARRIER
T-77 PIERCE
A-82 MORROW DRAIN
S-35 MORROW
T-76 MORROW DISTR.
A-96 FLEET
S-20 CHADBOURNE BARRIER
S-64 HUNTER CUT
GRIZZLY ISLAND
D7
GRIZZLY BAY
T-20 GODFATHER II
S-64 NATIONAL STEEL
S-90 ROARING R. AT SPRIG
S-72 ROARING R. AT MONTEZUMA SL.
S-71 MONTEZUMA SL. AT ROARING R.
C-2 COLLINSVILLE
RYER ISLAND
SUISUN BAY
D8
HONKER BAY
D6
CHIPPS ISLAND
MALLARD
SACRAMENTO RIVER
SAN JOAQUIN RIVER
PITTSBURG
BENICIA
D6
MARTINEZ
N
LEGEND CURRENT SITES
TIDE AND EC
FLOW ONLY
EC ONLY
DISCRETE SAMPLING
TIDE, EC AND FLOW
FIGURE 1
SUISUN BAY AND MARSH
CURRENT MONITORING STATIONS
09/29/94

FIGURE 2

Chipps Island 28-Day Running Average Specific Conductance For Water Years 1984-88

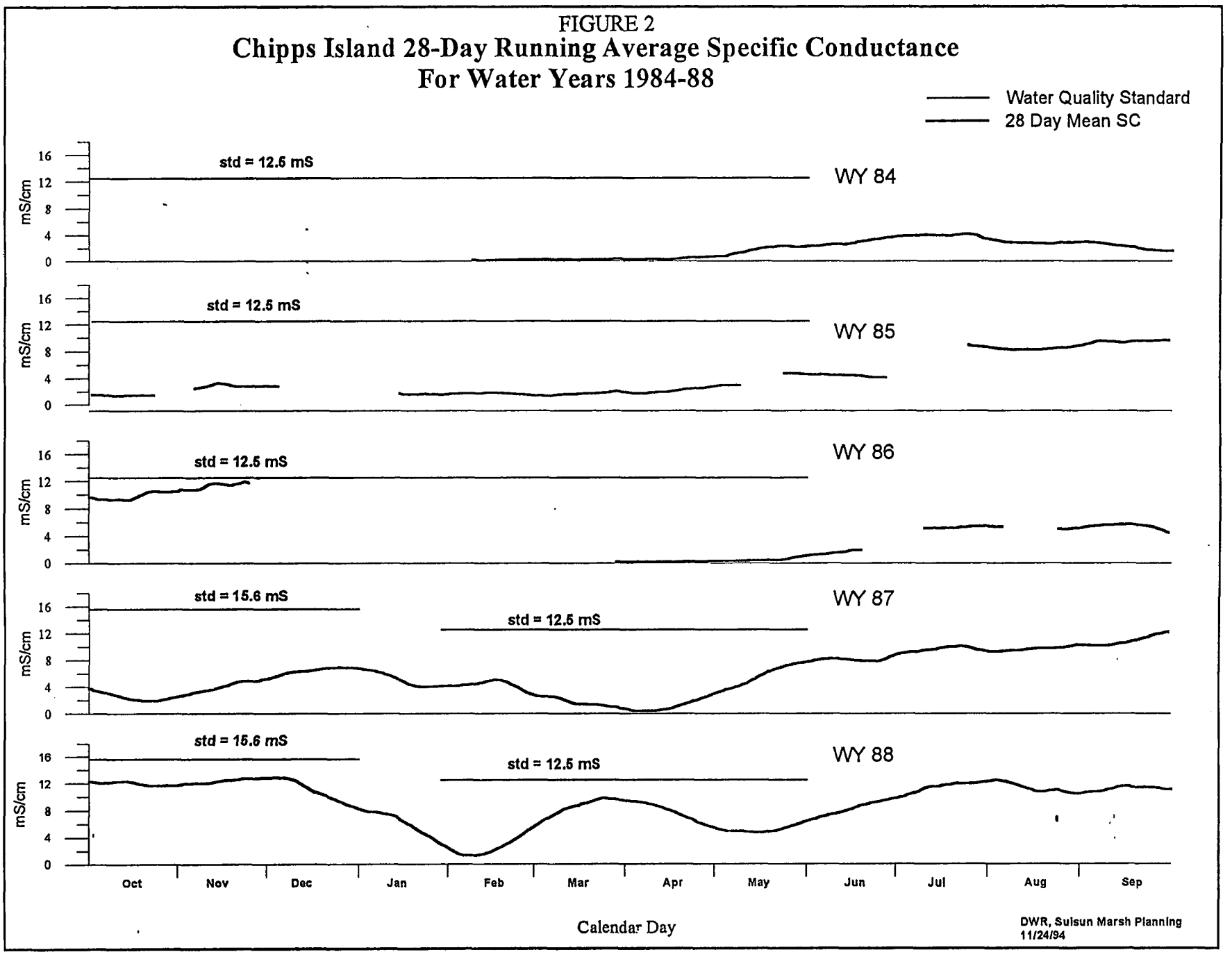
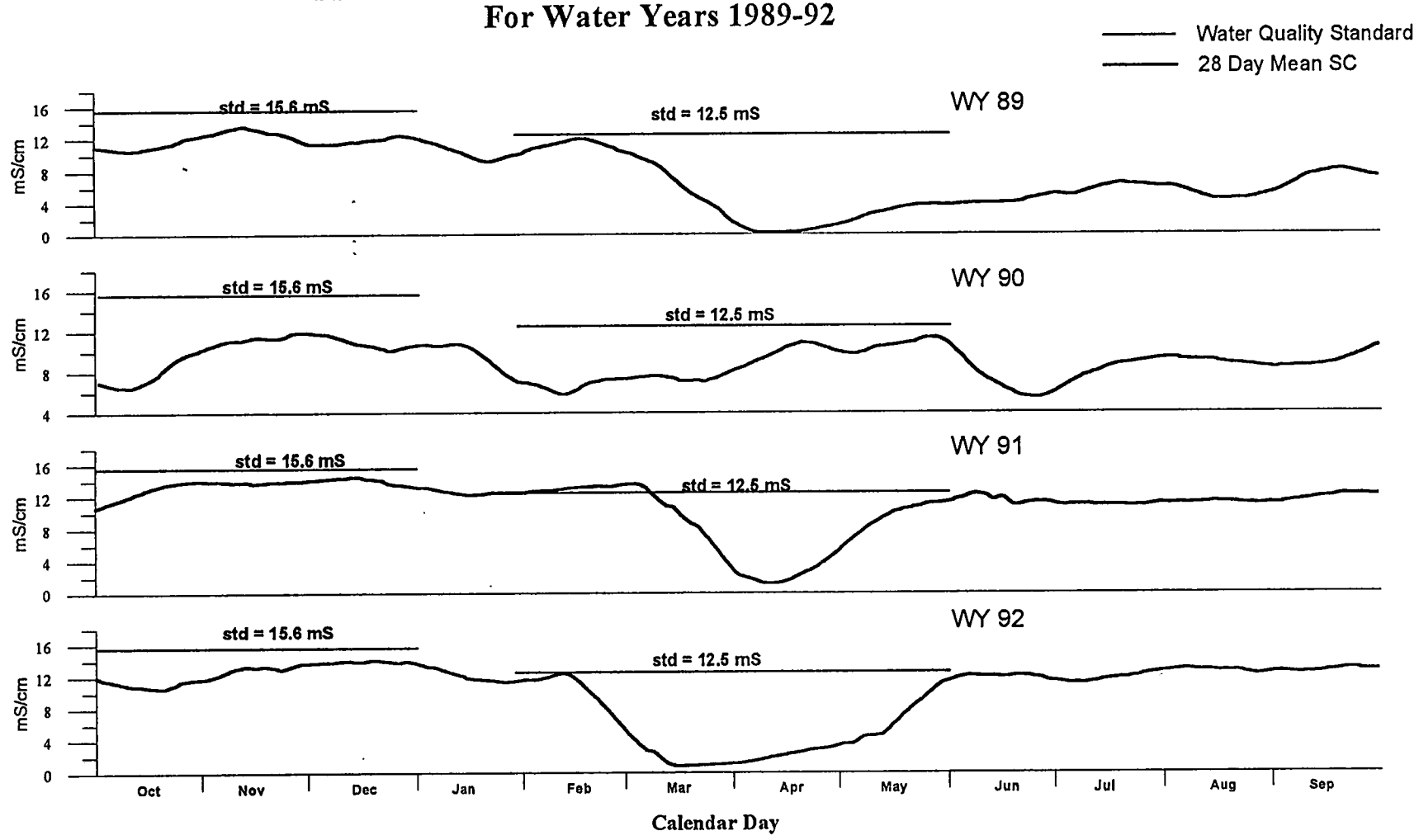


FIGURE 3

Chipps Island 28-Day Running Average Specific Conductance For Water Years 1989-92



