FINAL STAFF REPORT

WATER QUALITY PROTECTION

AND

NONPOINT SOURCE POLLUTION CONTROL IN SAN FRANCISCO BAY

October, 2003

SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION

50 California Street, Suite 2600
San Francisco, California 94111
Information: (415) 352-3600
Fax: (415) 352-3606
Web site: http://www.bcdc.ca.gov
e-mail: info@bcdc.ca.gov

This report was prepared with financial assistance provided by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration.

CONTENTS

FIGURES

TABLES

APPENDICES

INTRODUCTION

Our everyday activities often leave a variety of pollutants on the surface of our streets, sidewalks, parking lots, yards, parks and school grounds including: oil and grease from motor vehicles, fertilizer and pesticides from home gardening, and loose dirt and sediment from construction activities. When it rains or when people water their lawns and gardens or wash cars, sidewalks and work areas, the water running off the land carries these pollutants to storm drains, creeks, wetlands, groundwater basins, and ultimately to the San Francisco Bay. In many instances, once polluted runoff enters constructed storm drain systems, National Pollutant Discharge Elimination System (NPDES) permits specifically regulate its discharge. This polluted runoff (called nonpoint source pollution, or NPS) can poison our waterways, damage wetland habitat, harm or kill fish and wildlife, and make water bodies unsuitable for recreation. Further, changes to the vegetation in streams and to the shape and flow of streams and other aquatic systems can also increase the type and amount of pollutants transported and be a form of nonpoint source pollution.

Nonpoint source pollution is considered one of the top threats to the Bay's ecological health and may account for a considerable proportion of the Bay's total pollutant load. In recent years, up to 40,000 metric tons of at least 65 different pollutants enter the Bay annually from urban and agricultural runoff, rivers, atmospheric fallout, municipal sewage treatment plants, industrial facilities, natural and artificial erosion, illegal dumping, dredging and dredged material disposal, marine vessel discharges, accidental spills, and landfill seepage.[1] Trace metals such as mercury and other contaminants such as polychlorinated biphenyls (PCBs), DDT, and polyaromatic hydrocarbons (PAHs) are of particular concern in the Bay, and nonpoint source pollution is considered to be a probable source for many of them.[2] Although data gaps exist on the relative contributions of different sources of pollutants to the Bay, a recent San Francisco Estuary Institute study concludes that Bay Area stormwater runoff accounts for a large proportion of regional loading of some contaminants to the Bay. Despite the data gaps preventing comparisons among pollutant pathways, the study estimated that stormwater runoff accounted for 95 percent of the cadmium, 70 percent of the chromium, 89 percent of the copper, 76 percent of the nickel, and 87 percent of the zinc pollutant loads to the Bay.[3] The terms "nonpoint source pollution," "stormwater

---

[1] San Francisco Estuary Project. Comprehensive Conservation and Management Plan (CCMP). 1992. Available online at: http://www.abag.ca.gov/bayarea/sfep/reports/ccmp/ccmp3po.html, as of 07/26/02.

[2] State Water Resources Control Board. 1999. *1998 California 303(d) List and TMDL Priority Schedule*, approved by U.S. EPA May 12, 1999 (California 303(d) list); San Francisco Estuary Project (SFEP). 1992. *State of the Estuary Report, A Report on Conditions and Problems in the San Francisco Bay Sacramento-San Joaquin Delta Estuary*. California (SFEP 1992); San Francisco Estuary Institute (SFEI). 2000. *Pulse of the Estuary Monitoring and Managing Contaminants in the San Francisco Estuary 1993-99*. Regional Monitoring Program. Richmond, California (SFEI, 2000).

[3] SFEI, 2000. *Contaminant Loads From Stormwater to Coastal Waters in the San Francisco Bay Region: Comparison to Other Pathways and Recommended Approach For Future Evaluation*. Richmond, California (SFEI, 2000(a)). The terms "nonpoint source pollution," "stormwater runoff," and "urban runoff" are not necessarily interchangeable. Nonpoint source is a comprehensive term, covering diffuse agricultural pollutants as well as urban, etc. Stormwater runoff can refer to nonpoint source pollutants that are carried by rainwater into receiving waters and

runoff," and "urban runoff" are not necessarily interchangeable. Nonpoint source is a comprehensive term, covering diffuse agricultural pollutants as well as urban, etc. Stormwater runoff can refer to nonpoint source pollutants that are carried by rainwater directly into receiving waters or into constructed stormdrain systems, where the runoff is often regulated by NPDES permits, and is not necessarily limited to urban pollutants. In this report, urban runoff refers to both stormwater runoff and non-stormwater runoff from urban uses regardless of whether it flows directly into local water bodies or into constructed storm drain systems.

The San Francisco Bay Conservation and Development Commission (Commission or BCDC) has no control or jurisdiction over the vast majority of nonpoint source pollution entering the Bay. Approximately 40 percent of the State drains into the Bay, and the Commission's jurisdiction generally extends only 100 feet landward from the mean high water line of the Bay and five feet above mean sea level in the Bay's tidal marshes, and to tidal portions of certain tributaries to the Bay, and ends at the west end of the Delta. Furthermore, even within the Commission's jurisdiction, the Commission's regulatory authority over the prevention and control of nonpoint source pollution may be limited and depends in part on the location and context of particular projects. Although the McAteer-Petris Act, Suisun Marsh Preservation Act, *Suisun Marsh Protection Plan*, and the *San Francisco Bay Plan* (Bay Plan) policies give the Commission broad authority to consider the water quality impacts and to require appropriate permit conditions for most Commission-approved projects in the Bay and Suisun Marsh, this authority may be limited in the shoreline band where many of the Commission's projects are located. Within its jurisdiction and authority, the Commission seeks to prevent nonpoint source pollutants from entering the Bay through its permit and enforcement actions and by partnering with applicants, other public agencies, such as the San Francisco Bay Regional Water Quality Control Board (Regional Board), and non-governmental organizations to carry out its Bay Plan water quality policies.

As stated in the McAteer-Petris Act, the State Water Resources Control Board and the Regional Board have the primary responsibility for coordination, control and enforcement of water quality in the San Francisco Bay, and their policies, decisions, advice and authority are the primary basis for the Commission carrying out its independent water quality responsibilities in the Bay. In recognition of the various regulatory authorities over water quality, the Bay Plan does not deal extensively with the problems and means of pollution control, but is founded on the belief that water quality in the Bay can and will be maintained at sufficiently high levels to protect the Bay's beneficial uses such as recreational boating, navigation, and wildlife, aquatic, and estuarine habitat.

One of the Commission's Strategic Plan goals is to work collaboratively with other agencies and

---

is not necessarily limited to urban pollutants. In this report, urban runoff refers to both stormwater runoff and surface runoff from urban uses (in both wet & dry weather conditions).

organizations to achieve an effective, efficient Bay-wide planning and regulatory program. In order to better protect the Bay's resources, all agencies with jurisdiction or authority over water quality must collaboratively work to prevent or reduce to the maximum extent possible nonpoint source pollution. As a state agency with authority and jurisdiction over Bay resources, the Commission plays an important role in maintaining and improving the quality of the Bay's waters and can best address nonpoint source pollution control through a comprehensive program that includes both regulatory actions and joint efforts with other agencies and organizations.

