INVENTORY OF MONITORING PROGRAMS
IN THE SAN FRANCISCO BAY AND DELTA

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I. INTRODUCTION

The Bay Area Dischargers Association contracted with the Aquatic Habitat Institute (AHI) to prepare an inventory of major ecological research and monitoring programs in the Bay and Delta. The goal of this report is not to provide specific details on each study discussed, but rather to give the reader an overview of the many monitoring programs in the Estuary. These programs include studies on water quality, contaminant loading, toxic uptake and effects, fisheries, hydrodynamics, benthos, sediments and dredging, wetlands, Delta inflow, and biological resources. This report addresses only monitoring programs which are currently in progress, with the exception of a few relevant studies which have recently ended.

AHI obtained the information contained in this report during personal and telephone interviews, and by review of appropriate reports. The information obtained for this report has been included in the Estuarine Data Index, a database contained within the computerized Data and Information Management System (DIMS). Housed and maintained by AHI, DIMS contains detailed summaries of seventy research and monitoring programs that have been or are being conducted in the Estuary. These summaries contain an abstract, and information about methods and quality assurance procedures. They also list sampling site locations, parameters studied, references, and contain information on data storage, including contact names and phone numbers.

The body of the report, which discusses major research and monitoring programs, and is followed by three appendices. Appendix A contains documentation for the studies which are cited (in the order in which each study appears in the text), and is accompanied by a contact name and telephone number. Appendix B contains a list of monitoring programs organized by agency. Appendix C contains additional information on DIMS, as well as a log-on procedure for the system.
II. MONITORING PROGRAMS

A. Water Quality

Water quality parameters which are monitored in the Bay and Delta include salinity, total suspended solids, water temperature, trace metals, dissolved oxygen and nutrients. These parameters are evaluated on various temporal and spatial scales. Water quality monitoring programs can be divided into two categories, water chemistry, and phytoplankton studies.

WATER CHEMISTRY

The Department of Water Resources (DWR) monitors water chemistry in two programs, the Sacramento-San Joaquin Water Quality Surveillance Program and the Interagency Delta Health Aspects Monitoring Program (IDHAMP). The U.S. Bureau of Reclamation also collects water chemistry data in two studies, the Water Quality Monitoring Network, and the Selenium Speciation Study. Water quality is also monitored by municipal dischargers under the East Bay Municipal Utility District's Local Effects Monitoring Program, the South Bay Dischargers Authority Water Quality Monitoring Program, and the City of San Francisco's Bay Benthic studies program.

In the Sacramento-San Joaquin Water Quality Surveillance Program, suspended solids, nutrients, water transparency, temperature, and chlorophyll levels are analyzed twice a month from 28 stations in the Delta. Trace elements and chlorinated organics are analyzed twice a year. In accordance with Water Rights Decision 1485, DWR has 6 continuous monitoring stations in the Delta and Suisun Bay which provide hourly readings of conductivity, dissolved oxygen, pH, temperature, solar radiation, wind speed and direction, and temperature. At some of these sites tidal stage, chlorophyll, and turbidity are also measured.

The second program, the IDHAMP, has a broader scope and consists of three components, the Water Quality and Tidal Effects Study; the Effects of Agriculture on Water Quality Study; and the Wastewater, Trihalomethane (THM) and Modeling Study. The goal of the Water Quality and Tidal Effects Study is to ensure that raw water supplies are meeting drinking water standards, and
laboratory analyses are performed to monitor conductance, mineral and pesticide concentrations, and other parameters. This study also compares conductivity, major ion concentrations, and specific ion ratios from key stations to follow general water movement and water quality trends in the Delta.

The Effects of Agriculture on Water Quality Study is itself broken down into several components. In this study irrigation return waters are analyzed for salts, pesticides and trihalomethane (THM) formation potential and the discharge points of irrigation return flows are mapped. The San Joaquin River is sampled for pesticides, selenium and other trace elements. In addition, pesticide fate and transport are modeled, and a health effects database on selected chemicals has been compiled through a computer literature search.

The last component of the IDHAMP is the Wastewater, THM and Modeling Study, which is comprised of three tasks. These include an examination of total waste loads from effluents of major municipal and industrial dischargers in the Delta; measurements of trihalomethane formation potential in Delta waters; and the use of water quality models to study the distribution, fate and transport of waste waters and spilled materials.

The U.S. Bureau of Reclamation collects continuous monitoring data for use in maintaining salinity standards in the Delta. The Water Quality Monitoring Network, which began in 1950, takes hourly salinity readings at 14 sites in the Delta and 7 sites in Suisun Marsh.

In 1984 the U.S. Bureau of Reclamation contracted Dr. Greg Cutter of Old Dominion University to examine possible origins, concentrations and fates of waterborne selenium. In this Selenium Speciation Study surface water samples are collected throughout the Estuary two to three times a year. Beginning this year, samples are also being analyzed for arsenic and antimony.

Long-term studies of water quality and its effect upon biological resources have been conducted by the following municipal dischargers; the East Bay Municipal Utility District, the South Bay Dischargers Authority, and the City of San Francisco. From 1980-1981, and 1985 through 1987, the East Bay Municipal Utility District conducted a Local Effects Monitoring Program to
examine the effects of wet weather overflow. This program studied contaminant loadings in urban runoff and wastewater discharges, and contaminant levels in receiving waters, sediment, and shellfish.

The South Bay Dischargers Authority coordinated three sampling programs to assess the effects of wastewater discharge from the cities of San Jose, Santa Clara, Palo Alto, and Sunnyvale on biological resources and water quality. Avian Botulism, Biological, and Water Quality studies were conducted between 1981-1986 in the Artesian Slough and Coyote Creek area of the South Bay.

San Francisco's Bureau of Water Pollution Control conducts water quality, sediment, and benthic infauna sampling in the vicinity of the Southeast outfall, and the Islais Creek overflow outfall. Water quality sampling occurs monthly, and sediment and benthic infauna samples are collected annually at both sites. This study has been underway since 1982.

PHYTOPLANKTON STUDIES

Phytoplankton monitoring studies are conducted by the Department of Water Resources (DWR), and the U.S. Geological Survey (USGS). The Sacramento-San Joaquin Water Quality Surveillance Program, which was discussed above, also contains a phytoplankton studies component in which chlorophyll levels are measured as an indication of primary production. Factors that influence phytoplankton growth are analyzed, including nutrient availability, water clarity, temperature, and river flows. DWR currently samples at 15 stations from Hood on the Sacramento River and Mossdale on the San Joaquin River downstream to San Pablo Bay. The USGS phytoplankton studies program measures fluorescence, turbidity, salinity, temperature, stage and other parameters in the South Bay. There are no phytoplankton studies conducted at present in Central Bay.