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11/22/94

FIGURE 4

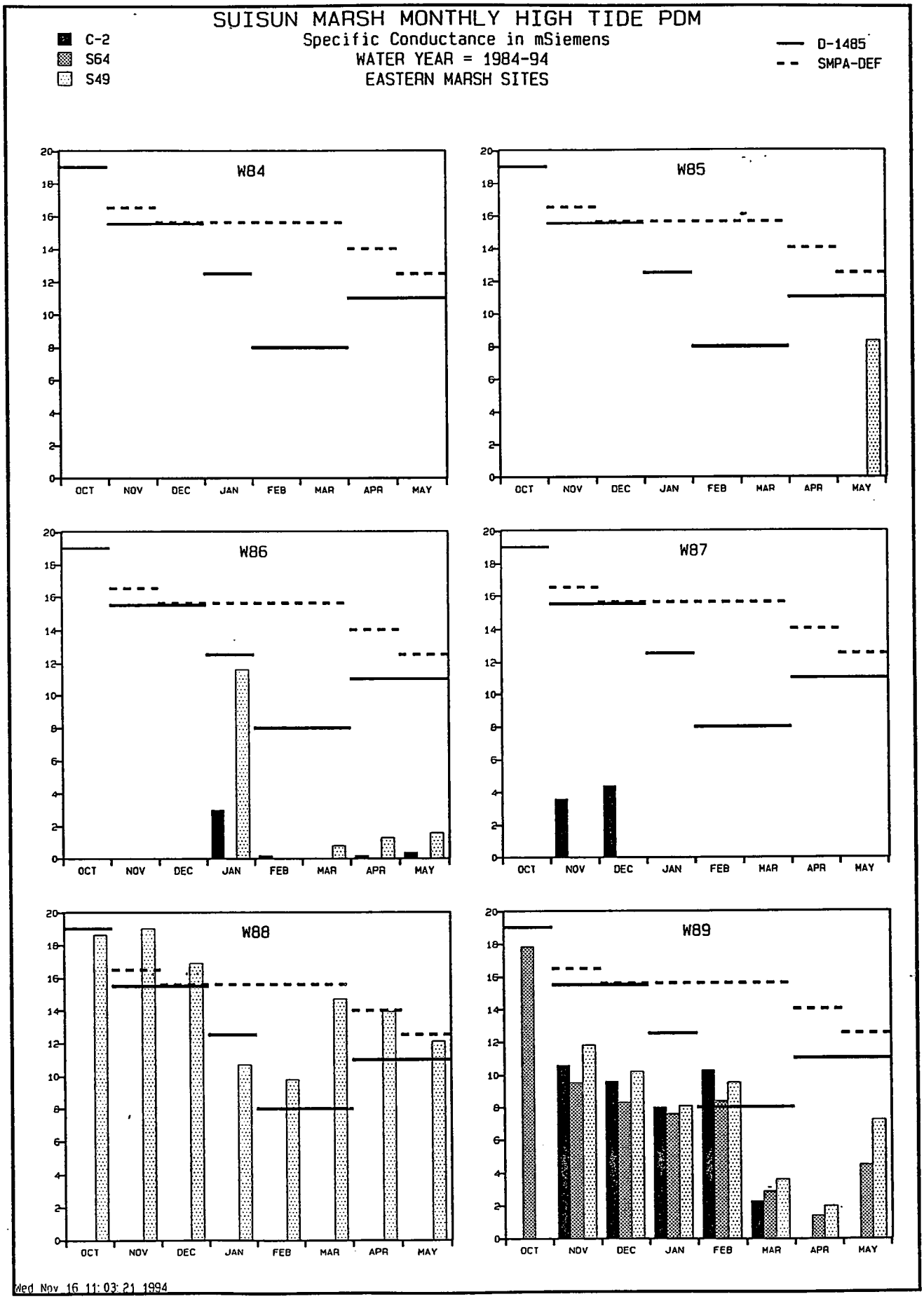

SUISUN MARSH MONTHLY HIGH TIDE PDM
Specific Conductance in mSiemens
WATER YEAR = 1984-94
EASTERN MARSH SITES
C-2
S64
S49
D-1485
SMPA-DEF
W84
W85
W86
W87
W88
W89
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
Wed Nov 16 11:03:21 1994

FIGURE 4

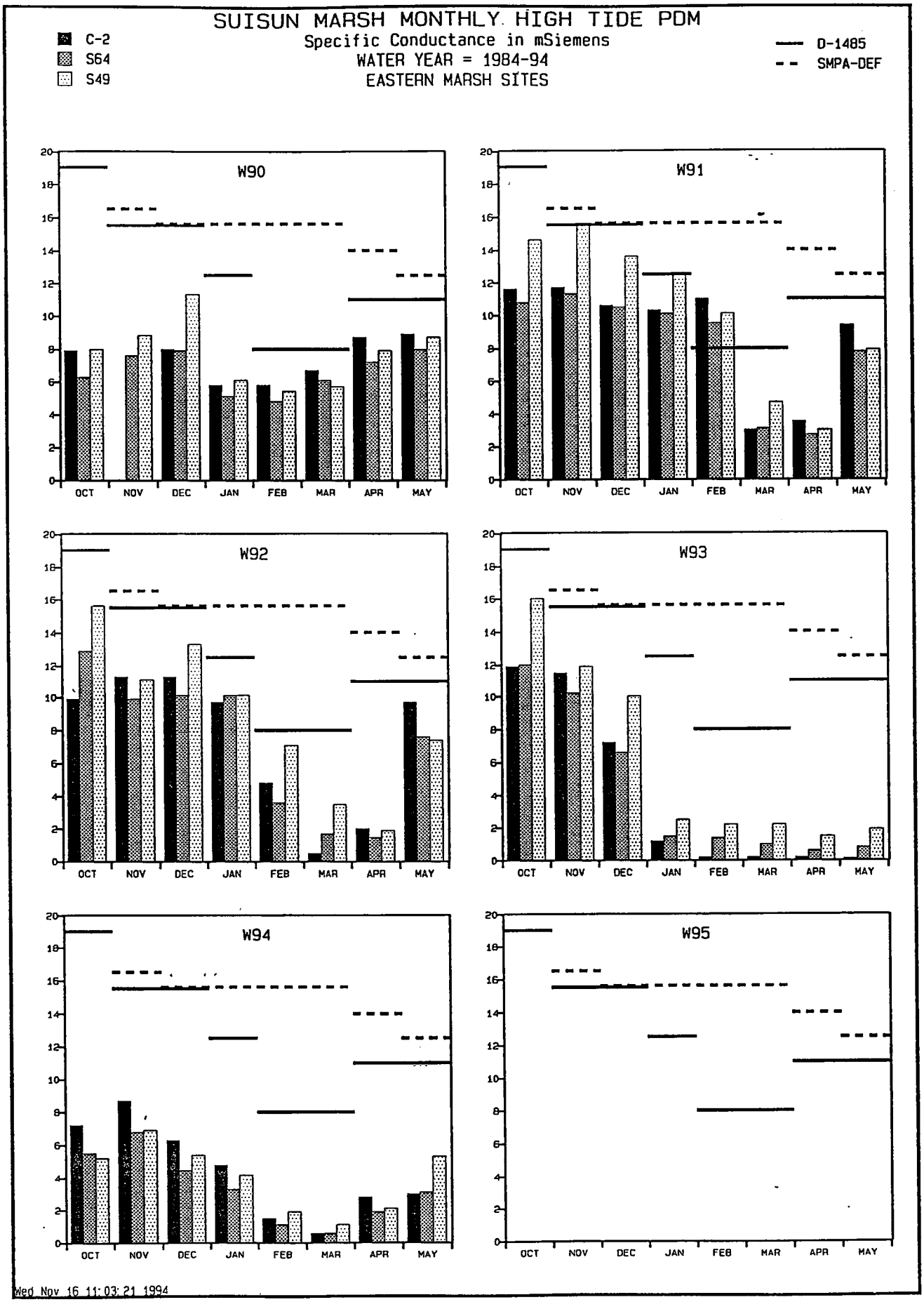

SUISUN MARSH MONTHLY HIGH TIDE PDM
Specific Conductance in mSiemens
WATER YEAR = 1984-94
EASTERN MARSH SITES
C-2
S64
S49
D-1485
SMPA-DEF
W90
W91
W92
W93
W94
W95
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
Wed Nov 16 11:03:21 1994

FIGURE 5

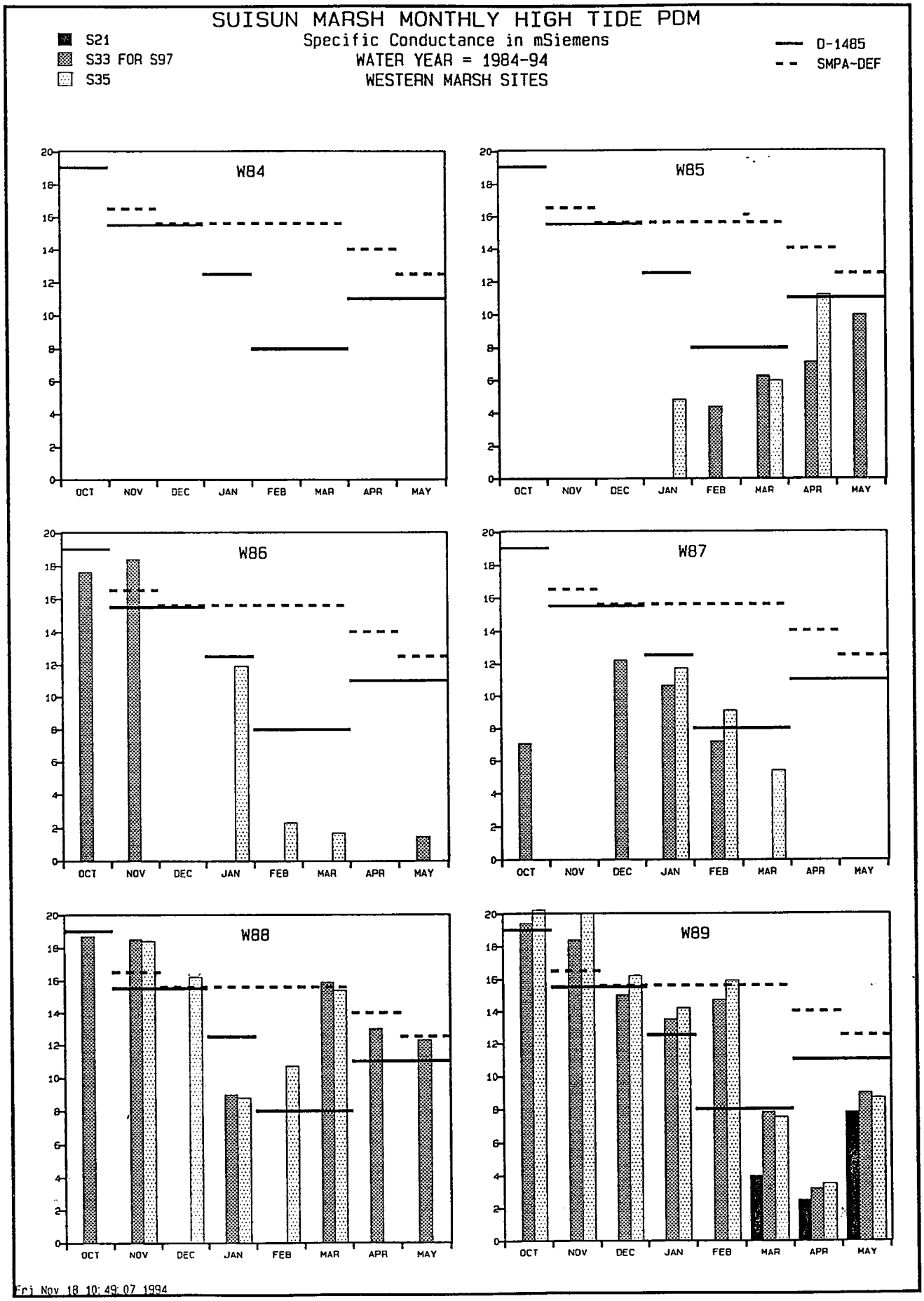

SUISUN MARSH MONTHLY HIGH TIDE PDM
S21
S33 FOR S97
S35
Specific Conductance in mSiemens
WATER YEAR = 1984-94
WESTERN MARSH SITES
D-1485
SMPA-DEF
W84
W85
W86
W87
W88
W89
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
Fri Nov 18 10:49:07 1994