Rationale For Report, Regulatory Drivers. This report is adapted from BCDC's *Nonpoint Source Pollution Report and Work Program* (August 2001), which was developed in response to a directive from the Resources Agency and intended to be consistent with the 2000 *Plan for California's Nonpoint Source Pollution Control Program* (California Plan) and the federal requirements of the Clean Water Act (CWA) and Coastal Zone Management Act. The CWA and the Coastal Zone Management Act require states to address nonpoint source pollution. For example, when the CWA was amended in 1987, Section 319 required states to develop assessment reports that described the state's nonpoint source problems and to establish a nonpoint source management program to control or prevent the problems. In 1990, the federal Coastal Zone Act Reauthorization Amendments (CZARA) were enacted. Section 6217 of CZARA requires coastal zone management agencies such as BCDC, in consultation with state water quality agencies, to develop and implement management measures to restore and protect coastal waters from the adverse impacts of polluted runoff.

To meet these federal mandates, the State Water Resources Control Board and the California Coastal Commission prepared a 15-year plan for reducing and preventing nonpoint source pollution in California. This plan was approved by US EPA and NOAA in July 2000. The Plan expands the State's polluted runoff control efforts by identifying 61 specific management measures that provide specific goals and practices for the control of nonpoint source pollution from land use activities related to agriculture, forestry, urban areas, marinas and boating, hydromodification, and wetlands.

In February 2000, the California Resources Agency directed BCDC to implement the California NPS Plan by developing a five-year plan that identifies the implementation actions for which the Commission has authority. The California Plan lists BCDC as an implementing agency for the following categories of NPS sources: (1) urban; (2) marinas and recreational boating; (3) hydromodification (waterway alteration); and (4) wetlands and riparian areas.

In response to the Resources Agency's directive, the staff worked closely with staffs of the San Francisco Bay Regional Water Quality Control Board and other local, State and federal agencies with water quality authority and expertise to analyze BCDC's existing polluted runoff controls and developed a *Nonpoint Source Pollution Report and Work Program* consistent with the Commission's jurisdiction and authority under the McAteer-Petris Act and the Suisun Marsh Preservation Act to control nonpoint source pollution. This report and work program was adopted by the Commission in September 2001. The Commission received NOAA grants in July 2001 and 2002 to implement the Work Program tasks.

One task in the *Nonpoint Source Work Program* was to review the existing Bay Plan policies on water quality pertaining to nonpoint source pollution, which have not been updated since 1987, to determine whether and to what extent nonpoint source pollution is a water quality problem in the Bay and whether policy revisions may be appropriate. The Commission included this update in its FY01-02 Work Program, contingent on outside funding. Since adoption of the Bay Plan water quality findings and policies, scientific understanding about nonpoint source pollution in the Bay has increased; the status and trends of priority pollutants of concern in the Bay have markedly changed; and different strategies such as pollution prevention, urban runoff management and watershed management are being used now to keep pollutants from entering the Bay. Furthermore, concern over nonpoint source pollution has grown, and the State's water quality agencies have increased their focus on collaborative efforts and the implementation of management practices to prevent or reduce pollution throughout the State, including San Francisco Bay.

In July 2001 the Commission initiated a review of its water quality findings and policies with specific attention to nonpoint source pollution control. Staff's intent in developing its water quality report is to provide our Commission the information needed to revise the Bay Plan water quality findings and policies to: (1) incorporate the latest scientific understandings about nonpoint source pollution in the Bay; (2) provide needed information on the status and trends of the priority pollutants of concern in San Francisco Bay; and (3) provide greater education about nonpoint source pollution and strategies on how best to avoid or minimize its

effects. The proposed revisions pertain only to water quality findings and policies and not to the marina-related findings and policies in the recreation policy section of the Bay Plan. The analysis of marina water quality policies is a separate study staff is carrying out with other agencies and the boating community over the next two years.

Structure of This Report. The report consists of five chapters. Chapter 1 provides a general overview of nonpoint source pollution including pollutant terms, types, sources and pathways, major pollutant categories and their associated impacts. Chapter 2 discusses significant nonpoint source pollution issues in San Francisco Bay such as the pollutants of particular concern, significant watershed issues, historical and current trends, top known contamination problems, and impacts and gaps. Chapter 3 presents a brief overview of the existing nonpoint source pollution federal, state, regional and local regulations, policies, plans and programs. Chapter 4 illustrates how the Commission currently addresses nonpoint source pollution through its existing regulatory and planning framework including the Commission's jurisdiction and authority under the McAteer-Petris Act, *San Francisco Bay Plan*, the Suisun Marsh Preservation Act and Suisun Marsh Protection Plan, and through its permit conditions, enforcement efforts, plan review process, Bay Plan policies, and planning efforts. Chapter 5 describes various types of existing pollution prevention and reduction strategies and regulatory controls that are being used to address nonpoint source pollution problems such as watershed management and restoration activities, permitting programs, planning and policy development, local controls, monitoring and assessment programs, wetlands and stream protection programs, education and outreach programs, partnerships and collaborative efforts, and management measures.

CHAPTER 1
AN OVERVIEW OF NONPOINT SOURCE POLLUTION

This chapter presents an overview of nonpoint source pollution, which gives the necessary context for understanding the nonpoint source pollution issues specific to San Francisco Bay (discussed in Chapter 2). The chapter first defines the key terms used throughout the report. Next, the chapter describes pollutant types followed by pollutant sources and pathways. The chapter then introduces the six major categories of nonpoint source pollutants as identified by the U.S. Environmental Protection Agency and illustrates the connections between nonpoint source pollution and various land uses and their associated potential impacts.

Definition of Terms: Pollutants, Point Source, Nonpoint Source. Pollutants are harmful substances that when discharged into the environment adversely affect the environment's physical, chemical, and biological properties and can occur naturally or be introduced. Pollution occurs when pollutant discharges unreasonably interfere with, damage, or destroy one or more of the beneficial uses of the waters of the Bay such as recreational boating, swimming, fishing, navigation or aquatic habitat designated in the *San Francisco Bay Regional Water Quality Control Board's Water Quality Control Plan, San Francisco Bay Basin*. The federal Clean Water Act divides pollution into two types, point sources and nonpoint sources. According to the U.S. Environmental Protection Agency (U.S. EPA), a "nonpoint source" is any source of water pollution that does not meet the following definition of a "point source" specified in the federal Clean Water Act:

> …Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.[4]

Unlike pollution from distinct identifiable point sources, nonpoint source pollution comes from many diffuse sources such as motor oil and grease left on streets from motor vehicles, and loose dirt and sediment from construction activities and new development. As runoff from rainfall, snowmelt or irrigation water moves over the ground, it picks up and carries away natural and human-made pollutants and deposits them into lakes, rivers, wetlands, groundwater, and inland and coastal waters including San Francisco Bay. Nonpoint source pollution, also known as polluted runoff, is the leading cause of water quality impairments in California and the nation. According to the State Water Resources Control Board (State Board), nonpoint sources, including natural sources, are the major contributors of pollution to impacted streams, lakes, wetlands, estuaries, marine waters, and groundwater basins in California and are