B. Contaminant Loading

Contaminant loads originate from municipal and industrial point sources, urban and non-urban runoff, riverine input, spills, uncontrolled releases from hazardous waste sites, atmospheric deposition and contaminant remobilization
during dredging and aquatic disposal of dredged material. There are no monitoring programs conducted at present for contaminant loading from hazardous waste sites. Data collected on dredging are discussed in the section on sediments, below. Contaminant monitoring programs for the other sources are discussed below.

POINT SOURCE DISCHARGE

Data from public and private point source dischargers in the Bay/Delta are submitted in monthly self-monitoring reports to either the San Francisco Bay Regional Water Quality Control Board or to the Central Valley Regional Water Quality Control Board. Information contained in these reports can be divided into two categories. The first is "routine monitoring" data, which consist of standard parameters such as nutrients, oil and grease, and trace metals included in each discharger's NPDES permit; the second is data regarding the concentration of U.S EPA priority pollutants in discharge from municipal treatment plants and petroleum refineries. Over 100 toxic volatile organics, semi-volatile organics, chlorinated pesticides, PCBs and trace elements are listed as priority pollutants. AH1 has compiled these discharger effluent data from NPDES permits for the years 1984-1987. These data have been placed into a personal computer database for use by the Regional Water Quality Control Boards.

URBAN RUNOFF

The Santa Clara Valley Non-Point Source Discharge Evaluation Study is examining pollutant loads to the South Bay, including both point source discharge and urban run-off, and is addressing the costs of reducing discharge from nonpoint sources. Water and sediment samples are collected at 16 stations, from discrete urban drainage areas, streams, and nonpoint source control sites. These samples are analyzed for metals, organics, nitrogen, and suspended solids, among other parameters. Existing hydrologic and meteorologic data, national and site-specific non-point source control effectiveness and cost data, and both point and non-point source discharge data are also being compiled.
NON-URBAN RUNOFF

Loading from non-urban runoff consists of contaminants that make their way into the Bay or Delta from agricultural lands, pastureland and forests. Contaminants in non-urban runoff are derived from the erosion of soils containing these elements, and the leaching of synthetic compounds such as pesticides. While there are currently no local studies monitoring non-urban runoff directly, data on several of the factors needed to estimate contaminant loads from non-urban runoff are being collected.

Data on soil characteristics are being gathered in the National Cooperative Soil Survey, conducted by the U.S. Department of Agriculture, in which all privately owned lands in the state are being mapped. These data are relevant to loading estimates as soil characteristics such as permeability, erodability, and texture are among the factors which must be considered in calculating the amount of sediment loss from non-urban lands. Estimates of sediment loss from various land-use types may be combined with average trace metal concentrations for those land use types to calculate loads for specific substances. This was the method used by the National Oceanic and Atmospheric Administration in their nationwide assessment of pollutant loading to coastal waters in the National Coastal Pollutant Discharge Inventory (Basta et al., 1985).

Information on the amount of pesticide applied to crops, combined with a loss factor, can be used to estimate the loading of pesticides to the Bay and Delta. The California Department of Food and Agriculture monitors the use of some pesticides and chemicals which are applied by licensed pesticide applicators through the Pesticide Use Reporting System (PURS). Information in PURS includes the crop type, and the dates, locations, and amounts of active ingredients applied.

RIVERINE INPUTS

Riverine contaminant loadings are carried into the Delta principally by the Sacramento and San Joaquin Rivers. Contaminant concentrations in the San Joaquin and Sacramento rivers are monitored by the U.S. Geological Survey in
cooperation with the U.S. Bureau of Reclamation in the Western San Joaquin Valley Hydrologic Studies Program. In this study the sources, transport and fate of selenium and other trace elements found in the San Joaquin Valley are examined. The surface water quality data are collected on the San Joaquin River at Vernalis and the Sacramento River at Freeport.

SPILLS

Spills are monitored by the U.S. Coast Guard and the California Department of Fish and Game (CDF&G). The Coast Guard Office of Marine Safety collects data on oil and hazardous material on reported spills that occur in navigable waters. Spills which occur in creeks and flood control channels are monitored by the CDF&G.

ATMOSPHERIC DEPOSITION

There are no on-going local studies conducted on the deposition of contaminants into the Bay/Delta from the atmosphere, although some historical information exists (John et al., 1973). While the Bay Area Air Quality Management District’s (BAAQMD) Air Quality Monitoring Program does not specifically consider the effects of air quality on the Bay, it has been included here as this data may be relevant to pollutant loading. The BAAQMD tests for criteria pollutants, such as ozone, carbon monoxide, NO₂, SO₂, and particulate matter at 22 stations throughout the Bay and lower Delta. A scaled-down version of this monitoring program began approximately 25 years ago, with new stations being added as needed. A special Toxics Hot Spots Monitoring Program was conducted jointly between the BAAQMD and the Contra Costa County Department of Health Services in 1987. For two months this short-term study was conducted at the request of concerned residents of Richmond; one sampling station was located in North Richmond (near the Chevron refinery), and another in Parchester Village.

C. POLLUTANT UPTAKE AND EFFECTS

This section discusses monitoring programs which collect and analyze the tissues of invertebrates, fish and birds for trace metals, organic contaminants and other parameters.
The State Water Resources Control Board is responsible for two programs involving pollutant uptake; the Toxic Substances Monitoring Program and the State Mussel Watch. In the former program, baseline conditions and trends of toxic substances in fresh water are evaluated by the analysis of fish and invertebrates. Muscle and liver tissues from fish are analyzed for selected trace elements and synthetic organic chemicals. Seven stations in the Bay/Delta are sampled once a year.

The State Mussel Watch program collects data on selected trace metals and organic contaminants in mussels and sediments. Bivalves have been examined for shell and body deformities since 1977. Sampling sites include 11 stations in San Francisco Bay, as well as stations in Morrow, and Humboldt Bays, and Cooz Bay, Oregon. Samples are routinely collected from the same sites to permit trend analysis. In addition to the routine sampling, "hot spot" monitoring at specific sites is also performed.