FIGURE 5

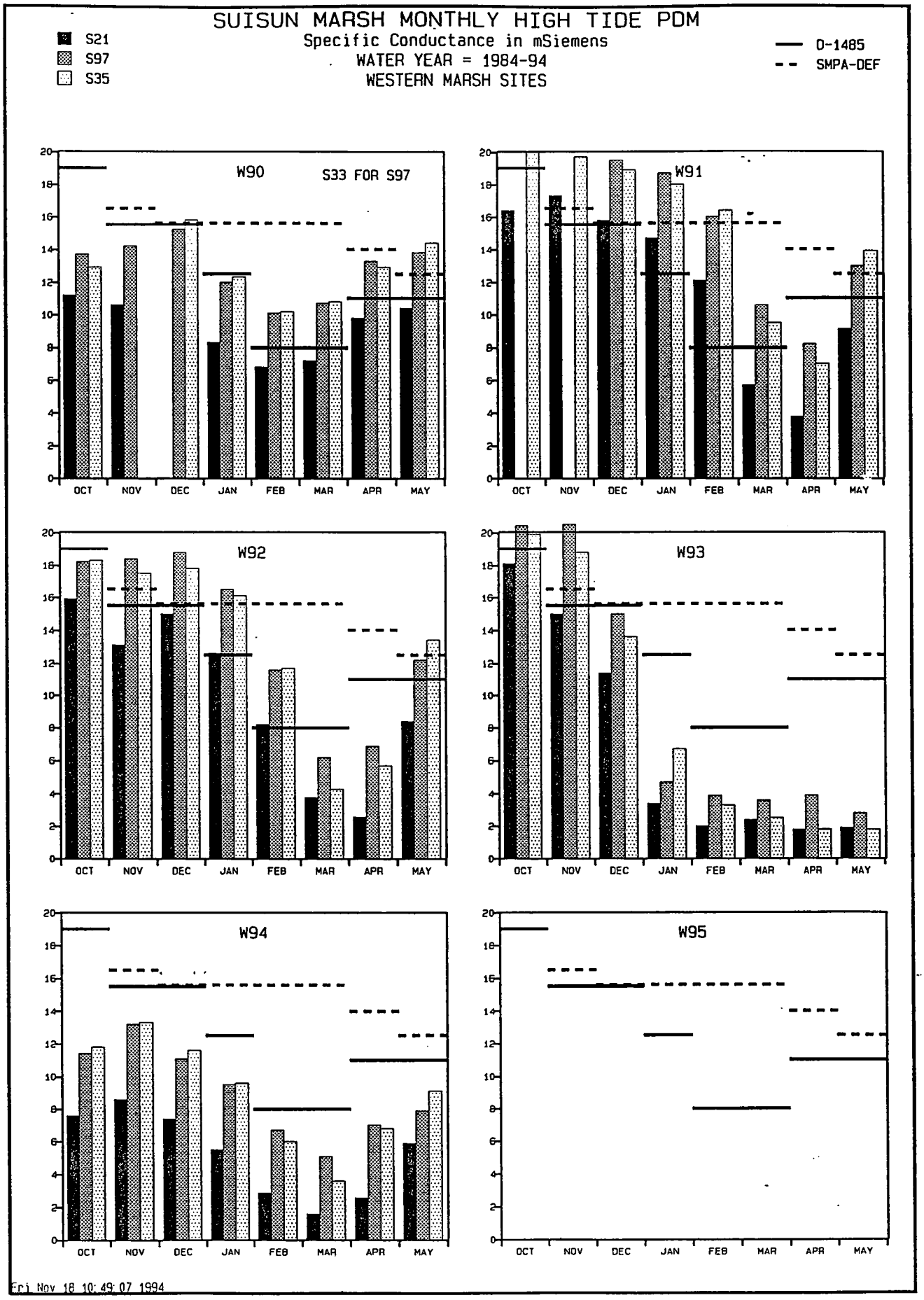

SUISUN MARSH MONTHLY HIGH TIDE PDM
Specific Conductance in mSiemens
WATER YEAR = 1984-94
WESTERN MARSH SITES
S21
S97
S35
D-1485
SMPA-DEF
W90
S33 FOR S97
W91
W92
W93
W94
W95
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
Fri Nov 18 10:49:07 1994

FIGURE 6

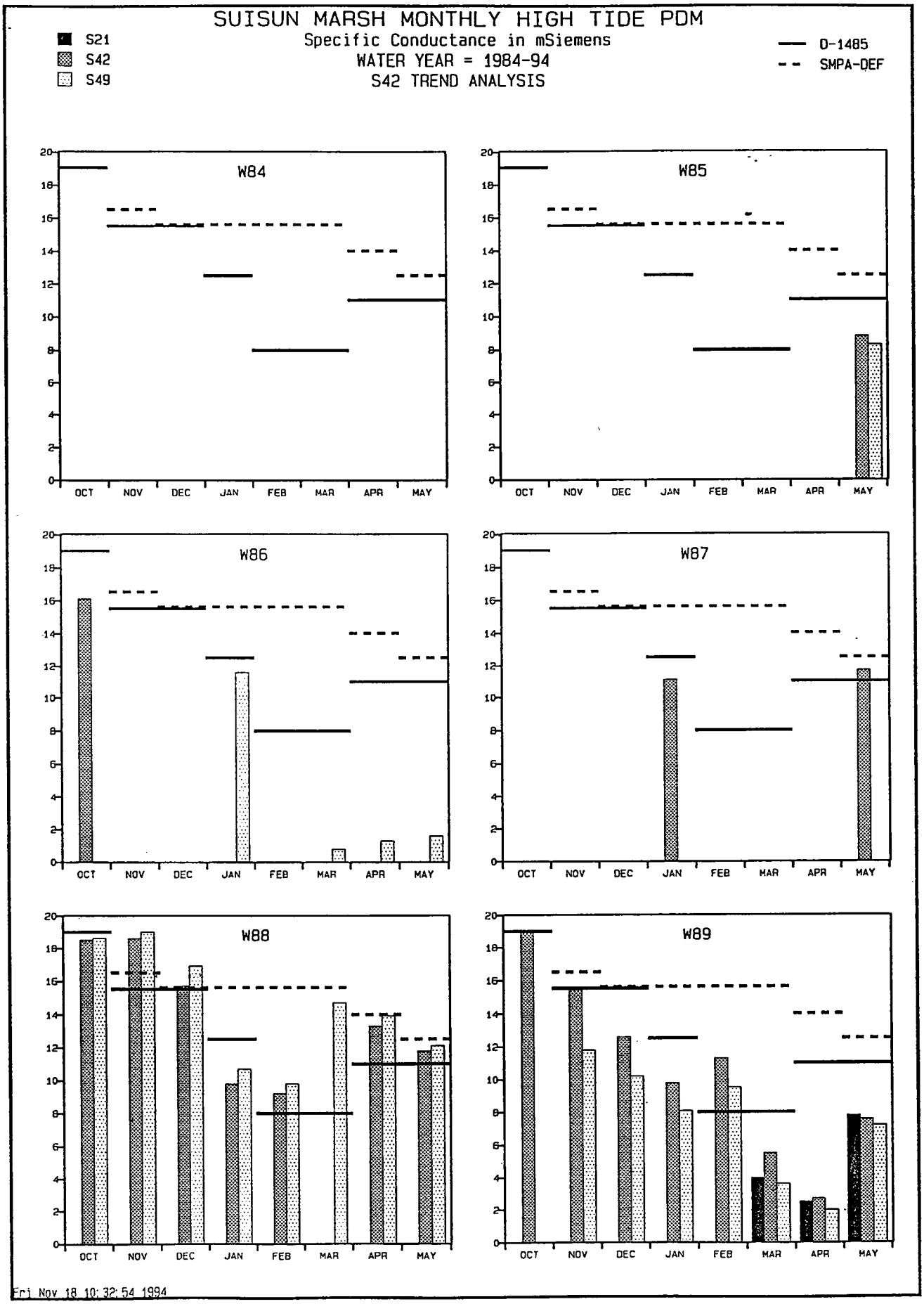

SUISUN MARSH MONTHLY HIGH TIDE PDM
Specific Conductance in mSiemens
WATER YEAR = 1984-94
S42 TREND ANALYSIS
S21
S42
S49
D-1485
SMPA-DEF
W84
W85
W86
W87
W88
W89
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
Fri Nov 18 10:32:54 1994