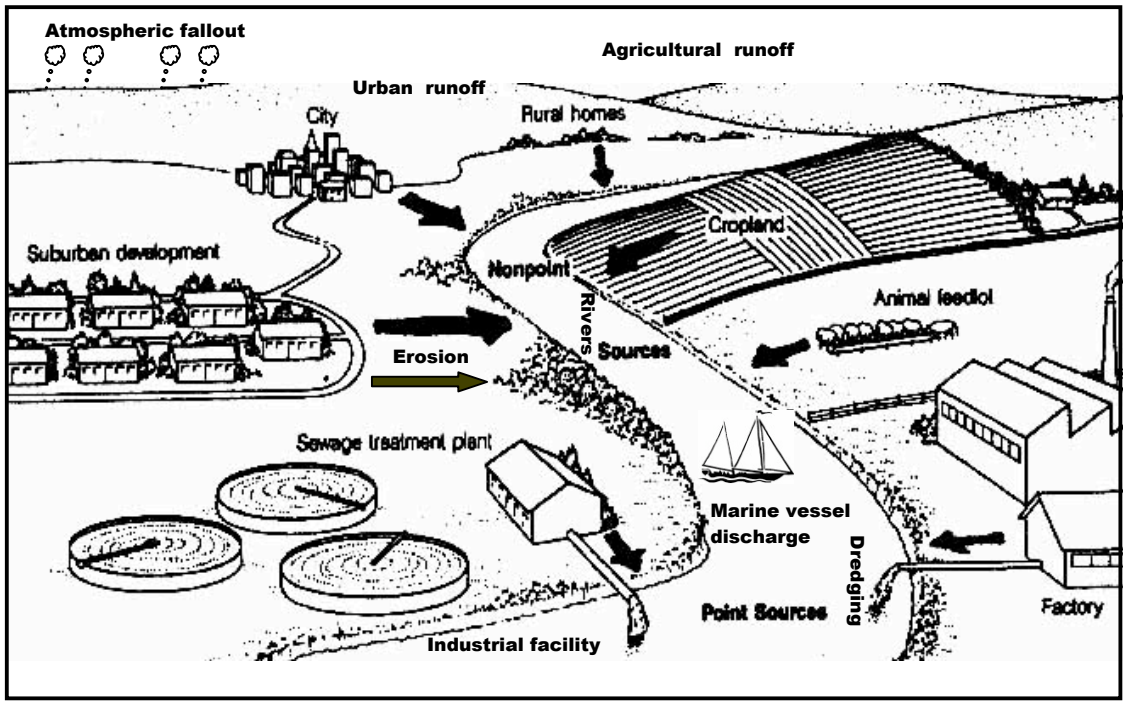
[4] Clean Water Act Section 502(14); 33 U.S.C. §1362(14).

important contributors of pollution to harbors and bays.[5] According to the U.S. EPA, metals, pesticides, polychlorinated biphenyls (PCBs), and priority organics are the most frequently identified pollutants in estuaries, harbors, and bays. Urban runoff and storm sewers are the leading source of pollution in California's coastal waters.[6]

Pollutant Types. The San Francisco Estuary Project's 1992 State of the Estuary Report (SOE) describes the four major pollutant types as: (1) inorganic chemicals, (2) natural and synthetic organic chemicals, (3) biological contaminants, and (4) suspended sediments and other particles. The most important *inorganic chemicals* are trace elements or trace or heavy metals and phosphorus and nitrogen. Trace metals occur naturally in low concentrations and can be introduced to estuaries such as San Francisco Bay in sewage and industrial effluent and urban and nonurban runoff at concentrations above background levels and in forms that are toxic. Nitrates and phosphates occur naturally at low concentrations and enable growth of algae and phytoplankton; they can be introduced at high levels in incompletely treated sewage or agricultural runoff. *Organic chemicals* include both natural and synthetic compounds, such as pesticides, plastics, fertilizers, solvents, and detergents that contain carbon. The most persistent and toxic compounds contain chlorine or bromine, such as PCBs and pesticides such as DDT.[7] *Biological pollutants* such as bacteria can harm human health and may be introduced from septic systems in untreated municipal sewage and recreational boat discharge, and in runoff from farms, feedlots and urban areas. Bacteria and viruses are of most concern in estuaries, for example, municipalities monitor fecal coliform bacteria. *Sediments and other particles* may be introduced from shorelines and rivers by natural sources such as eroding soil and decomposing plant and animal wastes, as well as by sources introduced by humans. Disturbances to the land surface, such as land development and road construction, can increase the amount of sediment transported.[8]

[5] State Water Resources Control Board and the California Coastal Commission. 2000. *Plan for California's Non-point Source Pollution Control Program*. Sacramento, California (California Plan, 2000).
[6] U.S. Environmental Protection Agency/Office of Water. 2000. *A Summary of the National Water Quality Inventory: 1998 Report to Congres*s. EPA 841-5-00-001. Washington, D.C.
[7] SFEP, 1992.
[8] SFEP, 1992.

Figure 1. Pollutant Sources and Pathways[9]



Pollutant Sources and Pathways. Pollutants can enter estuaries such as San Francisco Bay from multiple point and nonpoint sources (activities leading to the release of contaminants) and through numerous pathways (routes through which contaminants are transported) including urban and agricultural runoff, rivers, atmospheric fallout, municipal sewage treatment plants, industrial facilities, natural and artificial erosion, illegal dumping, dredging and dredged material disposal, marine vessel discharges, accidental spills, and landfill seepage. Major pathways and sources are described in Table 1 below and selected pathways are illustrated in Figure 1.

[9] Miller, 1992. Adapted from California Coastal Commission. *Procedural Guidance Manual: Addressing Polluted Runoff in the California Coastal Zone*. 1995; San Francisco Estuary Project. 1999. Pollution Fact Sheet.

Table 1. Major Pollutant Pathways and Sources[10]

Pollutant Pathways	Pollutant Sources
Urban Runoff: Rainfall, landscape irrigation, and street cleaning and other cleaning practices flush pollutants off paved surfaces such as streets, sidewalks, roofs, bridges, parking lots and buildings, mostly untreated, into storm drains, creeks and waterbodies such as San Francisco Bay	(1) Automobiles: crank case oil, tires, combustion byproducts and batteries (2) Household and garden chemicals (3) Sediments from new development, construction sites (4) Waste from commercial yards (5) Animal and human waste (6) Fertilizer or treated sewage (7) Trash, lawn clippings
Nonurban, Agricultural Runoff: Grazing, plowing, fertilizing, planting, and harvesting and rainfall and irrigation water flush pollutants from crop, pasture, park, range and forest lands through farm drains and rivers, leach pollutants from soils, untreated into waterbodies such as the Delta and San Francisco Bay	(1) Pesticides (2) Other agricultural chemicals, e.g., nutrients, salts (3) Animal wastes/confined animal facilities (4) Acid drainage from mine sites (5) Sediment from eroded soils
Rivers: Rivers act as conveyances of pollutants that originate from both point and nonpoint sources along their banks	(1) Nonurban: e.g., pesticides, agricultural chemicals, animal wastes, eroded sediment (2) Urban: e.g., sediment, household chemicals, auto-related pollutants, etc. (3) Other, e.g., industrial facilities
Atmospheric Fallout: Airborne pollutants reach the water through winds and precipitation	(1) Cars and trucks, especially diesels (2) Fossil fuels (automobiles, trucks, construction equipment) (3) Building materials and products (4) Windblown dust from roadways and construction (5) Other, e.g., manufacturing and industrial facilities, businesses[11]

[10] Adapted From San Francisco Estuary Project. San Francisco Bay-Delta Estuary Fact Sheet. March 1999 (SFEP, 1999); San Francisco Estuary Project. Comprehensive Conservation and Management Plan (CCMP). 1992. Available online at: http://www.abag.ca.gov/bayarea/sfep/reports/ccmp/ccmp3po.html, as of 07/26/02

[11] California Air Resources Board Fact Sheet: Air Pollution and Health. Updated August 24, 2001. Available online at: http://arbis.arb.ca.gov/research/health/fs/fs1/fs1.htm. as of 02/14/02.