The National Status and Trends Program of the National Oceanic and Atmospheric Administration (NOAA), which began in the summer of 1984, is part of a nationwide monitoring program that measures contaminant concentrations in benthic organisms and sediments. In the Benthic Surveillance Project the livers of bottom-feeding fish, tissues of filter-feeding bivalve molluscs, and surface sediments are evaluated at 9 sites in the Bay for contamination by chlorinated organics, PAHs, and trace elements. Four of these sites have been sampled since the beginning of the program; the remaining 5 sites were added in 1986. The National Mussel Watch Project collects bivalves from 150 sites along the U.S. coastline during the winter months. These molluscs are analyzed for the same suite of trace elements and organic contaminants as the samples collected in the Benthic Surveillance Project.

A study of trace metal accumulation in benthos and sediments is carried out by the U.S. Geological Survey (USGS). For the past thirteen years researchers at USGS have studied trace metal accumulation in bivalves and sediments with the goal of quantifying the nature of accumulation of metals and suggesting key sources of the contaminants.
The California Department of Fish and Game is currently involved in two studies which monitor pollutant uptake and their effects on biota. The Striped Bass Health Monitoring study (a continuation of the multi-agency Cooperative Striped Bass Study), is concerned with the effects of water pollution on the striped bass population. In this program, 20 fish are collected each spring from both the Sacramento and the San Joaquin Rivers. The physiological condition of the fish and tissue concentrations of contaminants are evaluated.

The U.S. Fish and Wildlife Service studies the levels and effects of toxic contaminants in water birds. Diving ducks, terns and wading birds from South, Central, and San Pablo Bays are monitored for trace metal contaminants, most notably selenium, mercury and cadmium.

Birds, fish and invertebrates are sampled for selenium and other trace elements by the Department of Fish and Game in the Selenium Verification Study. In this statewide monitoring program 26 locations are sampled overall, with 7 of those stations located in the Bay and Delta.

D. FISHERIES

Historical data on San Francisco Bay fisheries, including striped bass, sturgeon, chinook salmon, and shad are available from the late 1800s. Annual landings of bay shrimp, Dungeness crab, oysters, clams, and mussels by the commercial fishery are also available from the late 1800 to early 1900s (Phillips, 1987). The California Department of Fish and Game (CDF&G) began tracking "party boat" catches in the early 1930s, providing data on catch per angler day from early this century to the present. In the past 20 to 30 years, long-term monitoring programs on various resident fish species and invertebrates found in the Bay and Delta have been conducted.

The Interagency Ecological Studies Program began collecting data on fisheries in 1980. Current participants in the program are the California Department of Fish and Game, the California Department of Water Resources, the State Water Resources Control Board, the U.S. Bureau of Reclamation, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey. On-going
fisheries studies overseen by the Interagency Ecological Studies Program are conducted primarily by the California Department of Fish and Game (CDF&G).

CDF&G collects data on striped bass, chinook salmon, sturgeon, American shad, crab, shrimp and plankton. Otter trawls, midwater trawls, tow and plankton nets are used to collect data on species distributions, abundance, fecundity and various other parameters. In addition, factors such as freshwater inflow, phytoplankton abundance, and position of the null zone, that regulate the population of zooplankton in the upper portions of the Estuary, are examined in the Neomysis-Zooplankton Study (see below). To assist with fishery population estimates, landing records by commercial fishermen and charter vessels are also tracked.

CDF&G carries out long-term studies on the three life-stages of the striped bass; egg/larval, juvenile, and adult. The Striped Bass Egg and Larva Study evaluates factors which are important in the early life history including phytoplankton production, food supply, water diversion, and pollutant levels. Sixty stations in Suisun Bay, up the Sacramento river to Colusa, and the San Joaquin river to Empire Tract, are sampled every 2 to 4 days from mid-April to mid-July. These studies were carried out from 1966-1973, 1975-1977 and 1984-1986. The sampling equipment was evaluated in 1987, and sampling is expected to resume in 1988.

The Striped Bass Summer Net Tow Study began in 1959 and describes the distribution and abundance of juvenile striped bass. Between 30 and 40 stations are sampled within the area bounded by Rio Vista, Stockton, Clifton Court and San Pablo Bay. Sampling occurs twice a month during the summer. The adult phase of the life cycle is studied through the Adult Bass Gill Net and Fyke Trap monitoring program which began in 1958. Adult bass are tagged daily in both the Delta and the Sacramento river in April and May, and recaptures are monitored through angler catches and a creel census in summer and fall. The abundance of adults in each year class is calculated and population size and mortality rates are estimated. In addition to these studies, predictions from mathematical models are checked against the actual abundance of both juveniles and adults.
Long-term monitoring programs have also been conducted by CDF&G on other species, including sturgeon, herring, and salmon. The Sturgeon Tagging Program was initiated in 1954. Adult white sturgeon captured in San Pablo Bay have been tagged approximately every five years during the fall. Sport fishery tag returns are used to estimate abundance, harvest and survival rates, and migration patterns.

The Pacific Herring Research Project of CDF&G conducts hydroacoustic and larval sampling surveys to determine reproductive success, recruitment levels, age and growth rates, biomass and distribution of the herring population in the Bay.

The Midwater Trawl Study measures fall and winter survival of striped bass, American shad, longfin and delta smelts, and other resident fish species. Samples are taken once a month from September to December. The area sampled includes all of San Francisco Bay, and downstream from Empire Tract on the San Joaquin River, from Rio Vista on the Sacramento River and from Clifton Court Forebay.

The Interagency Salmon Study Program, a joint project between the CDF&G and USFWS, measures the abundance of juvenile salmon to determine the effects of water diversion on the population. Beach seining usually occurs weekly or twice a month in spring, and surface trawls take place daily from April to June at Chipps Island. Approximately 50 stations total are sampled in the Delta, San Pablo Bay, and Central San Francisco Bay.