FIGURE 6

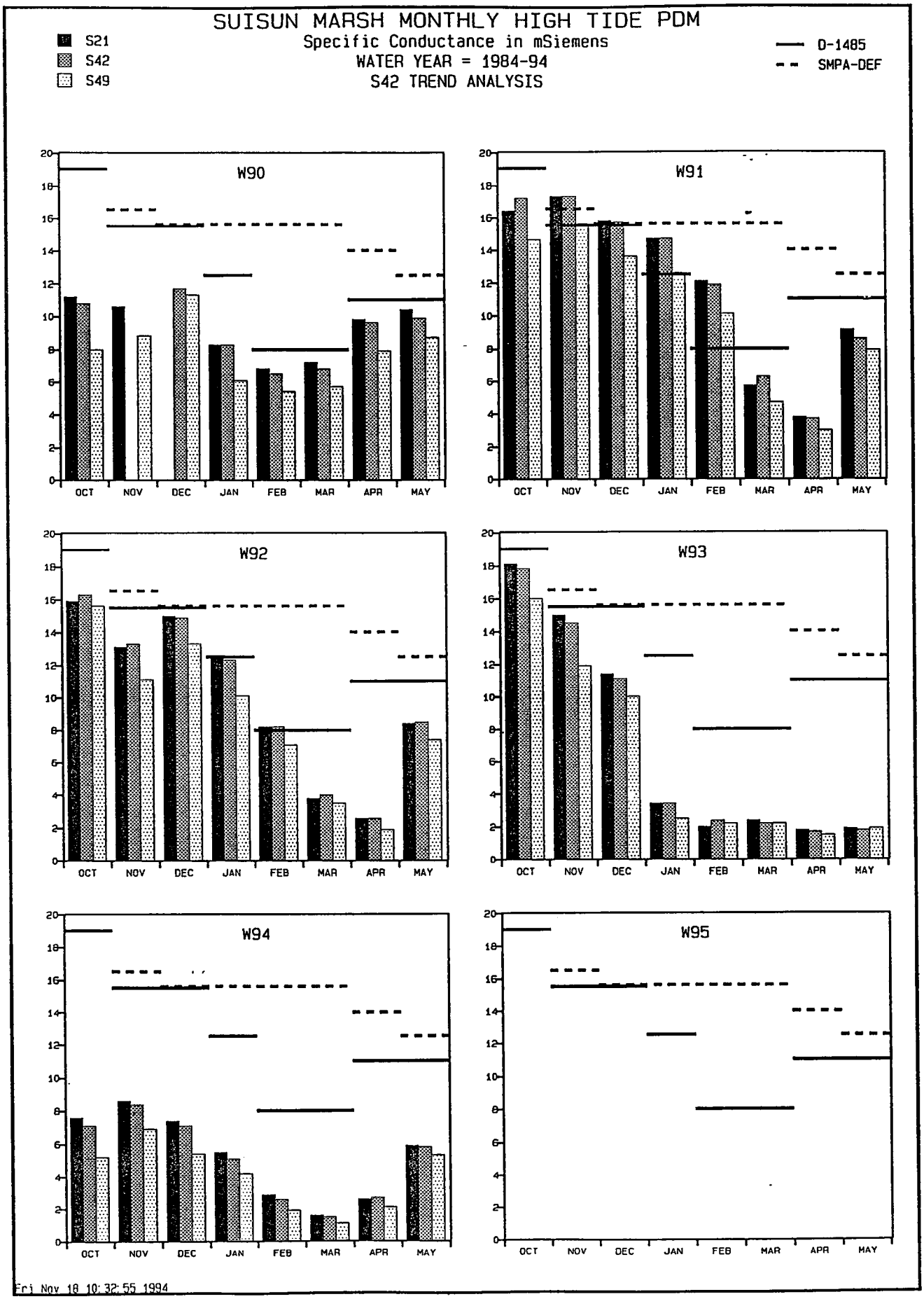
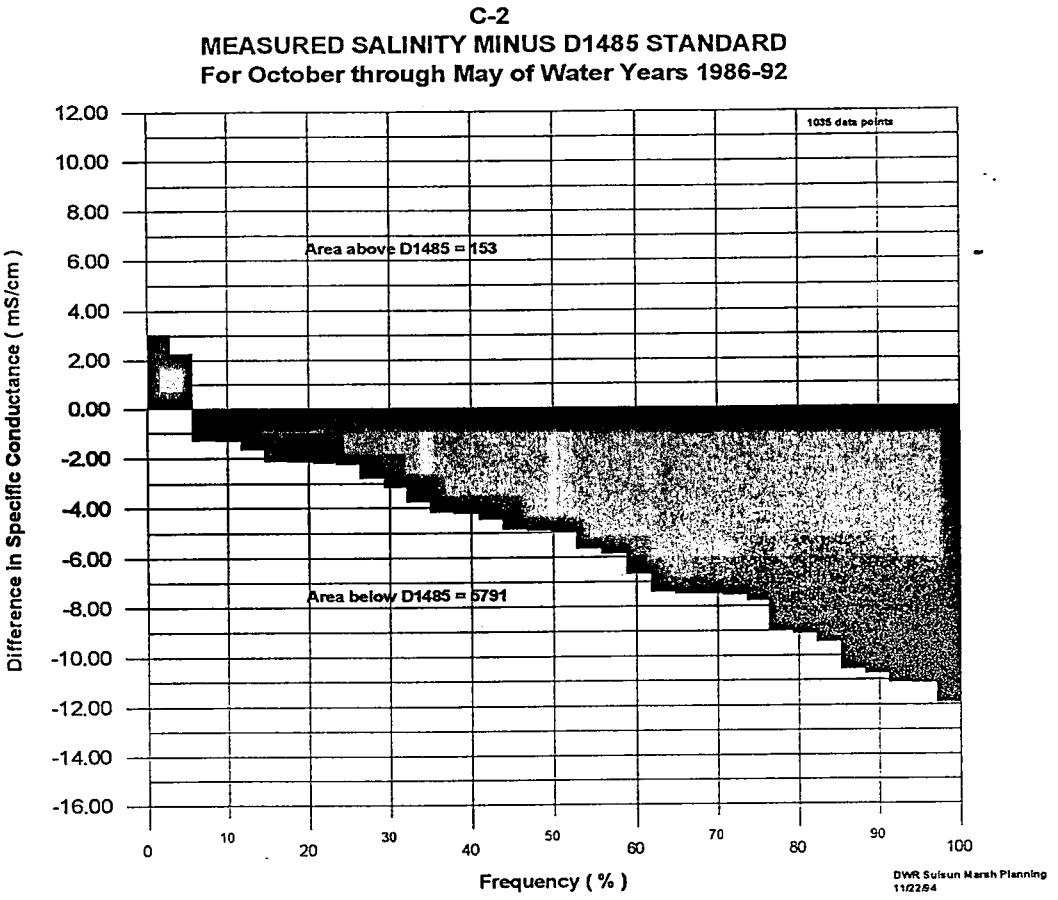

SUISUN MARSH MONTHLY HIGH TIDE PDM
Specific Conductance in mSiemens
WATER YEAR = 1984-94
S42 TREND ANALYSIS
S21
S42
S49
D-1485
SMPA-DEF
W90
W91
W92
W93
W94
W95
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
Fri Nov 18 10:32:55 1994

FIGURE 7


C-2
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1986-92
1035 data points
Area above D1485 = 153
Area below D1485 = 5791
Difference in Specific Conductance (mS/cm)
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

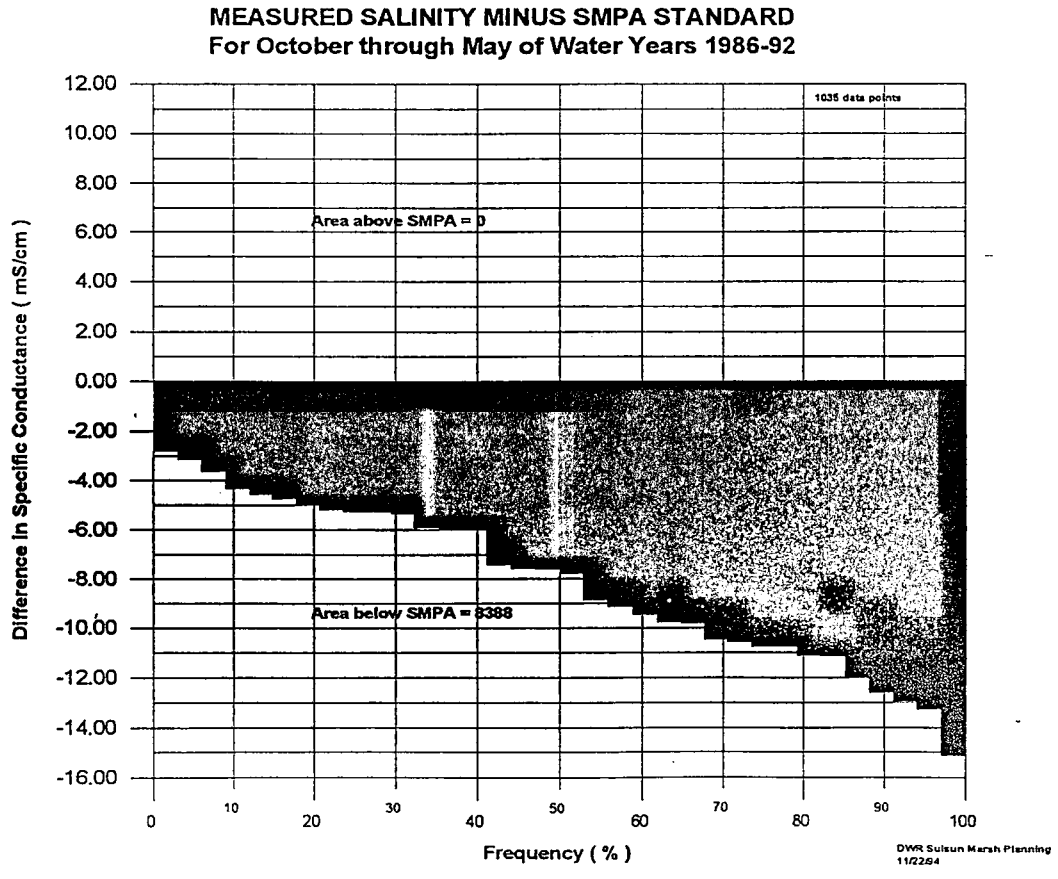
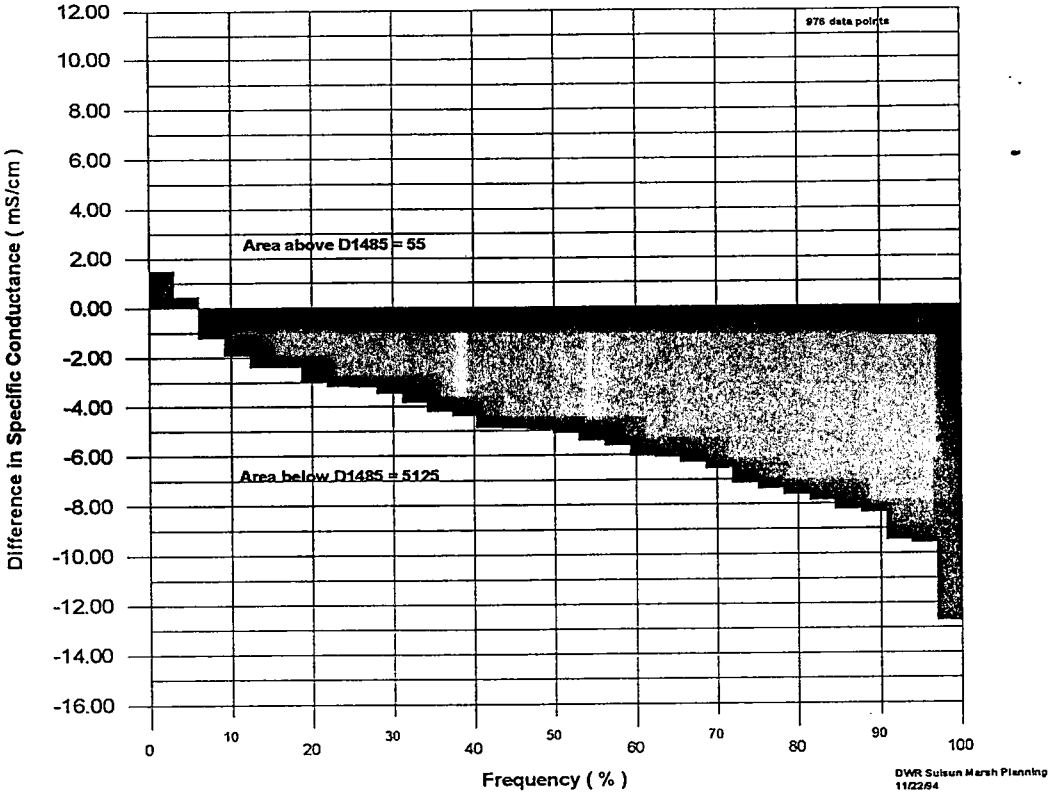

MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Years 1986-92
1035 data points
Area above SMPA = 0
Area below SMPA = 8388
Difference in Specific Conductance (mS/cm)
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

FIGURE 8

S-64
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1989-92



MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Year 1989-92

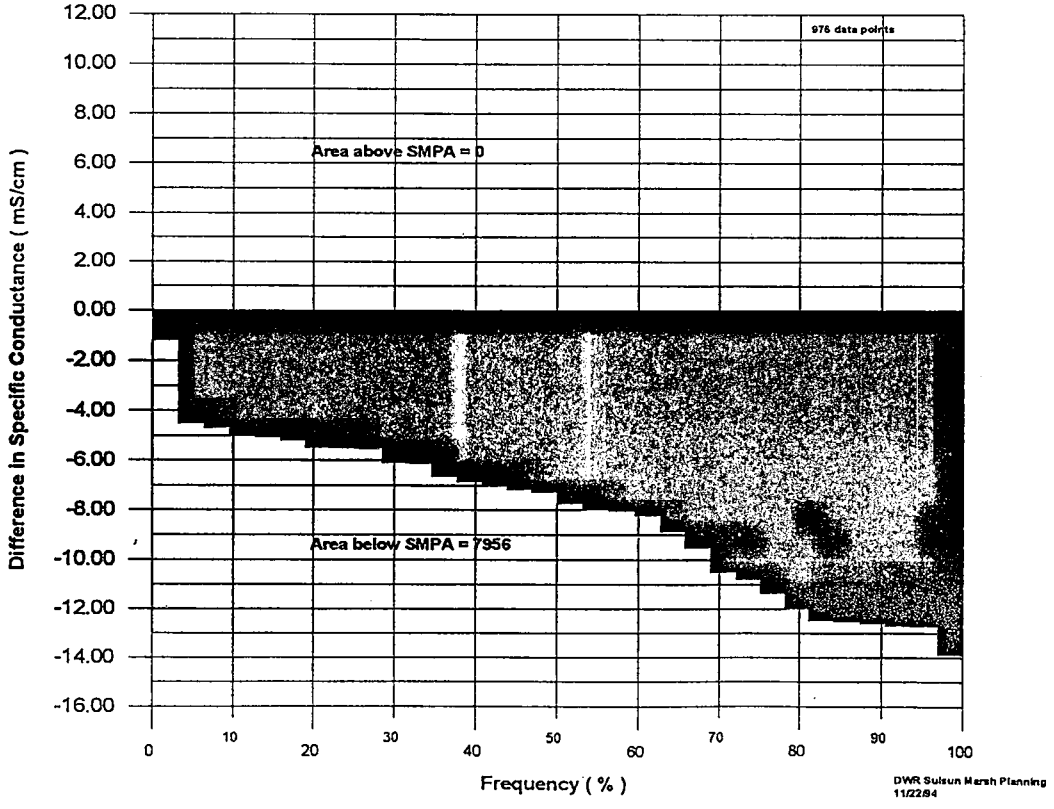
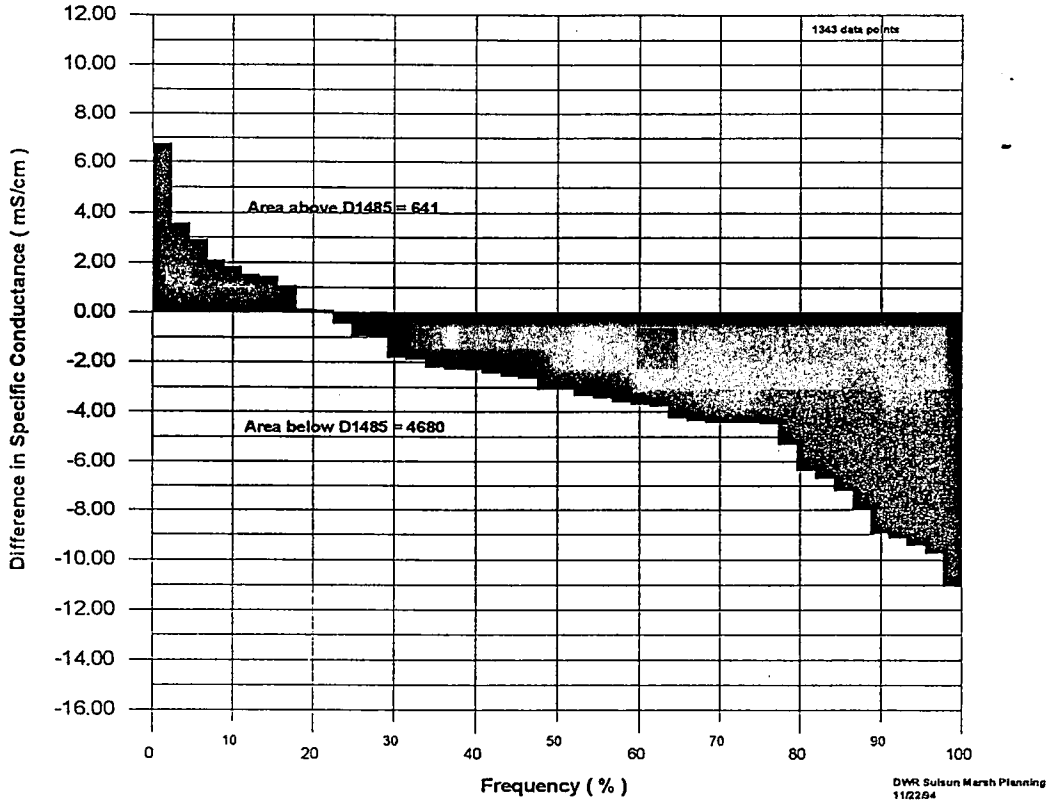


FIGURE 9

S-49
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1985-92



MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Year 1985-92

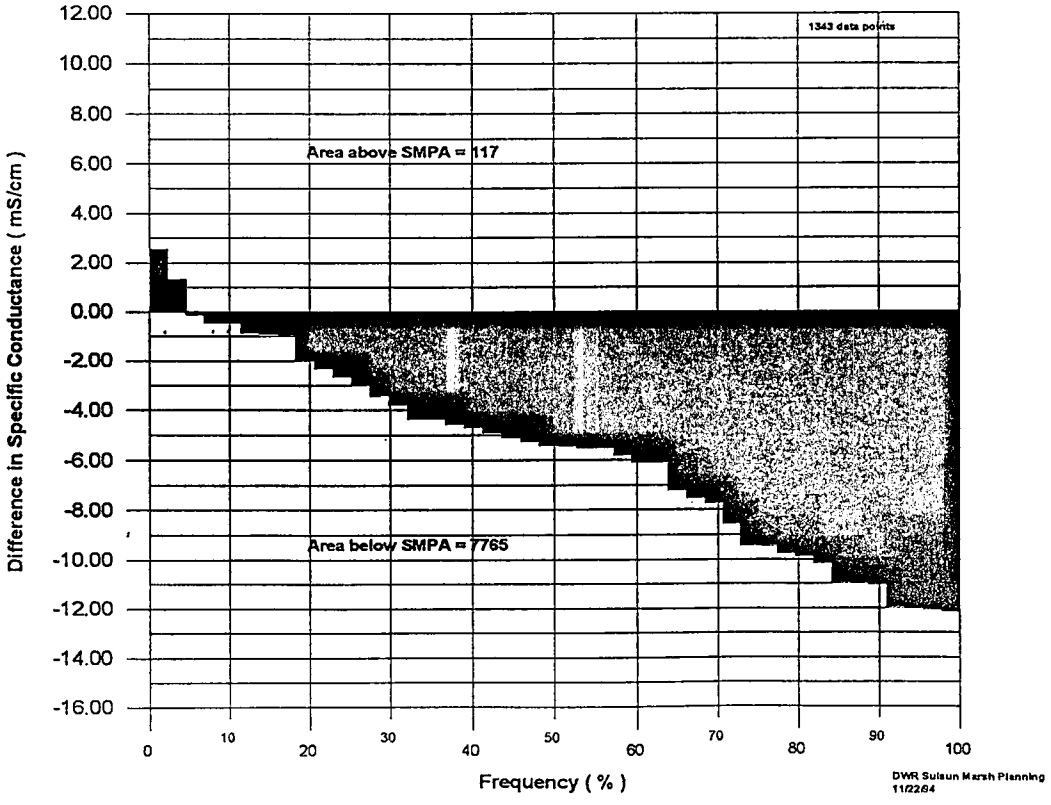
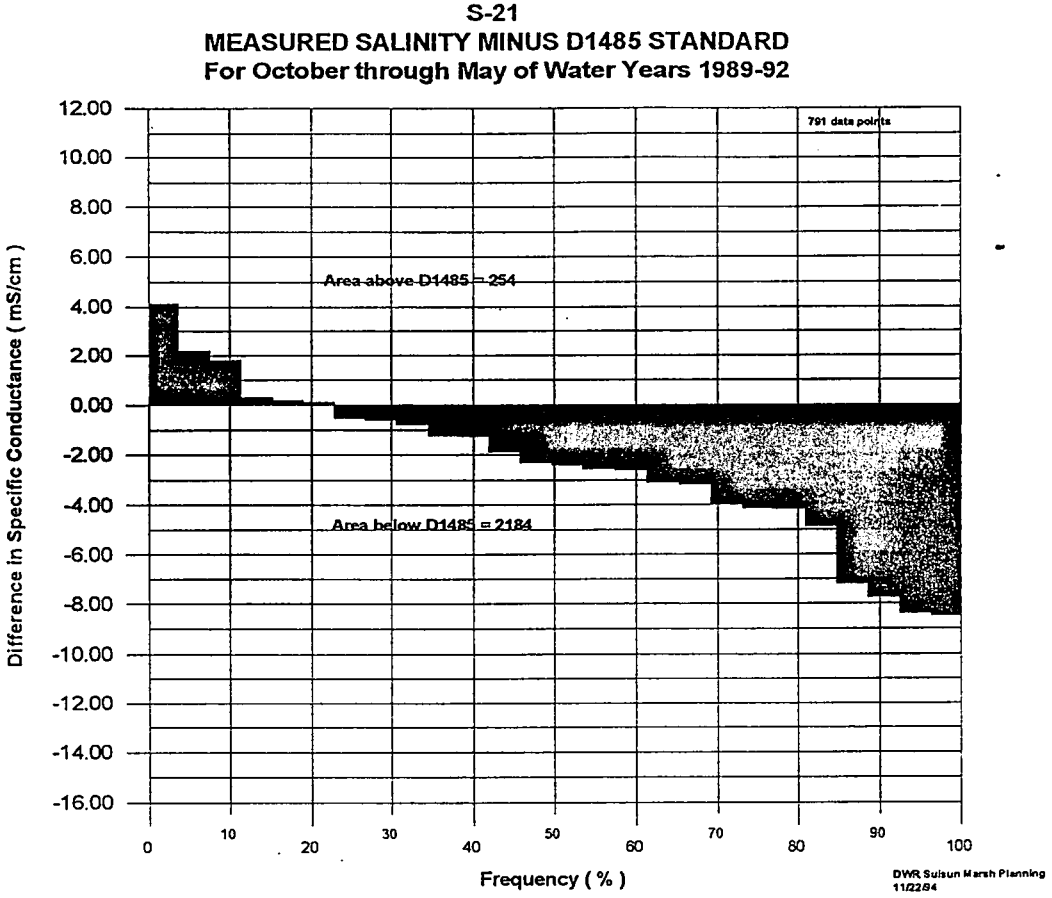