Table 1 (cont.). Major Pollutant Pathways and Sources

Pollutant Pathways	Pollutant Sources
Municipal Sewage Treatment Plants, Industrial Facilities: Wastewater treatment plant processes cannot remove all solvents, metals or chemicals from wastewater. Current treatment practices remove at minimum 85 percent of solids and biodegradable materials, along with 40-95 percent of solvents and metals. [12].	(1) Urban: improper use and disposal of household, lawn and garden products, pool and spa chemicals (2) Petroleum refining, manufacture of agricultural pesticides and fertilizers (3) Manufacturing, shipping, storage operations (4) Equipment, vehicle, building and surface cleaning (5) Building repair and maintenance practices
Illegal Dumping/ Illicit Connections: Improper discharges of pollutants to storm drains, catch basins and other conveyance facilities and improper permanent storm drain connections that allow sanitary wastewater to enter storm drains; untreated pollutants flow to creeks and waterbodies such as San Francisco Bay	(1) Non-storm water from industrial plants: industrial process water, building waste water (2) Improper use and disposal of household liquid and solid wastes, e.g., antifreeze, oil, paint, household cleaners, detergents, yard wastes (3) Floatable debris
Accidental Spills: Spills resulting from both residential and business practices, if not properly and immediately cleaned up, can result in pollutants flowing directly into storm drains, remaining on pavement and being washed by rains into a storm drain, or remaining in the soil to become a possible groundwater pollutant. Spills from vessels can also contribute pollutants to waterbodies	(1) Industrial/commercial and light industrial facility practices: materials storage, building repair and maintenance, cleaning, landscaping (2) Vehicle service practices: changing oil, fluids, engine cleaning, washing cars, body repair, painting (3) Urban: automobile repair, painting, house-cleaning, landscaping (4) Boating practices
Dredging and Dredged Material Disposal: Dredging and disposal activities may redistribute pollutants in the dredged muds and/or release contaminants, resuspend sediment particles and increase turbidity	(1) Dredging material from shipping channels and ports

[12] Available online from http://www.epa.gov/npdes/pubs/chapt_05.pdf, Section 5.2.1, Exhibit 5.6 as of 4/24/03. Department Of Defense Handbook Nondomestic Wastewater Control And Pretreatment Design Criteria. October 30, 1998. Available online from http://www.afcesa.af.mil/Directorate/CES/Civil/WasteWtr/Wastewtr.htm, 1005_17.pdf, p. 28, as of 04/16/03.

Table 1 (cont.). Major Pollutant Pathways and Sources

Pollutant Pathways	Pollutant Sources
Natural and Artificial Erosion and Sedimentation: Erosion is the washing away of soil by wind and water. When rain strikes bare soil, topsoil is dislodged and dirt and debris are carried into storm drains and creeks in stormwater runoff. The more that land is disturbed, the more its erodability increases and the more sediment can be transported. Sedimentation is the accumulation of soil and other particles washed into waterways from land.[13] Erosion of shorelines and streambanks contributes significant amounts of NPS pollution in surface waters	(1) Sediment from new development, construction sites (2) Excavation and grading, road building (3) Bare or poorly vegetated soils, steep, unstable slopes (4) Decomposing plant and animal wastes (5) Seepage of ground water, overland flow of surface water runoff[14]
Marine Vessel Discharges: When operating and maintaining boats significant amounts of solvent, paint, oil, and other pollutants potentially can seep into the ground water or be washed directly into surface water. Discharge of sewage and waste from boats can degrade water quality[15]	(1) Discharge of untreated waste: garbage, sewage, grey water, oil (2) Motors and refueling activities, ballast material (3) Paint pigment, antifouling paints, pesticides solvents, and wood preservatives (4) Boat cleaners
Landfill Seepage, Leakage From Waste Disposal Sites, Groundwater: Pollutants can enter waterbodies such as San Francisco Bay through landfill or waste disposal seepage, or leaching and through groundwater. Old, leaking disposal sites near the estuary may contribute toxic leachate	(1) Fertilizers and pesticides (2) Urban sources, e.g., motor oil, metals, paints, solvents (3) Hazardous and municipal solid waste (4) Other, e.g., industrial and manufacturing facilities, septic tanks (5) Floatable Debris (plastics, wood, cigarette butts, etc.)

[13] California San Francisco Bay Regional Water Quality Control Board. *Erosion and Sediment Control Field Manual* .

[14] U.S. EPA. Office of Water. Streambank and Shoreline Erosion Management Measure. Available online at: http://www.epa.gov/owow/nps/MMGI/Chapter6/ch6-4.html, as of 02/14/02.

[15] Although this information is included as part of the background information on nonpoint source pollution , marinas and boating-related nonpoint source pollution is not a focus of this report.

Six Major Categories of Nonpoint Source Pollutants. The U.S. EPA has identified the following six categories of nonpoint source pollutants, which are also included in the California Plan: (1) Urban Runoff, (2) Agricultural Runoff, (3) Forestry Runoff, (4) Marinas and Recreational Boating, (5) Hydromodification, and (6) Alteration of Wetlands and Riparian Areas. This report focuses on four of these nonpoint source categories over which the California Plan specifically identifies BCDC as an implementing agency: (1) urban runoff, (2) marinas and recreational boating, (3) hydromodification, and (4) wetlands and riparian areas. This section emphasizes the connections between nonpoint source pollutants, land uses and everyday activities and their associated impacts. Because BCDC does not have jurisdiction or regulatory authority over the prevention or control of pollution from agricultural land uses and forestry practices, and because in the highly urbanized San Francisco Bay area these are not the dominant land uses, this report does not focus on these categories. Also, the "Marinas and Recreational Boating" category is included as background in this general overview chapter, but because BCDC is currently undertaking extensive efforts as part of its Nonpoint Source Work Program to work collaboratively to identify and address specific marina-related issues of concern in San Francisco Bay and to help determine whether and to what extent marina-related nonpoint source pollution is a problem in San Francisco Bay, it is not a focus of this report.