EFFECTS OF FRESH-WATER DIVERSION ON FISHERIES

The Delta Outflow/San Francisco Bay study is a multi-agency effort to determine the effects of freshwater diversion on the fishery resources of the Bay and Delta. In this study, adult, juvenile and larval stages of Chinook salmon, Dungeness crab, striped bass and shrimp are sampled to determine fecundity and survival rates. Conductivity, temperature and secchi disc readings are also taken. Monthly sampling occurs at 35 stations throughout the bay and upstream as far as the lower Sacramento and San Joaquin Rivers.
ZOOPLANKTON

The Neomysis - Zooplankton Study began in 1968 and evaluates population trends and importance to the food chain of the shrimp Neomysis by examining fecundity, food supply, light intensity, dissolved oxygen, water flow, temperature, and circulation. Eighty-six stations in the Delta, Suisun Bay, Suisun Marsh, and San Pablo Bay are sampled twice a month from March to October, and single surveys may be conducted in November, December, January, or February.

COMMERCIAL FISHERY AND CHARTER BOAT LANDINGS

Finally, CDF&G tracks fish landings from commercial fishing boats and charter vessels. The total poundage of each species caught in the San Francisco area and the retail dollar value associated with that catch are published in quarterly and annual reports. This information is maintained by the Biostatistics section of CDF&G in Long Beach, California.

E. HYDRODYNAMICS

The U.S. Geological Survey has conducted studies of estuarine hydrodynamic processes since the 1960s. In 1978, in cooperation with the National Oceanic and Atmospheric Administration, the present hydrodynamics monitoring and modeling study began. Data from 30 current meter and 11 tidal stations were gathered, measuring current speed and direction, as well as conductivity and temperature. Water levels were recorded, and for a period of time USGS operated three weather stations that measured wind speed, temperature and irradiance. Data is presently collected from South Bay and Suisun Bay. These tide and tidal current data are being analyzed using harmonic analysis, which allows data to be extrapolated beyond existing stations.

F. BENTHOS

Studies of benthic invertebrates and macroalgae are carried out by the Department of Water Resources, (DWR), Chevron USA, the U.S. Geological Survey (USGS), and the Tiburon Center for Environmental Studies (San Francisco State University). In addition to these on-going studies, a review of the
National Oceanic and Atmospheric Administration's Sediment Quality Triad has been included.

BENTHIC INVERTEBRATES AND SUBSTRATES

A baseline benthic study, which began in 1975, is conducted by the Department of Water Resources under the Sacramento-San Joaquin Water Quality Surveillance Program. Monthly grab samples are employed to estimate species composition, abundance, and substrate characteristics from five stations in the Western Delta.

A Deep Water Outfall Study was conducted by Chevron USA to assess the impacts of moving the refinery's outfall from Castro Cove to deeper water. In this study, sediments, and benthic organisms were examined for three years, and studies were conducted on fish for one year. Surface sediments were sampled twice a year, in April-May and September-October, and analyzed for organic and inorganic constituents. Benthic trawl sampling occurred monthly, and the abundance of organisms, with standard parameters such as salinity and temperature, were determined. The distribution of fish in the water column, particularly salmon and striped bass, was also evaluated.

A Benthic Community Structure study, which was conducted by researchers at USGS and has recently ended, concentrated upon the species composition and abundance of macro-invertebrates in a mudflat at Palo Alto. The effects of physical and chemical disturbance of the habitat, such as salinity, precipitation, wind velocity, Delta outflow, and the texture and stability of the sediments were examined.

The Regional Effects Monitoring Program (REM), which also recently ended, examined the environs and organisms representative of large open-water areas throughout the Bay. REM assessed the natural variation in benthic communities, including benthic infauna, and the possible chronic effects of pollutants in large, open-water areas of the Bay. Eight stations from Grizzly Island to Palo Alto were sampled bimonthly by researchers from USGS.

The REM also contained a Macroalgae component, conducted by researchers at the Tiburon Center for Environmental Studies (San Francisco Inventory of Monitoring Programs in the San Francisco Bay and Delta Page 13
In the this component, long-term changes in macroalgae were monitored to investigate relationships between macroalgae communities and water quality. From 1978-1988, samples were collected at eight sites from Suisun Bay to South Bay.

SEDIMENT QUALITY TRIAD

In 1985 the National Oceanic and Atmospheric Administration conducted the Sediment Quality Triad study. As a supplement to the National Status and Trends Program (NST), the Triad was a pilot study to assess the methodology employed for sediment analysis. Sediment bioassays were run, bulk sediment chemistry samples were analyzed, benthic community structure determined and the extent of degradation in polluted areas assessed. The chemicals analyzed were the same as those in the NST program. The 3 sampling sites, consisting of 10 stations each, were in San Pablo Bay, Oakland Inner Harbor, and Islais Creek.

G. SEDIMENTS AND DREDGING

There are no current routine monitoring programs designed specifically for sediments or dredging. Studies which include the examination of sediments, among other parameters, include the NOAA National Status and Trends Program, the Regional Effects Monitoring Program, Chevron's Deep Water Outfall, and the USGS Benthic Community Structure Study (all are discussed in the section on Benthos above). Although not designed as a monitoring program, the U.S. Army Corps of Engineers has required sediment bioassays and chemical analyses for dredging projects occurring within the Bay/Delta since 1972. Relevant data which are collected and filed with the sediment testing data and permit application include the quantity of dredged material or fill, location, site descriptions, and environmental impacts, among other parameters.

Organic contaminants in sediment and starry flounder have been examined by researchers at Lawrence Livermore Laboratory since 1982. The effects of PCBs, PAHs and other toxic organics on the reproductive success of starry flounder throughout the Bay and Delta are being studied.
H. WETLANDS

Studies involving the monitoring and mapping of wetlands are undertaken by the U.S. Fish and Wildlife Service (USFWS), the Bay Institute and the San Francisco Bay Conservation and Development Commission.

The USFWS has two programs which involve wetlands, the National Wetlands Inventory and the Diked Baylands Wildlife Study. The National Wetlands Inventory employs aerial photography to classify and map wetlands. Analysis of the digitized maps allows researchers to identify trends and produce statistics.

In the Diked Baylands Wildlife Study, 145 sites are surveyed from both the ground and air to gather data for assessment of the use of diked historic wetlands by wildlife. Observations are made at least once a month throughout the year, and more often during the wet season.

The Bay Institute has developed a computerized data management system, the San Francisco Bay Shoreline Information System, to store and process information on shoreline areas and wetlands in Marin County. The location, ownership, land use, site descriptions, (such as data on soils, geology, presence of rare or endangered species, and wetlands classification), and other parameters, are stored by tax assessor's parcels.

Permit information for development projects on the San Francisco Bay shoreline, Suisun Marsh and diked historic baylands is maintained by the San Francisco Bay Conservation and Development Commission. Data stored with the project application include the location, site characteristics, permit status, and amounts of dredge and fill, among other parameters.