FIGURE 10


S-21
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1989-92
791 data points
Area above D1485 = 254
Area below D1485 = 2184
Difference in Specific Conductance (mS/cm)
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

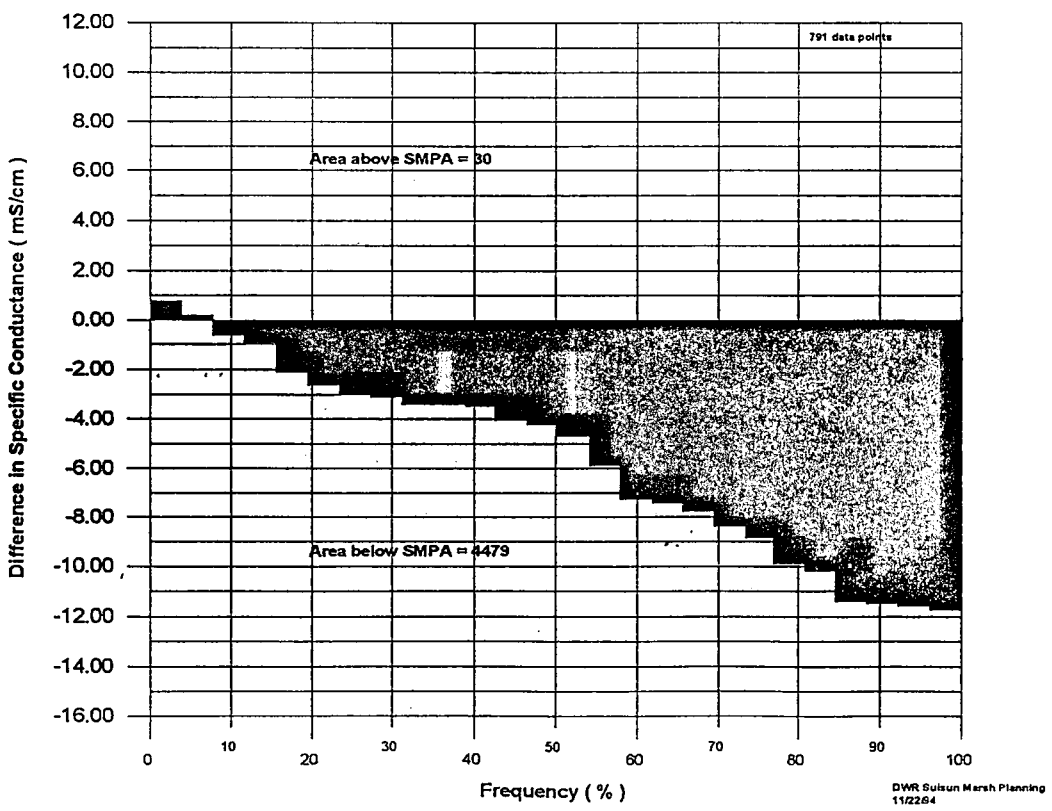
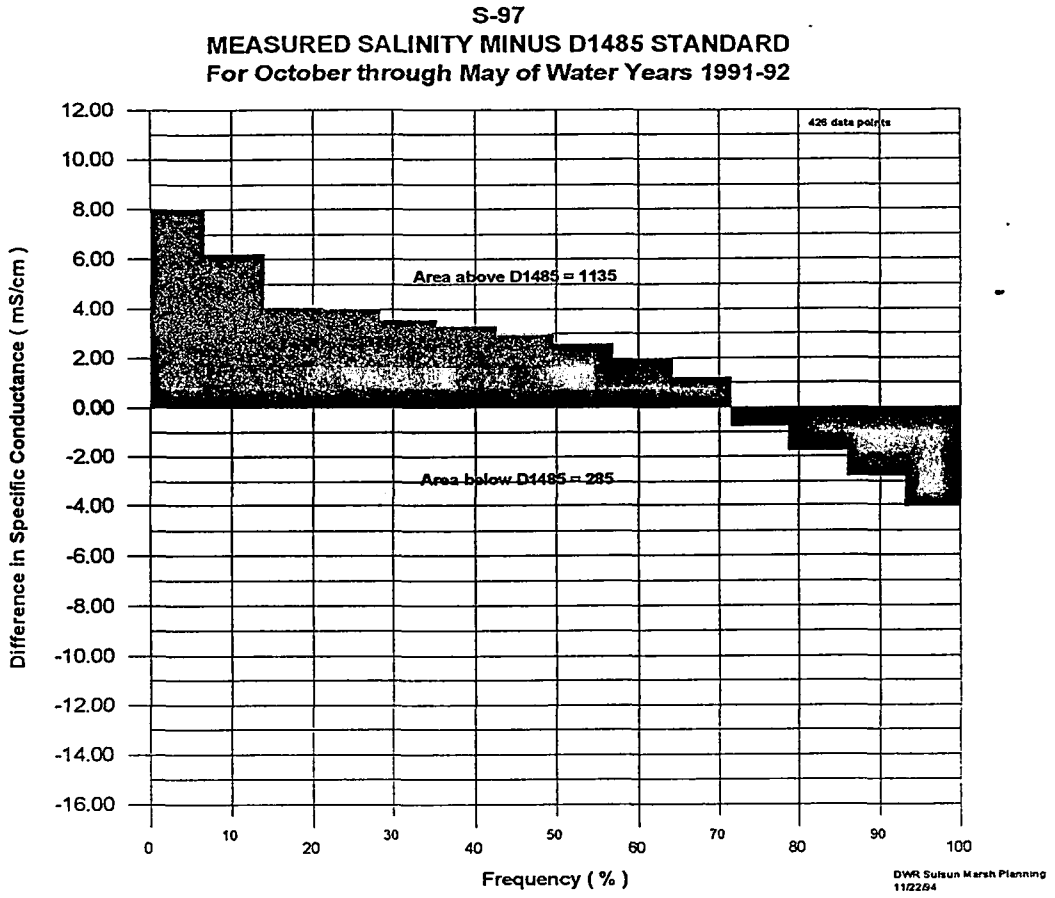

MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Years 1989-92
791 data points
Area above SMPA = 30
Area below SMPA = 4479
Difference in Specific Conductance (mS/cm)
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

FIGURE 11


S-97
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1991-92
426 data points
Area above D1485 = 1135
Area below D1485 = 285
Difference in Specific Conductance (mS/cm)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
0
10
20
30
40
50
60
70
80
90
100
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