1. **Urban Runoff: Problems and Impacts.** U.S. EPA's latest national water quality inventory states that runoff from urban areas is the leading source of water quality impairments to surveyed estuaries.[16] The ways that people use their homes, gardens, cars and businesses directly affect the quality of the environment. Every year, Americans illegally dump 120 million gallons of used oil-11 times the amount of the Exxon Valdez spill-on the ground, down storm drains and in the trash.[17] Each year in California, over 20 million gallons of used motor oil is disposed in an unknown manner by do-it-yourself (DIY) oil changers, which equates to nearly 1 gallon of DIY used oil improperly disposed of for every adult.[18] Gardeners use up to 10 times more toxic chemicals per acre than farmers.[19] Landscapes that contain naturally vegetated areas such as grasslands and wetlands allow water to filter slowly into the ground and groundwater. When these areas are converted to land uses that have increased areas of impervious surface, such as paved roads and buildings, increased runoff volumes and pollutant loadings, as well as changes to the physical, chemical, and biological characteristics of the watershed are likely to occur. How much water runs off depends on the slope and permeability (the rate water passes through

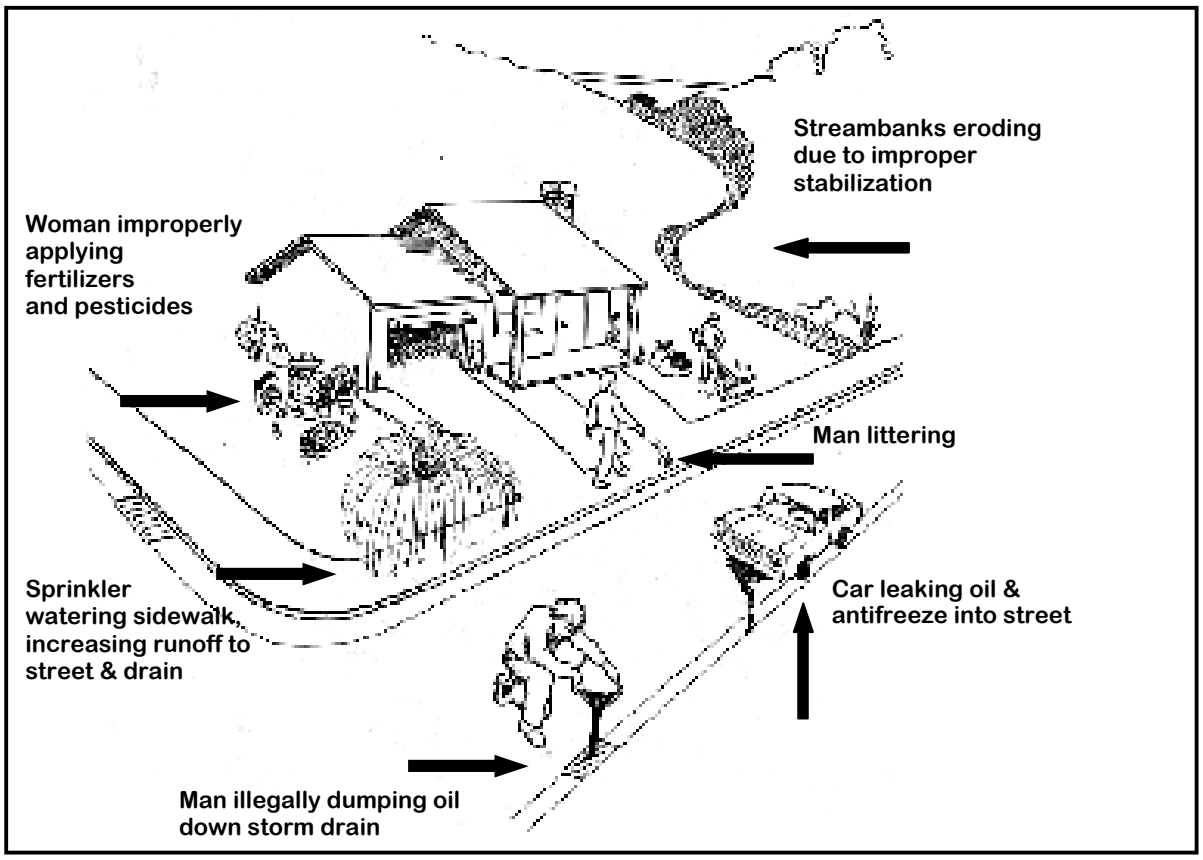
[16] U.S. EPA, 2000.
[17] San Francisco Estuary Project, 1993. *Estuarywise*, page 10.
[18] California Integrated Waste Management Board. Used Oil Facts. Available online at: http://www.ciwmb.ca.gov/Publications/default.asp?cat=17, as of 07/10/02.
[19] Mayer, Jim. 1995. Changing the Course of California's Water: The Impact of Polluted runoff on our Aquatic Resources and Responsible Actions We Can Take. The Lindsay Museum, Walnut Creek, California. (Lindsey Museum, 1995).

soil) of the land surface. Urban landscapes such as roads, bridges, parking lots, and buildings don't allow runoff to percolate slowly into the ground, and water quickly runs off transporting pollutants to stormdrains, creeks, wetlands, and bays.[20] Pollutants from autos, road surfaces and parking areas are a significant source of water pollution. Pollutants such as oil and grease, antifreeze, and metals accumulate in stormwater as they pass over impervious road surfaces, and are rapidly transported to water bodies.[21] (See Figure 2)

Land development activities such as grading or construction can also result in changes to the hydrology such as widening of stream channels and subsequent changes to the water depths, resulting in increased streambank erosion, increased sediment loads and damage to vegetation, all of which can have severe impacts on native fish and other aquatic life.[22] New building and land development projects could potentially generate sediment levels 10-20 times greater than agricultural lands despite these projects being site-specific and of limited duration.[23] These types of activities could also remove native vegetation, riparian areas and wetlands and expose graded areas to erosion by wind and water, which carry sediment to waterways.

[20] U.S. Environmental Protection Agency. Undated. Nonpoint Source Fact Sheet #1: Pointer No. 7: *Managing Urban Runof*f. EPA841-F-96-004G, available online at: www.epa.gov/owow/NPS/facts/point7.htm, as of May 4, 2001. (U.S. EPA Fact Sheet #1)
[21] State Water Resources Control Board. Polluted Runoff Watershed Solutions. Undated. (State Board, undated).
[22] Undated. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Water*s. Ch. 4. Washington, D.C. Available online at: www.epa.gov/owow/NPS/MMGI/Chapter4/index.html., as of May 14, 2001. In U.S. EPA MM Ch. 2,4,5, or 6. (U.S. EPA MM Ch.4).
[23] State Board, undated.

Figure 2. Urban Landscape and Urban Runoff Pollution[24]



In addition to increased volume of runoff, the types and amounts of pollutants that are transported also increase in urban areas. Urban areas are contributors of NPS pollutants such as heavy metals, for example copper from auto brake linings, hydrocarbons from oil and grease, nutrients from fertilizer, sediment from development and new construction sites, pesticides from gardens and landscapes, and pathogens from animal and human waste. Through complex systems of pipes, outfalls, and storm drains, most of these pollutants flow directly into creeks and rivers without treatment, eventually ending up in waterbodies such as the San Francisco Bay. According to the U.S. EPA, sediments and solids constitute the largest volume of pollutant loads to receiving waters in urban areas.[25] These types of pollutants can have myriad negative impacts on watershed ecosystems. Metals such as copper, mercury, and zinc are often toxic to fish and wildlife, bind to sediment and settle out, are consumed by clams and oysters and are passed up the food chain. High concentrations can cause cancer, nerve disorders, and birth defects in humans. Sediment can clog streams,

[24] Environmental Protection Agency. Office of Wetlands, Oceans, and Watersheds. Revised October 15, 1997. Available online at: http://www.epa.gov/owow/nps/kids/whatwrng.htm, as of July 26, 2002.
[25] U.S. EPA Fact Sheet #1.

choke fish, reduce sunlight, and harbor other pollutants. Pesticides can accumulate in the tissues and organs of fish and wildlife. Pathogens such as bacteria can cause health threats, threaten recreational uses, and contaminate shellfish.[26] See Table 2 for an overview of general types of urban runoff pollutants, sources and impacts.