I. INFLOW

The quantity and distribution of waters entering the San Francisco Bay Estuary from the Delta are estimated by the Department of Water Resources computer program DAYFLOW and monitored by the U.S. Geological Survey.
DAYFLOW estimates mean daily flows at Chipps Island and other significant locations in the Delta. Principal stream inflows, precipitation, and exports are among the data inputs to the model. The boundaries of the model are the Sacramento River at Freeport, the San Joaquin River at Vernalis and Chipps Island.

The USGS collects surface water data, including stage, discharge and water quality from a large number of major and minor streams, other water bodies, and aquifers to assess the quantity and distribution of surface water resources. Monitoring of standard water quality parameters, trace elements, nutrients, radioactive particles, sediment discharge and temperature occurs at a selected number of stations.

J. OTHER BIOLOGICAL RESOURCES

Waterfowl abundance and the locations of endangered species are monitored by the U.S. Fish and Wildlife Service, and the California Department of Fish and Game. These programs are described below.

The U.S. Fish and Wildlife Service (USFWS) conducts two studies on waterfowl abundance. The Midwinter Fowl Survey covers the 11 states which comprise the Pacific Flyway. During the first week in January for the past 30 years bird populations have been estimated. The Aerial Surveys of San Francisco Wintering Waterfowl Study, also carried out by the USFWS, consist of monthly flights over open waters and wetlands throughout San Francisco Bay and up the Delta as far as Suisun, Honker and Grizzly Bays.

The Natural Diversity Database is a statewide inventory of locations of rare, endangered and threatened animals and plants that has been developed by the California Department of Fish and Game. Documented observations from agencies, consultants and the public are included in this database, which encompasses the entire Bay/Delta.
LITERATURE CITED


APPENDIX A

DOCUMENTATION, CONTACT NAMES AND PHONE NUMBERS FOR STUDIES CITED
WATER QUALITY

Sacramento-San Joaquin Water Quality Surveillance Program:
Department of Water Resources
Contact: Harlan Proctor (916) 445-5703

Interagency Delta Health Aspects Monitoring Program
Department of Water Resources
Contact: Rick Woodard (916) 323-8896

Water Quality Monitoring Network
U.S. Bureau of Reclamation
Contact: Sandy Wagner (916) 978-5225
Documentation: None available

Selenium Speciation Studies
U.S. Bureau of Reclamation
Contact: Greg Cutter (804) 440-4285


Local Effects Monitoring Program
East Bay Municipal Utility District
Contact: Tom Selfridge (415) 465-3700
Water Quality Monitoring Program
South Bay Dischargers Authority
Contact: Marty Stevenson (408) 462-6200
Documentation: Kinnetic Laboratories, Inc. and Larry Walker Associates.

Larry Walker Associates and Kinnetic Laboratories, Inc.

Bay Benthic Studies
San Francisco Department of Public Works
Contact: Arleen Navarret (415) 296-9836
Documentation: San Francisco Department of Public Works. Bay benthic report; San Francisco Bay outfall monitoring, Southeast - Islais Creek. San Francisco Department of Public Works, Bureau of Water Pollution Control. San Francisco, CA.

Sacramento-San Joaquin Water Quality Surveillance Program: Phytoplankton
Department of Water Resources
Contact: Harlan Proctor (916) 445-5703

Phytoplankton Studies
U.S. Geological Survey
Contact: Jim Cloern (415) 354-3357

CONTAMINANT LOADING

Discharger Effluent Monitoring Data
Aquatic Habitat Institute
Contact: Jay Davis (415) 231-9539

Santa Clara Valley Urban Runoff Study
Santa Clara Valley Water District
Contact: Marty Stevenson (408) 462-6200

National Cooperative Soil Survey
U.S. Department of Agriculture
Contact: Ron Hoppes (916) 449-2872

Pesticide Use Reporting System
California Department of Food and Agriculture
Contact: Kathy Gatenby (916) 322-6074
Documentation: Annual pesticide use reports are available from the Department. The latest report covers 1985.

Western San Joaquin Valley Hydrologic Studies
U.S. Geological Survey and the U.S. Bureau of Reclamation
Contact: Bob Gilliom (916) 978-4648

Coast Guard Spills Data
United States Coast Guard
Contact: Lt. Ray Perry (415) 437-3781

Fish and Game Spills Data
Department of Fish and Game
Contact: Ryan Broderick (707) 944-2011 Bay
        Jerry Mensch (916) 355-7030 Delta
Documentation: None available

Air Quality Monitoring
Bay Area Air Quality Management District
Contact: Public Information and Education (415) 771-6000


Toxic Hot Spots Monitoring
Bay Area Air Quality Management District
Contact: Public Information and Education (415) 771-6000
Documentation: None available.

POLLUTANT UPTAKE AND EFFECTS

Toxic Substances Monitoring Program
State Water Resources Control Board
Contact: Del Rasmussen (916) 324-1261
State Mussel Watch
State Water Resources Control Board
Contact: Mike Martin (408) 624-0864

National Status and Trends Program
National Oceanic and Atmospheric Administration
Contact: Ed Long (206) 526-6338

Studies of Trace Metal Accumulation in Benthos and Sediments
U.S. Geological Survey
Contact: Sam Luoma (415) 329-4481

Striped Bass Health Monitoring Study
California Department of Fish and Game
Contact: Kevan Urquhard (209) 466-4421

Studies of Toxic Contaminant Occurrence and Effects in Water Birds
U.S. Fish and Wildlife Service
Contact: Harry Ohlendorf (916) 752-6420
Selenium Verification Study
California Department of Fish and Game
Contact: James White (209) 466-4421

FISHERIES

Striped Bass Egg and Larva Survey
Department of Fish and Game
Contact: Lee Miller (209) 466-4421

Striped Bass Summer Net Tow Study
Department of Fish and Game
Contact: Lee Miller (209) 466-4421

Adult Bass Gill Net and Fyke Trap Study
Department of Fish and Game
Contact: Lee Miller (209) 466-4421

Sturgeon Tagging Program
Department of Fish and Game
Contact: Dave Kohlhorst (209) 466-4421

Pacific Herring Research Project
Department of Fish and Game
Contact: Paul Reilly (408) 326-0324

Midwater Trawl Study
Department of Fish and Game
Contact: Lee Miller (209) 466-4421

Interagency Salmon Study Program
U.S. Fish and Wildlife Service
Contact: Patricia Brandes (209) 466-4421
Delta Outflow/San Francisco Bay Study
Department of Fish and Game
Contact: Chuck Armor (209) 466-4421

Neomysis-Zooplankton Study
Department of Fish and Game
Contact: Jim Orsi (209) 466-4421
Documentation: "Zooplankton population trends and environmental relationships." DFG Exhibit#28 submitted in the State Hearings. Department of Fish and Game, 4001 N. Wilson Way, Stockton, CA, 95205.