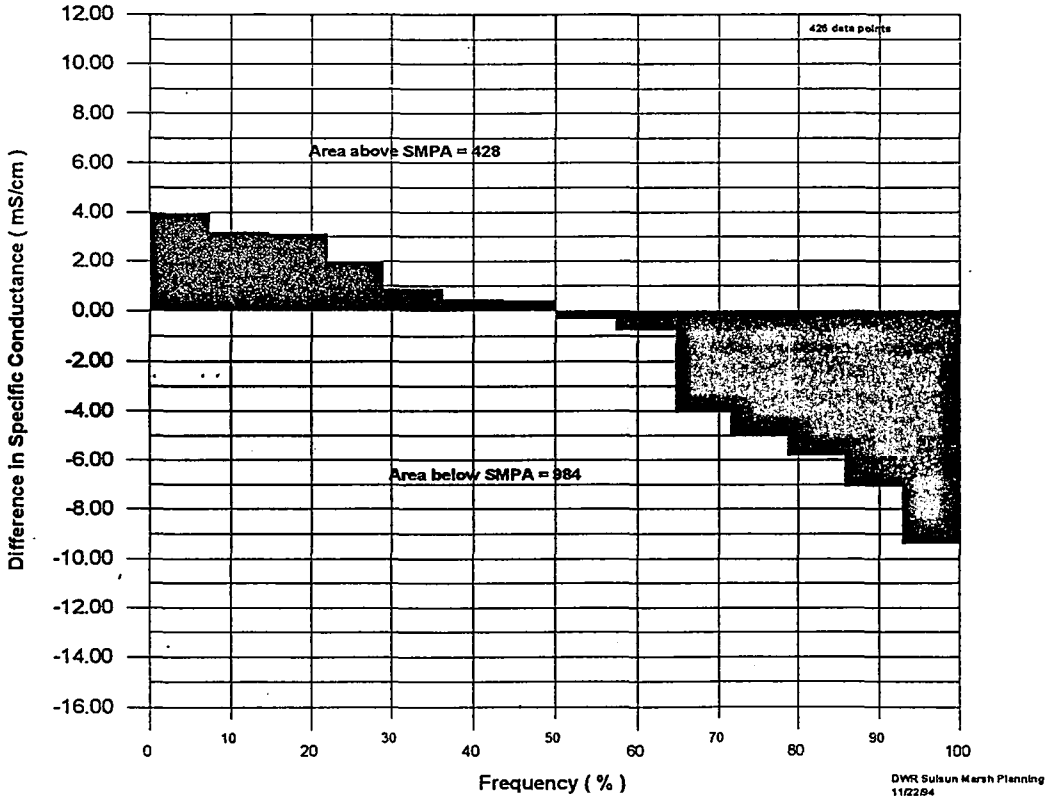
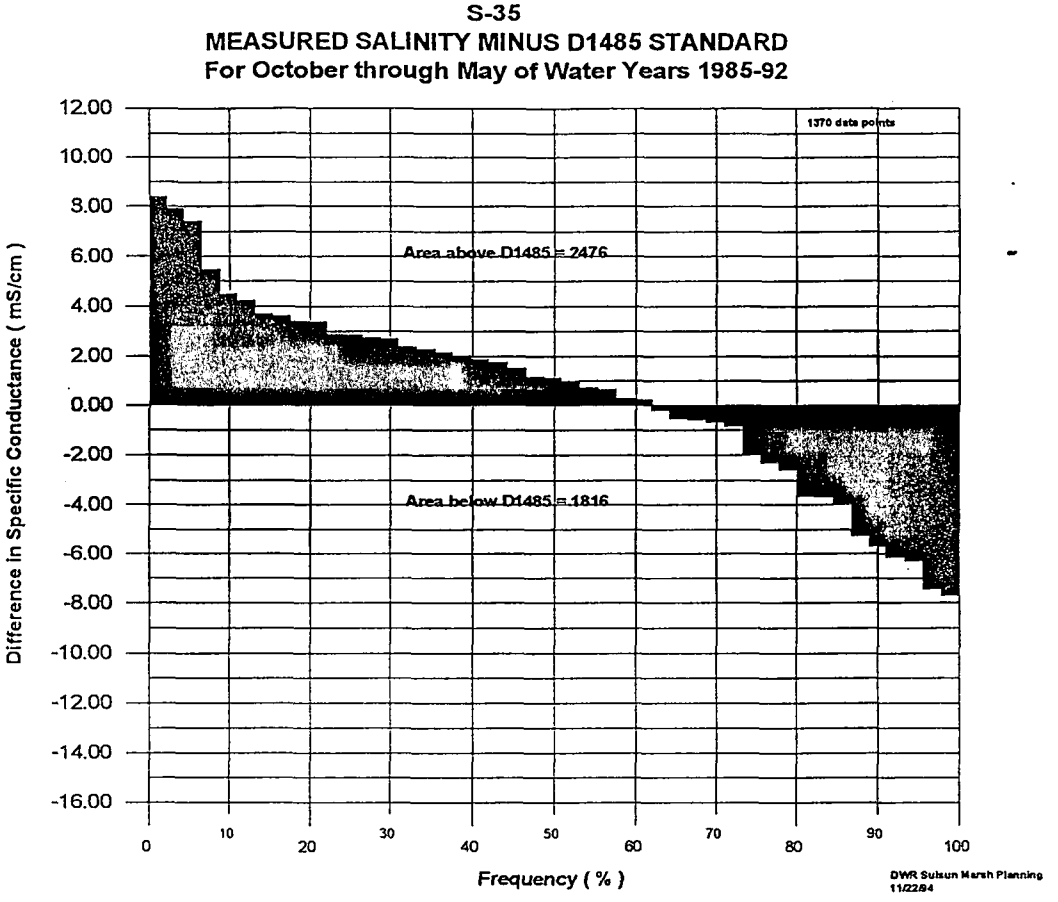

MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Year 1991-92
426 data points
Area above SMPA = 428
Area below SMPA = 984
Difference in Specific Conductance (mS/cm)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
0
10
20
30
40
50
60
70
80
90
100
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

FIGURE 12


S-35
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1985-92
1370 data points
Area above D1485 = 2476
Area below D1485 = 1816
Difference in Specific Conductance (mS/cm)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
0
10
20
30
40
50
60
70
80
90
100
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

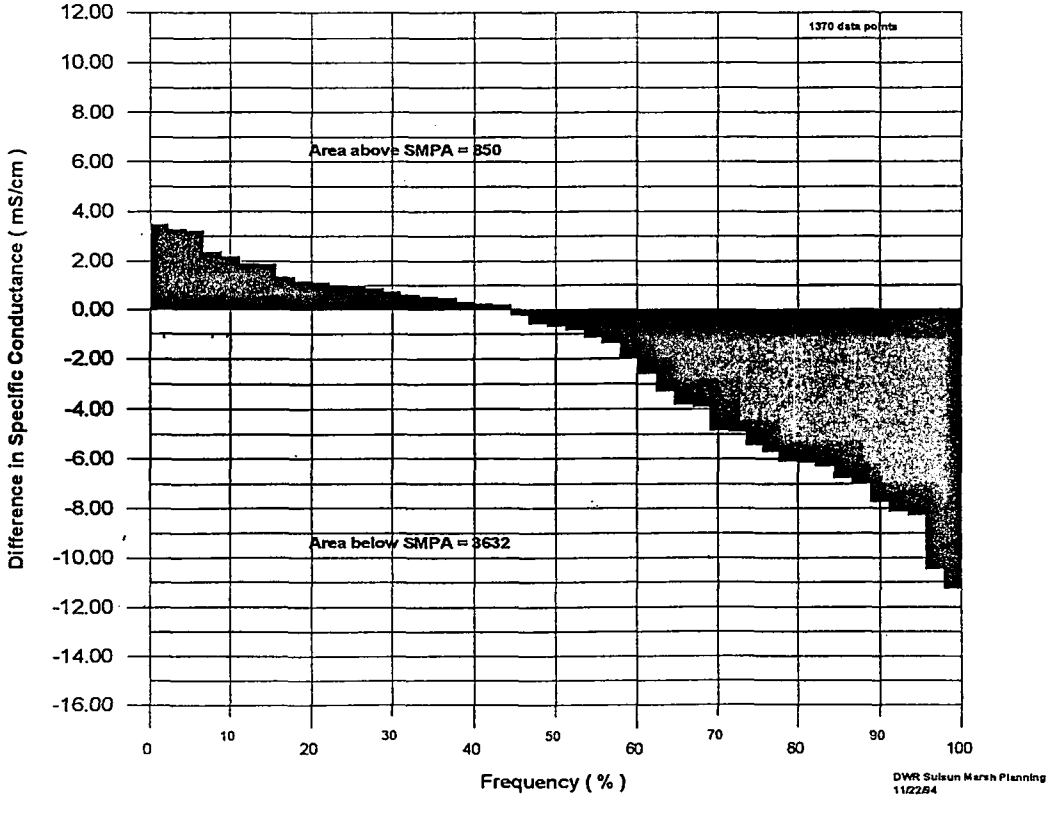
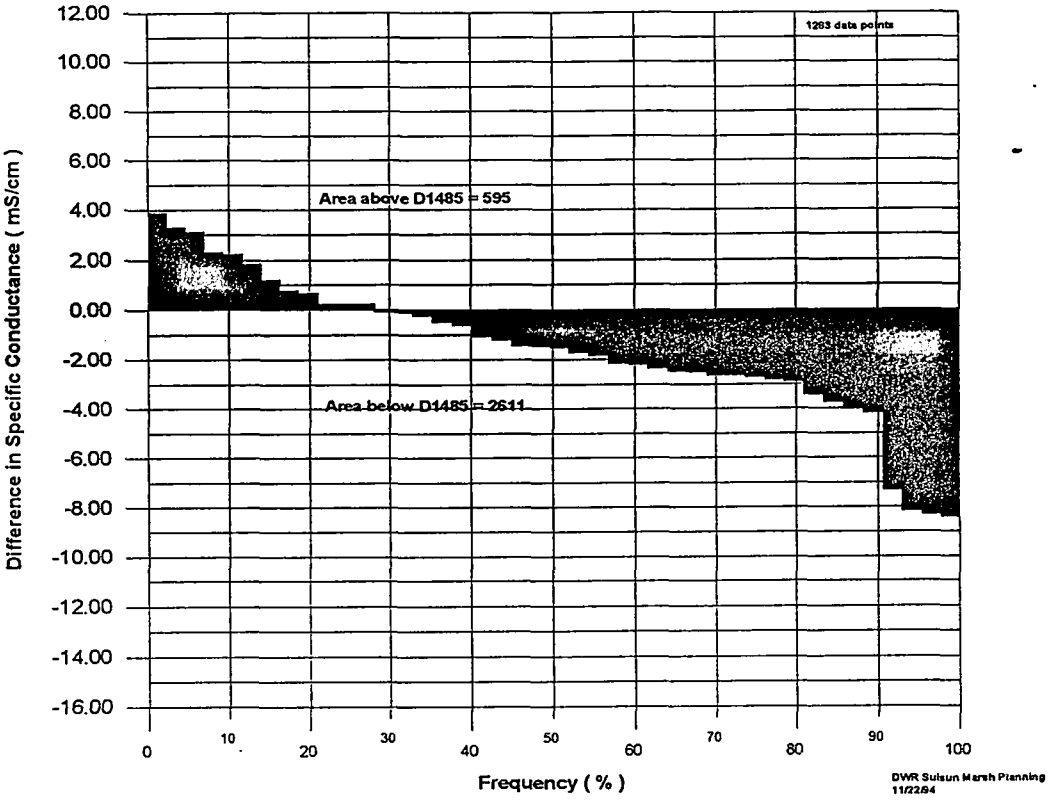

MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Years 1985-92
1370 data points
Area above SMPA = 850
Area below SMPA = 3632
Difference in Specific Conductance (mS/cm)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
0
10
20
30
40
50
60
70
80
90
100
Frequency (%)
DWR Suisun Marsh Planning
11/22/94