2. **Marinas and Recreational Boating: Problems and Impacts.** An individual boater's contribution to the overall pollution problem may appear to be small, but considering there are over 960,000 registered boats in California (180,000 of which are in the nine San Francisco Bay Area counties) the total contributions can be significant.[27] Simply tossing out oily bilge water, cleaning a boat or flushing a boat's head could be polluting waters. Unlike developments further ashore, a marina can be a direct conduit for pollutants; a marina's polluted runoff will not be filtered through land or through riparian vegetation and may reach a water body in a more concentrated form. According to the U.S. EPA, common pollutants that might be generated at a marina or enter a marina basin include "nutrients and pathogens, (from pet waste and overboard sewage discharge), sediments (from parking lot runoff and shoreline erosion), fish waste (from dockside fish cleaning), petroleum hydrocarbons (from fuel and oil drippings and spills and solvents), toxic metals (from antifoulants [used for barnacle control] and hull and boat maintenance debris), and liquid and solid wastes (from engine and hull maintenance and general marina activities)."[28] Examples of some common pollutants include lead from fuel and ballast material, arsenic in paint pigment, pesticides and wood preservatives, zinc from anodes, and copper and tin biocides in antifouling paint.[29] The U.S. EPA has also identified the following sources for boating and marina pollutants: poorly flushed waterways, boat maintenance, discharge of sewage from boats, storm water runoff from marina parking lots, and the physical alteration of shoreline, wetlands, and aquatic habitat during the construction and operation of marinas.[30]

---

[26] Lindsay Museum, 1995.
[27] California Department of Boating and Waterways. Available online at: http://www.dbw.ca.gov/PDF/VesselReg/Vessel01.pdf., as of 04/05/02, data as of December 31, 2001.
[28] U.S. EPA MM Ch. 5.
[29] State Board, undated.
[30] U.S. EPA. Fact Sheet #2: Pointer No. 9: *Managing Nonpoint Source Pollution From Boating and Marina*s. EPA841-F-96-004I, available online at: www.epa.gov/owow/NPS/facts/point9.htm. , as of May 4, 2001. (U.S. EPA Fact Sheet #2).

Table 2. Urban Runoff: Pollutants, Sources and Impacts

(Adapted from BCDC, 2001, BCDC 1999 and California Coastal Commission, 1995)

Pollutant Type/ Stressor	Sources	Potential Impacts
Heavy or Trace Metals, (e.g. Mercury, Copper, Nickel, Zinc, Selenium)	Motor fuel and exhaust Auto brake linings Leachate from landfills Illegal hazardous waste disposal/spills Consumer products Construction materials Naturally in soil	Disrupt fish reproduction Bioaccumulation in fish tissues and can be passed up the food chain Human health concerns: eating contaminated fish can cause brain damage, birth defects and miscarriages
Petroleum Hydrocarbons	Runoff from roads, parking lots, driveways Fluid and air emissions from motor vehicles (e.g., fuel, oil, grease, exhaust, brake-lining particles) Leaking underground storage tanks Accidental spills Illegal dumping	Toxic to aquatic life at low concentrations Highly persistent Alter reproduction and feeding behavior of marine organisms
Nutrients (e.g., nitrates and phosphates)	Improperly sited/maintained septic tanks Treated or partially treated sewage Garden and roadside fertilizers Pet excrement Landscaping practices	Fish kills and diseases Destruction of bottom-dwelling habitats Algae blooms Increase turbidity, which can impact recreational activities Human health problems from nitrates in drinking water
Sediments and Other Particles	Erosion from land clearing, development, grading, construction, natural processes Dredging Stream channelization	Fill of marshes Smother aquatic spawning and feeding areas Destroy wetland habitats Reduce fish populations Increase dredging needs Increase turbidity, which can impact recreational activities Transport or harbor pollutants
Synthetic Organic Chemicals (e.g. DDT, PCBs)	Household cleaners Paints Pesticides and herbicides Plastics Solvents Detergents	Reduce populations of desirable organisms Tendency to persist and bioaccumulate in the food chain Behavioral and structural changes Destroy food sources for higher-order organisms Acute or chronic effects in aquatic organisms
Bacteria & Pathogens	Improperly sited/maintained septic tanks Leachate from landfills Untreated municipal sewage Pet excrement	Contaminate drinking water supplies, shellfish beds, recreation areas Hepatitis or other infections Beach closures, limit recreational activities such as swimming, boating, surfing or diving, prohibitions on shellfish harvesting
Physical Parameters (Freshwater, Salinity, Temperature, Dissolved Oxygen)	Habitat alteration (e.g., land clearance, removal of vegetative cover, stream channelization) Increased freshwater runoff from new/existing impervious surfaces and stormwater drains Industrial discharges Decaying organic matter (e.g., garden trimmings)	Habitat loss Soil dispersion Deplete oxygen, which can cause reproductive problems in fish, alteration of aquatic species composition, destruction of benthic habitats Fish kills

Water pollution from boating and marinas can have numerous potential environmental impacts including: "high toxicity in the water; increased pollutant concentrations in aquatic organisms and sediments; increased erosion rates; increased nutrients, leading to an increase in algae and a decrease in oxygen (eutrophication); and high levels of pathogens."[31] Furthermore, construction at marinas can create reduced water circulation from the installation of docks or breakwaters, introduce pollutants, and result in the physical destruction of sensitive ecosystems and bottom-dwelling aquatic communities. The discharge of sewage, gray water, and waste into the Bay from commercial and recreational marine vessels can affect water quality. According to the Department of Boating and Waterways, "a weekend boater flushing untreated sewage into the water produces the same bacterial pollution as that of 10,000 people whose sewage passes through a treatment plant."[32] Sewage effluent can be a source of coliform bacteria, which can cause severe health problems, stimulate algae growth and have negative impacts on recreational opportunities. Excess fish waste can also stimulate algae growth and cause water quality problems.[33] Boat maintenance activities are often responsible for washing significant amounts of solvent, paint, oil, and other pollutants directly into surface water. The chemicals and metals in antifouling paint can limit bottom growth. Chlorine and phosphates found in many boat cleaners can harm plankton and fish. Petroleum hydrocarbons from fuel, oil, and grease tend to attach to waterborne sediments and tend to persist in aquatic ecosystems and to harm mussels, oysters or other bottom-dwelling organisms.[34] U. S. EPA emphasizes that siting and design of marinas are two of the most significant factors impacting marina water quality and that poorly planned marinas can disrupt natural water circulation and cause shoreline soil erosion and habitat destruction.[35] Table 3 describes typical marina and boating-related pollutants, sources and impacts.

[31] U.S. EPA Fact Sheet #2.
[32] This quote is from Kevin Atkinson at the Department of Boating and Waterways, at an interagency meeting on May 1, 2001 in Sacramento.
[33] U.S. EPA Fact Sheet #2.
[34] U.S. EPA MM Ch. 2.
[35] U.S. EPA Fact Sheet #2.