Commercial and Passenger Fishing Vessel Landings
Department of Fish and Game
Contact: Dixie Nowell (213) 590-5141
Documentation: CDFG. Quarterly report. Preliminary report of fish caught by the commercial passenger fishing boat fleet. California Department of Fish and Game, Long Beach, Ca.

CDFG. Quarterly report. The California commercial fish landings by region preliminary report. California Department of Fish and Game, Long Beach, CA.

CDFG. Annual Report, Table 17. California Department of Fish and Game, Long Beach, CA.

HYDRODYNAMICS

Hydrodynamic Monitoring and Modeling
Contact: Jeff Gartner (415) 853-8300


**BENTHOS**

**Sediment Quality Triad**
National Oceanic and Atmospheric Administration
Contact: Ed Long (206) 526-6338

**Sacramento-San Joaquin Water Quality Surveillance Program: Benthic Studies**
Department of Water Resources
Contact: Harlan Proctor (916) 445-5703


**Deep Water Outfall Study**
Chevron, USA
Contact: Larry Goodheart (415) 620-4145
Studies of Benthic Community Structure
U.S. Geological Survey
Contact: Fred Nichols (415) 354-3218


Regional Effects Monitoring Program: Benthic Component
U.S. Geological Survey
Contact: Larry Schemel (415) 354-3335

Regional Effects Monitoring Program: Macroalgae
Tiburon Center for Environmental Studies (San Francisco State University)
Contact: Mike Josselyn (415) 435-1717

SEDIMENTS AND DREDGING

Permitting Activities: San Francisco District
U.S. Army Corps of Engineers
Contact: Dave Hodges (415) 974-0426
Documentation: Annual report summarizing dredging activities.

Permitting Activities: Sacramento District:
U.S. Army Corps of Engineers
Contact: Art Champ (916) 551-2275
Documentation: Internal reports summarizing permit activities.
Organic Contaminants in Sediments and Fish
Lawrence Livermore National Laboratory
Contact: Bob Spies (415) 422-5792

WETLANDS

National Wetlands Inventory
U.S. Fish and Wildlife Service
Contact: Ben Harrison (504) 231-6154

Diked Baylands Wildlife Study
U.S. Fish and Wildlife Service
Contact: Ruth Pratt (916) 978-4613
Documentation: None available

Project Tracking System
San Francisco Bay Conservation and Development Commission
Contact: Alan Pendleton (415) 557-3686

San Francisco Bay Shoreline Information System
The Bay Institute
Contact: Bill Davoren (415) 331-2303
Documentation: "San Francisco Bay Shoreline Information System." Available from the Bay Institute, Schoonmaker Bldg. #120, 10 Liberty Ship Way, Sausalito, CA, 94965.
**INFLOW**

**DAYFLOW**
Department of Water Resources
Contact: Kamyar Guivetchi (916) 445-5157

**Surface Water Resources Study**
U.S. Geological Survey
Contact: John Bader (916) 978-4643

**BIOLOGICAL RESOURCES**

**Midwinter Waterfowl Surveys**
U.S. Fish and Wildlife Service
Contact: Jim Bartonek (503) 231-6162

**Aerial Surveys of San Francisco Bay Wintering Waterfowl**
U.S. Fish and Wildlife Service
Contact: Jean Takekawa (415) 792-0222

**Natural Diversity Database**
Department of Fish and Game
Contact: John Ellison (916) 322-2495
Documentation: "The California Natural Diversity Database." Available from the Department of Fish and Game 1416 9th Street, Sacramento, CA, 95814.
APPENDIX B

LIST OF BAY-DELTA MONITORING PROGRAMS BY AGENCY
AQUATIC HABITAT INSTITUTE
Discharger Effluent Monitoring Data

Bay Area Air Quality Management District
Air Quality Monitoring
Toxic Hot Spots Monitoring

California Department of Fish and Game
Commercial and Passenger Fishing Boat Landings
Delta Outflow/San Francisco Bay Study
Fish and Game Spills Data
InterAgency Salmon Study Program
Midwater Trawl Study
Natural Diversity Database
Neomysis-Zooplankton Study
Pacific Herring Research Project
Selenium Verification Study
Striped Bass Egg and Larva Study
Striped Bass Health Monitoring Study
Striped Bass Summer Net Tow Study
Striped Bass Gill Net and Fyke Trap Study
Sturgeon Tagging Program

California Department of Food and Agriculture
Pesticide Use Reporting System

California Department of Water Resources
DAYFLOW
Interagency Delta Health Aspects Monitoring Program
Sacramento San-Joaquin Water Quality Surveillance Program

Chevron, USA
Deep Water Outfall Study

City of San Francisco, Bureau of Water Pollution Control
Bay Benthic Studies

East Bay Municipal Utility District
Local Effects Monitoring

Lawrence Livermore National Laboratory
Organic Contaminants in Sediments and Fish

National Oceanic and Atmospheric Administration
National Status and Trends Program
Sediment Quality Triad

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San Francisco Bay Conservation and Development Commission
Project Tracking System

South Bay Dischargers Authority
Water Quality Monitoring Program

State Water Resources Control Board
State Mussel Watch Program
Toxic Substances Monitoring Program

Santa Clara Valley Water District
Santa Clara Valley Urban Runoff Study

U.S. Army Corps of Engineers
Permitting Activities: San Francisco District
Permitting Activities: Sacramento District

U.S. Bureau of Reclamation
Selenium Speciation Studies
Water Quality Monitoring Network

U.S. Coast Guard
Coast Guard Spills Data

U.S. Department of Agriculture
National Cooperative Soil Survey

U.S. Fish and Wildlife Service
Aerial Surveys of San Francisco Bay Wintering Waterfowl
Diked Baylands Wildlife Study
Midwinter Waterfowl Surveys
National Wetlands Inventory
Studies of Contaminant Occurrence and Effects in Water Birds