FIGURE 13

S-42
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1985-92



MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Year 1985-92

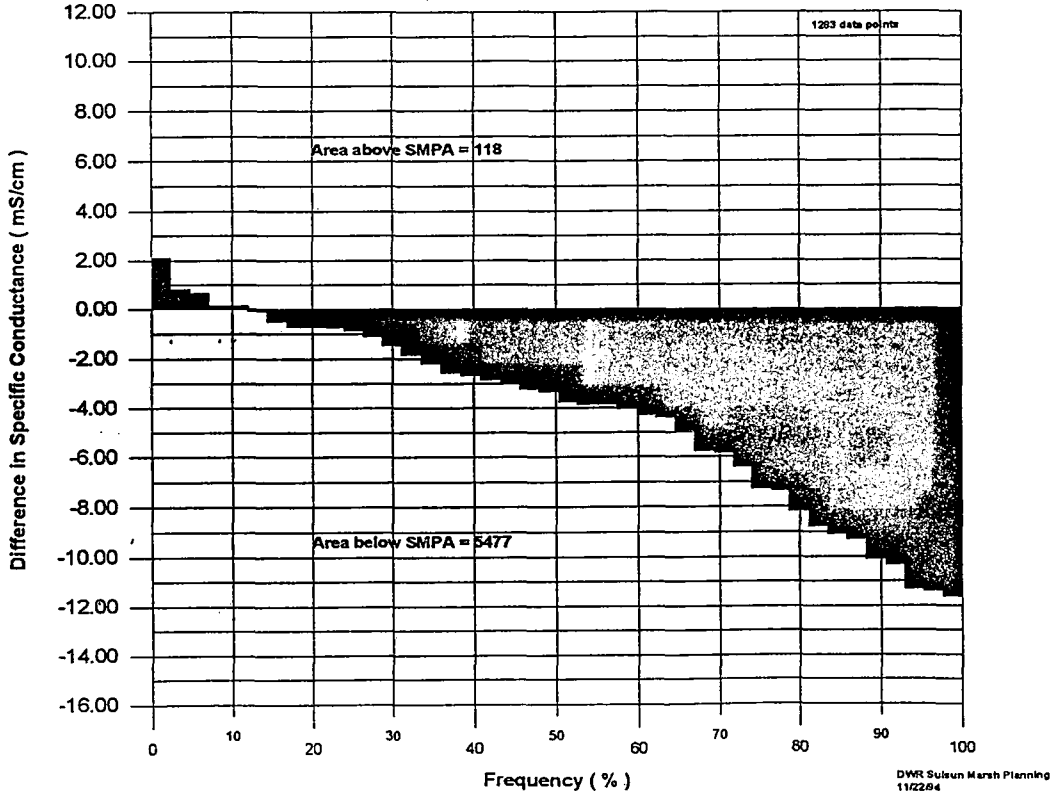
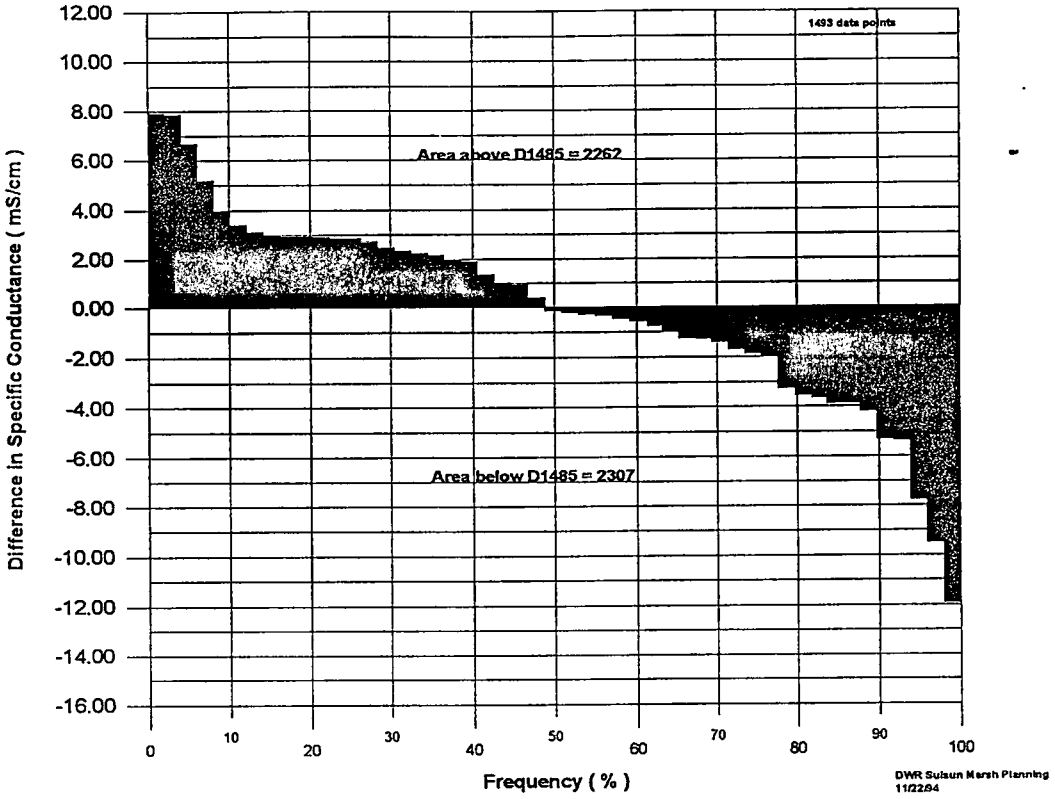


FIGURE 14

S-33
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1985-92



MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Years 1985-92

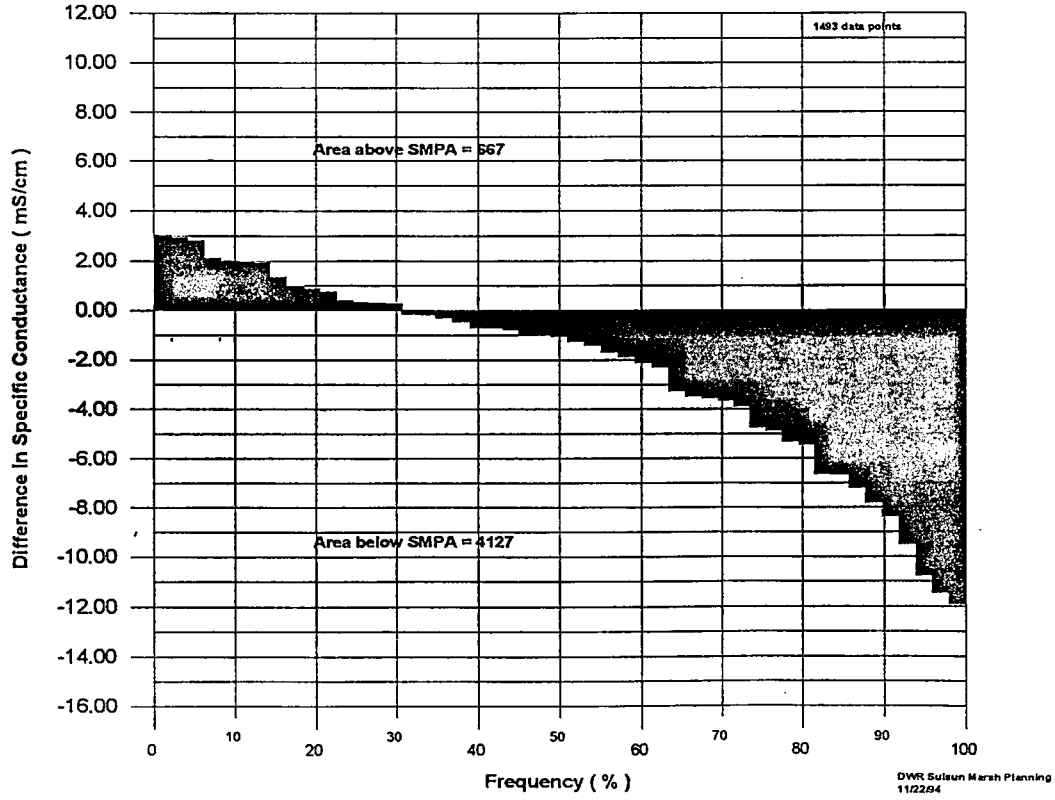
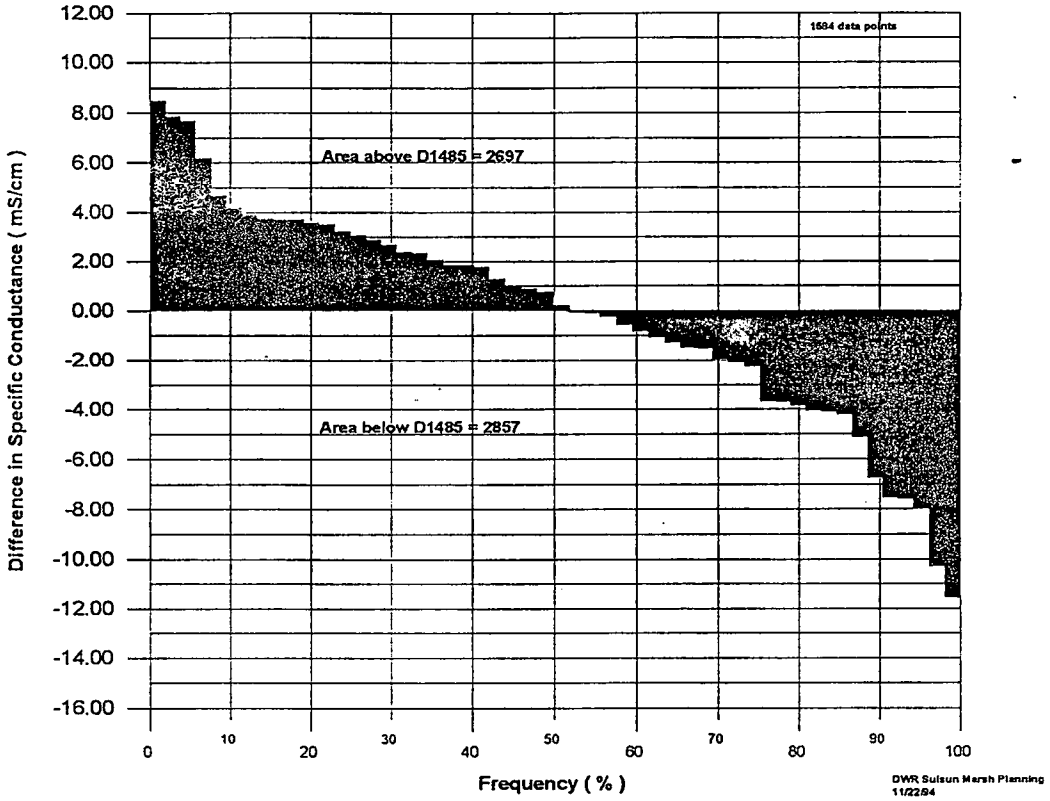


FIGURE 15

S-54
MEASURED SALINITY MINUS D1485 STANDARD
For October through May of Water Years 1985-92



MEASURED SALINITY MINUS SMPA STANDARD
For October through May of Water Year 1985-92