Table 3. Marinas and Recreational Boating: Pollutants, Sources and Impacts
(Adapted from BCDC 2001, BCDC, 1999 and California Coastal Commission, 1995)

Pollutant Type/ Stressor	Sources	Potential Impacts
Nutrients and Pathogens (e.g., Bacteria and Viruses)	Fecal coliform in sewage discharged by recreational and commercial boats Excess fish waste from dockside fish cleaning Pet wastes	Coliform bacteria can cause severe health problems such as Hepatitis Stimulates algae growth Limit recreational activities such as swimming, boating, surfing or diving Lower oxygen water levels Fish kills and diseases
Heavy or Trace Metals, (e.g. Mercury, Copper, Nickel, Zinc, Selenium), Chlorine, Phosphates	Boat operation, construction, maintenance and repairs Application of antifouling paints, pesticides, wood preservatives, and biocides Hull pressure washing Fuel additives Boat cleaners	Disrupt fish reproduction Destruction of bottom-dwelling habitats Bioaccumulation in fish tissues and can be passed up the food chain Human health concerns: eating contaminated fish can cause brain damage, birth defects and miscarriages
Petroleum Hydrocarbons	Refueling activities (fuel, oil, and grease) Bilge or fuel discharges Oil spills Runoff from parking areas Engine and hull maintenance	Toxic to aquatic life at low concentrations Attach to waterborne sediments and harm mussels, oysters, other bottom dwelling organisms Highly persistent Alter reproduction and feeding behavior of marine organisms
Shoreline Erosion and Sediment and Habitat Disruption	Marina construction and siting operations Natural wave activity and wave generation from boats (e.g., propeller wash/agitation) Dredging Parking lot runoff	Accelerate erosion (shearing and sloughing of streambanks), washes away fringe plants and animals Increase stream temperature Increase wetland habitat/riparian vegetation losses Increase need for additional dredging and maintenance of ports, marinas and recreational boat areas Increase transport of pollutants
Physical Parameters: Dissolved Oxygen, Water Circulation	Organic matter in sewage discharged by recreational ar commercial boats High sediment chemical oxygen demand Poor flushing (from improper marina design) Marina construction, e.g., installation of docks or breakwaters	Habitat loss Soil dispersion Deplete oxygen, which can cause reproductive problems in fish, alter aquatic species composition, destruction of benthic habitats Fish kills and diseases Reduce water circulation

3. **Hydromodification: Problems and Impacts.** According to the California Plan, hydro-modification (waterway alteration) includes modification of stream and river channels, dams and water impoundments, and streambank/shoreline erosion. Channel modification, such as straightening, widening, deepening, or relocating channels, is often undertaken for the purpose of flood control, navigation, drainage improvement, and reduction of channel migration potential.[36] When areas are paved and roofed, the volume of stormwater flow increases and has higher peak flows, and groundwater filtration is often prevented, which can result in downcutting, stream widening and channelization.[37] Channel modifications can deprive wetlands and estuarine shorelines of enriching sediments, make riparian habitat for fish and wildlife unsuitable, alter the rates and paths of sediment erosion, transport and deposition, reduce the availability of fresh water, alter the instream water temperature, and through the hardening of banks, increase the velocity of NPS pollutants from the upper reaches of watersheds into coastal waters.[38] Flow alterations can negatively affect a wide variety of living resources such as streamside vegetation, riparian habitat, and historic plant and animal communities. Restricted flows can also impede the movement of fish or other aquatic life. Table 4 provides a description of the general types of pollutants, sources and impacts associated with hydromodification activities.

[36] U.S. EPA MM Ch. 6.
[37] State Board, undated. p. 22.
[38] California Plan, 2000.

Table 4. Hydromodification: Pollutants, Sources and Impacts
(Adapted from BCDC 2001, California Coastal Commission, 1995; California Plan, 2000)

Pollutant Type/ Stressor	Sources	Potential Impacts
Physical Parameters: Fresh Water, Salinity, Temperature	Flow alterations: diversions, withdrawals, impoundments Flood protection levees and dams Channelization Drainage improvements	Habitat loss Impede movement of fish or other aquatic life Deplete oxygen, which can cause reproductive problems in fish, alteration of aquatic species composition, destruction of benthic habitats Fish kills and diseases Reduce water circulation
Sediment and Habitat Alteration	Increased streambank and shoreline erosion Sediment delivery changes from channeling Channel modification activities: straightening, widening, deepening or relocating channels Draining and filling wetlands Removal of native vegetation that stabilizes slopes Construction of impervious surfaces	Deprive wetlands and estuarine shorelines of enriching sediments Increase turbidity, which can limit recreational activities Make riparian habitat for fish and wildlife unsuitable Alter rates and paths of sediment erosion, transport and deposition Increase need for dredging Reduce availability of fresh water Alter stream temperature Increase transport of pollutants
Overbank Area Contact Disruption	Instream hydraulic changes Dam construction	Reduce water contact in over-bank areas and pollutant filtering by streamside vegetation and soils Affect wetland drainage, groundwater quantity, erosion

4. **Wetlands and Riparian Areas: Benefits and Problems.** Wetlands are intermittently or permanently flooded areas that are the link between land and water and can perform many functions that help prevent NPS pollution from degrading water quality. They can intercept runoff, filter, transform and store NPS pollutants like sediment, nutrients, and certain heavy metals without being degraded, keep stream channels intact by slowing runoff, protect against channel scour and streambank erosion, and regulate stream temperature by providing streamside shading.[39] Wetlands and riparian areas reduce polluted runoff by filtering out runoff-related contaminants such as sediment, nitrogen and phosphorus.[40] Wetlands are critical to the

[39] U.S. EPA Fact Sheet #3: Pointer No. 11: *Managing Wetlands to Control Nonpoint Source Pollution*. EPA841-F-96-004K, available online at: www.epa.gov/owow/NPS/facts/point11.htm., as of May 4, 2001 (U.S. EPA Fact Sheet #3).
[40] California Plan, 2000.

survival of numerous plants and animals, and those degraded by excessive pollutant loads can no longer provide important water quality benefits, often become significant sources of NPS pollution and can result in decreased oxygen in the water, making habitat unsuitable for fish and other aquatic life.[41] Vegetated treatment systems such as artificial or constructed wetlands and other vegetated landscapes remove sediment and other pollutants from runoff and wastewater and can prevent pollutants from entering waterbodies such as the San Francisco Bay. As indicated in the 2000 California Plan, activities such as hydromodification, highway construction, and excavation for ports and marinas can result in impaired wetlands. Table 5 below, provides a description of typical types of pollutants, sources, and impacts associated with wetlands and riparian areas.

Table 5. Wetlands and Riparian Areas: Pollutants, Sources and Impacts
(Adapted from BCDC 2001, California Coastal Commission, 1995; California Plan 2000)

Pollutant Type/ Stressor	Sources	Potential Impacts
Urban Areas	Development and highway construction Filling wetlands Channelization Surface mining	Increase sediment and pollutant runoff Siltation Destroy wetland/riparian ecosystems
Physical Parameters: Dissolved Oxygen, Water Circulation	Decaying wetland vegetation Excess nutrients Changes to water flows: more frequent inundation, increased turbidity	Increase Biological Oxygen Demand Make habitat unsuitable for fish and other aquatic life Release stored nutrients and other chemicals
Hydromodification	Channel modification activities: straightening, widening, deepening or relocating channels Draining and filling wetlands Construction of impervious surfaces, e.g., highways Deposition of dredged material Excavation for ports and marinas	Impair ability of wetlands/riparian areas to filter out excess sediment and nutrients and to buffer receiving waters from the effects of polluted runoff Change species composition

[41] U.S. EPA Fact Sheet #3.