U.S. Geological Survey
Benthic Community Structure Study
Hydrodynamic Monitoring and Modeling
Phytoplankton Studies
Regional Effects Monitoring: Benthic Component
Studies of Trace Metal Accumulation in Benthos and Sediments
Surface Water Resources Study
Western San Joaquin Valley Hydrologic Studies

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APPENDIX C

LOG-ON PROCEDURE FOR THE DATA AND INFORMATION MANAGEMENT SYSTEM
San Francisco Estuary Project

and

State Water Resources Control Board

DATA AND INFORMATION SYSTEM/INFORMATION SERVICES

Bay-Delta Hearing Testimony and Exhibits Data Base
Estuarine Data Index
Bay-Delta Bibliography

The Aquatic Habitat Institute and SCI Data Systems, Inc. have developed three databases as part of the San Francisco Estuary Project’s Data and Information Management System (DIMS). The development of this on-line information service has been funded by the EPA San Francisco Estuary Project and the State Water Resources Control Board. The DIMS includes the Estuarine Data Index, the Bay-Delta Hearing Testimony and Exhibits Database, and the Bay-Delta Bibliography. The first two databases are currently available, the bibliography will be available by late summer, 1989.

The first database, known as the Estuarine Data Index, contains detailed summaries of 70 research and monitoring programs that have been, or are presently being, conducted in the San Francisco Estuary. Each summary contains an abstract, and information about methods, and quality assurance procedures. The summaries also list sampling site locations, parameters studied, references, and contain information on data storage, including contact names and telephone numbers. Each summary was verified by the principal investigator. This database was designed to be useful in enhancing coordination and communication between the scientific community, environmental managers, and the public.

The second database is the Bay-Delta Hearing Testimony and Exhibits database. The California State Water Resources Control Board is presently conducting evidentiary hearings to set water quality standards for the San Francisco
The second database is the Bay-Delta Hearing Testimony and Exhibits database. The California State Water Resources Control Board is presently conducting evidentiary hearings to set water quality standards for the San Francisco Estuary, and to consider amending water rights to implement these standards. This complex task began in 1987 with the receipt of tremendous quantities of written and oral evidence regarding the beneficial uses of the Estuary, factors that affect those uses, and means of implementing water quality objectives. The Hearing Testimony and Exhibits Database contains verbatim transcripts of the oral testimony given during Phase I of the Bay-Delta Hearings; it also contains a list of the exhibits submitted during the hearings.

A third database, due to come on-line the summer of 1989, is the San Francisco Bay-Delta bibliography. The more than four thousand entries in the database can be searched by author, title, or subject. Compiled from in-house publication lists from state and federal agencies, consulting firms, and environmental organizations, this menu-driven, user-friendly database will be a welcome addition to the DIMS.

All of the DIMS information services are menu-driven, keyword searchable, and are available to any interested party at no charge. Individuals may access the system at publicly available terminals (locations are listed in Dial-up access instructions) or by using a personal computer and modem. The modem number is (415) 643-7485. Communications software with VT-100 emulation capability is needed to log onto the system. Dial-up access instructions are attached. Public domain communications software is available from the Aquatic Habitat Institute at (415) 231-9539.
DIAL-UP ACCESS INSTRUCTIONS

for the State Bay-Delta Hearing Testimony and Exhibits Database, the Estuarine Data Index and the Bay-Delta Bibliography on the San Francisco Estuary Project Micro Vax-II Minicomputer

The following instructions are intended to serve as a general reference guide to the utilization of the Data and Information Management System of the San Francisco Estuary Project. This system contains the State Bay-Delta Hearing Testimony and Exhibits Database, the Estuarine Data Index, and the Bay-Delta Bibliography (the Bibliography will be available by late summer, 1989). The system has been installed on an EPA MICRO VAX-II minicomputer which is located at the San Francisco Bay-Delta Aquatic Habitat Institute (AHI) in Richmond, CA. The public may access the system at any one of the eight official Bay-Delta Hearing exhibit lodging locations listed in Table 1. Each location is equipped with a Digital Equipment Corporation (DEC) VT-320 video terminal and a Packard Bell 1200/2400 baud modems. Alternately, the system may be accessed using any personal computer which has telecommunication capability (i.e., a microcomputer with a 300/1200/2400 baud modem and appropriate software such as XTALK or PROCOMM).

To link one of the DEC VT-320 video terminals up with the MICRO VAX-II via a telephone line, follow the instructions below starting with Step 1.

NOTE - Within the following instructions the information to be entered through the terminal or microcomputer accessing the database is enclosed in quotation marks.

DO NOT TYPE THE QUOTATION MARKS!

If attempting to access the database with a microcomputer follow the procedure given in the appropriate telecommunication software system’s users manual to establish contact with the E.P.A’s MICRO VAX-II. The parameter settings which should be used to initialize telecommunication software systems are presented in Table 2. Once communication has been established between your microcomputer and the MICRO VAX-II follow the instructions below starting with Step 4.
Step 1: Turn on the modem and video terminal using the on-and-off switches on the back of the modem and on the lower left-hand side of the terminal monitor.

Step 2: Once the terminal's automatic startup test sequence has been completed and the 'wait' light on the keyboard goes out, type "AT" (the modem's Attention code) and press the RETURN key to "awake" the modem.

Step 3: After terminal responds with 'OK', type "ATDT phone number" and again press the RETURN key. The basic phone number is 643-7485. When dialing out through a switchboard to a public long distance telephone line use "9,1,415, 643-7485". When using a State ATSS telephone line the "phone number" should be replaced with "8,583-7485". If you are using a State telephone line in the 415 area code use "3-7485". A successful connection is indicated on the screen as 'CONNECT 2400' or 'CONNECT 1200' or 'CONNECT 300'.

Step 4: Once your video terminal or microcomputer is successfully connected to the E.P.A's MICRO VAX-II press the RETURN key once or twice and the MICRO VAX-II will request 'USERNAME:' If you are a first time user of the system, type "GUEST". If you have previously accessed the State Hearing Testimony and Exhibits database you will have been assigned a USERNAME at that time (see Step 7 explanation). Please use that USERNAME in response to the request.

Step 5: The MICRO VAX-II will next prompt you with 'PASSWORD:' If you are a first time user enter "GUEST" as your PASSWORD and then press the RETURN key. If you were given a USERNAME previously, you selected a unique PASSWORD at that time, please enter that PASSWORD in response to the 'PASSWORD' prompt and then press the RETURN key.

AT THIS POINT ALL BUT FIRST TIME USERS ADVANCE TO STEP 9.
Step 6: If you entered "GUEST" in response to the 'USERNAME:' prompt and "GUEST" in response to the 'PASSWORD:' prompt you will be asked for the following information:

FIRST NAME:
LAST NAME:
ORGANIZATION:
STREET ADDRESS:
CITY:
STATE:
ZIP:
PHONE NUMBER:

After each prompt enter the requested information and press the RETURN key. After entering all of the above information the MicroVax-II will repeat your entries and prompt you to make any necessary changes to them or to press RETURN to continue.

Step 7: Following your verification of the above information, the system will automatically assign you a USERNAME that is your "first name initial'_'last name' "

For example: Alfred Newman is assigned the USERNAME of A_NEWMAN.

Step 8: You will next be prompted to enter a 6 to 12 character long PASSWORD of your choice. You may enter any combination of 6 to 12 letters and/or numbers for your PASSWORD and then press the RETURN key. Both your USERNAME and PASSWORD should be written down at this time so that you may use them in the future to access the Data and Information Management System (DIMS).

Step 9: The system will take you directly to the Main DIMS menu, from which you can select the State Hearing Testimony and Exhibits Database or the Estuarine Data Index. Use the arrow keys to move the cursor to your selection and then press RETURN. Your selection will be loaded and further instructions will be available. Please read the information provided on each screen carefully. Following your queries of the database, select EXIT and LEAVE DIMS and the system will
automatically log you off and hang up the telephone line to which your modem is connected.

Step 10: Please turn off both the modem and video terminal before leaving.

Step 11: Please report problems or suggestions to one of the individuals listed below:

A. For assistance on the AHI-EPA computer system and/or telecommunications problems;

   Todd Featherston  
   c/o Aquatic Habitat Institute  
   180 Richmond Field Station  
   1301 South 46th Street  
   Richmond, CA 94804  
   (415) 231-9539

B. For questions relative to the State Bay-Delta Hearing Testimony and Exhibits Database and/or hearing schedules, procedures, etc.;

   Tom Tamblyn  
   State Water Resources Control Board  
   Division of Water Rights, Bay-Delta Program  
   901 P Street  
   P.O. Box 2000  
   Sacramento, CA 95810  
   (916) 445-8841 or ATSS 8-485-8841

C. For questions relative to the contents of the Estuarine Data Index or the Bay-Delta Bibliography:

   Kathryn Kramer  
   Aquatic Habitat Institute  
   180 Richmond Field Station  
   1301 S. 46th St.  
   Richmond, CA 94804  
   (415) 231-9539

6
<table>
<thead>
<tr>
<th>Address</th>
<th>Contact Person/Phone No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Water Resources Control Board&lt;br&gt;Bay-Delta Hearing Record, Room 311 B&lt;br&gt;910 P Street&lt;br&gt;Sacramento, CA 95814</td>
<td>Tom Tamblyn&lt;br&gt;(916) 445-8841 or&lt;br&gt;ATSS 8-485-8841</td>
</tr>
<tr>
<td>U.S. Environmental Protection Agency&lt;br&gt;215 Fremont Street, 6th Floor&lt;br&gt;San Francisco, CA 94720</td>
<td>Linda Sunnen&lt;br&gt;(415) 974-8076</td>
</tr>
<tr>
<td>Regional Water Quality Control Board&lt;br&gt;Oakland - San Francisco Bay Region (2)&lt;br&gt;1111 Jackson Street, Room 6040&lt;br&gt;Oakland, CA 94607</td>
<td>Michael Carlin&lt;br&gt;(415) 464-1255</td>
</tr>
<tr>
<td>Regional Water Quality Control Board&lt;br&gt;Los Angeles Region (4)&lt;br&gt;107 South Broadway, Room 4027&lt;br&gt;Los Angeles, CA 90012-4596</td>
<td>Dennis Dasker&lt;br&gt;(213) 549-5522</td>
</tr>
<tr>
<td>Regional Water Quality Control Board&lt;br&gt;Fresno - Central Valley Region (5)&lt;br&gt;3614 East Ashland&lt;br&gt;Fresno, CA 93726</td>
<td>Loren Harlow&lt;br&gt;(209) 445-5116</td>
</tr>
<tr>
<td>Regional Water Quality Control Board&lt;br&gt;Redding - Central Valley Region (5)&lt;br&gt;100 East Cypress Avenue&lt;br&gt;Redding, CA 96002</td>
<td>Jim Pedri&lt;br&gt;(916) 225-2045</td>
</tr>
<tr>
<td>Regional Water Quality Control Board&lt;br&gt;Riverside - Santa Ana Region (8)&lt;br&gt;6809 Indiana Avenue, Suite 200&lt;br&gt;Riverside, CA 92200</td>
<td>Robert Clayton&lt;br&gt;(714) 782-4130</td>
</tr>
<tr>
<td>Regional Water Quality Control Board&lt;br&gt;San Diego Region (9)&lt;br&gt;9771 Clairemont Mesa Boulevard&lt;br&gt;San Diego, CA 92124</td>
<td>Mike McCann&lt;br&gt;(714) 265-5114</td>
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### TABLE 2

Microcomputer Parameter Settings for Telecommunication Software Systems

<table>
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<tr>
<th>Parameter</th>
<th>Setting</th>
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<tbody>
<tr>
<td>Speed</td>
<td>300/1200/2400 baud</td>
</tr>
<tr>
<td>Data</td>
<td>8 bits</td>
</tr>
<tr>
<td>Port</td>
<td>COMM1</td>
</tr>
<tr>
<td>Parity</td>
<td>None</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1</td>
</tr>
<tr>
<td>Duplex</td>
<td>Full</td>
</tr>
<tr>
<td>Terminal Emulation</td>
<td>VT-100*</td>
</tr>
</tbody>
</table>

* If your telecommunications program does not support VT-100 emulation, obtain another that does support this emulation before using the system. Todd Featherston at the Aquatic Habitat Institute can supply you with a copy of PC-VT 100 at no charge.

Please mail a diskette to:

Todd Featherston  
Aquatic Habitat Institute  
180 Richmond Field Station  
1301 South 46th Street  
Richmond, CA 94804