CHAPTER 2
NONPOINT SOURCE POLLUTION IN SAN FRANCISCO BAY

This chapter discusses the significant nonpoint source pollution issues in San Francisco Bay. First, information is provided on the San Francisco Estuary and on what's known about the extent of pollution and the estimated pollutant loads to San Francisco Bay. Next, this section presents the pollutants of particular concern and describes issues related to the Bay's status as an impaired waterbody. Then, the specific pollutant categories and associated pollutants of concern are described, followed by significant watershed issues in the Bay. Next, historical, current, and long-term trends are covered, followed by nonpoint source pollution impacts. Finally, the chapter concludes with information on gaps and further research needed.

San Francisco Estuary. The San Francisco Bay Estuary is made up of approximately 1,600 square miles, including 700 square miles of rivers and sloughs and 1,100 miles of levees. The Estuary is comprised of San Francisco Bay, San Pablo Bay, Suisun Bay and the Sacramento-San Joaquin Delta, and the Bayshore extends for 275 miles at mean sea level.[42] The Estuary drains about 40 percent of California's land (over 60,000 square miles) and 47 percent of the state's total runoff. The Bay has a total water volume at mean high tide of over five million acre feet.[43] The Bay receives 90 percent of its freshwater from the Sacramento and San Joaquin Rivers and 10 percent from the watershed surrounding San Francisco Bay. More than 8.4 million people live and work in the 12-county Bay-Delta region.[44] The Bay can be divided into four subregions: the North Bay, Central Bay, South Bay, and Suisun Bay

While San Francisco Bay, San Pablo Bay, and Suisun Bay (and others) are part of BCDC's jurisdiction, the Sacramento-San Joaquin Delta is not. However, it is important to consider the Bay in the context of the larger Estuary, including the Delta, because so much of the drainage and associated nonpoint source pollutants transported to the Bay come from Sacramento and San Joaquin Rivers, the Delta and the surrounding watersheds. Indeed, many the pollutants of concern elsewhere in the Estuary are also pollutants of concern in the Bay. Furthermore, much of the watershed information available is based on the Bay-Delta Estuary as a whole, of which the Bay is an important part.

[42] SFEP, 1999.
[43] An "acre foot" is the amount of water needed to cover an acre, one foot deep in water, which is equal to 325,851 gallons. Available online at: www.tpwd.state.tx.us/texaswater/sb1/primer/primer1/wf-acrefoot.htm., as of 07/11/02.
[44] SFEP, 1999.

Extent of Pollution, Estimated Pollutant Loads. According to the San Francisco Estuary Institute's Regional Monitoring Program, although some contaminants are reduced from peak levels seen in earlier decades, the level of contamination in the Bay today is high enough to impair the health of the ecosystem. San Francisco Bay is considered moderately impaired.[45] Although there is a serious lack of data on total pollutant loading into San Francisco Bay, it is estimated that in recent years, up to 40,000 metric tons of at least 65 pollutants enter the Bay annually from urban and agricultural runoff, municipal wastewater treatment plants, industrial facilities, dredging, chemical spills, and atmospheric deposition (see Chapter 1 and Table 7). Due to factors such as growth and development, that quantity has presumably increased. Pollutants have been detected in the Bay's water, sediment and organisms. These pollutants are widespread and reach their highest concentrations in harbors, marinas, industrial waterways and at effluent discharge sites.[46]

Rural and urban runoff are considered to contribute the greatest quantity of trace elements to the Bay. Each year, 88 million pounds of pesticides and toxic chemicals enter the Bay from sources such as roads, lawns, farms, construction sites, and abandoned mines.[47] Urban runoff is considered to be a major source for oil and grease while municipal and industrial point sources are considered to contribute large quantities of cadmium, mercury and silver.[48] Urban runoff is estimated to contribute 19,000 to 160,000 kilograms of copper per year to the Bay and Delta compared to 19,000 to 30,000 kilograms for municipal and industrial effluent.[49] Although many data gaps exist in the Bay Area on the relative contributions of different sources of pollutants to the Bay, a recent SFEI study concludes that Bay Area stormwater runoff accounts for a large proportion of regional loading of some contaminants to the Bay. Despite data gaps preventing comparisons among pathways, the study estimated that stormwater runoff accounted for 95 percent of the cadmium, 70 percent of the chromium, 89 percent of the copper, 76 percent of the nickel, and 87 percent of the zinc pollutant loads to the Bay.[50] (See Table 6) Most of these metals are not included on the 2002 303(d) list for San Francisco Bay water bodies (e.g., copper and nickel have been de-

[45] San Francisco Estuary Project. 2000. *State of the Estuary 2000 Restoration Primer, San Francisco Bay, Sacramento-San Joaquin River Delta Estuary*. California. p. 8 (SFEP 2000(b)).
[46] SFEP Pollution Fact Sheet, 1999; Comprehensive Conservation and Management Plan (CCMP), Chapter 2, State of the Estuary. Available online at: http://www.abag.ca.gov/bayarea/sfep/reports/ccmp/ccmpch2.html, as of August 1, 2002.
[47] Save San Francisco Bay Association, 2001.
[48] CCMP, Chapter 2, State of the Estuary.
[49] SFEP Pollution Fact Sheet, 1999.
[50] SFEI, 2000(a).

listed and included on a watch list). In a 1997 metals study, urban nonpoint pollutant sources were estimated to contribute 53 percent of the total load of copper, 39 percent of the total load of mercury, and 13 percent of the total load of nickel to the Bay.[51]

In addition to runoff, other pathways are considered to contribute large quantities of pol_lutants to the Bay. Effluent discharges (point sources), which refer to municipal publicly owned treatment works (POTWs)-facilities that receive and treat sanitary waste-and industrial effluent, are considered to be a potentially significant pathway to the Bay for two high priority pollutants: selenium and organophosphate pesticides. Dredged material disposal is considered to be a minor pathway for pollutant loading to the Bay, and copper is the only pollutant where that pathway may be significant.[52] Although there is a lack of understanding of contaminant loads from rivers to the Bay, because few data are available on contaminant transport during individual storms that transport large proportions of total loads, this type of loading is considered to be significant for mercury, selenium, nickel, silver and registered pesticides and possibly significant for PCBs, PAHs, copper, and cadmium.[53] Tables 6 and 7 below provide estimated pollutant loads to the Bay (and Delta for Table 7) for various contaminants from several pollutant pathways, many of which lack the data to enable comparisons between pathways. There is insufficient loading data on many of the pollutants of concern in the Bay (see section below) such as mercury, selenium, PCBs, PAHs, DDT, Diazinon, and Dioxins, and they are not included in Table 6.[54] However, because Total Maximum Daily Loads (TMDLs) are required to be developed for all of the listed impaired waterbodies in San Francisco Bay (see section below), many individual pollutant loads will likely be estimated as part of setting the TMDL. For example, pollutant loads have been estimated for mercury as part of the development of a Mercury TMDL in the San Francisco Bay region. The best estimate for mercury loading for all segments of San Francisco Bay is 1,220 kilograms per year. The majority of this loading is believed to come from legacy sources associated with historic mining operations in the South Bay (e.g., New Almaden), the

[51] Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997. *Metals Control Measures Plan: Volume 1.* Prepared by Woodward Clyde Consultants, EOA, Inc. and Michael Drennan Associates. California.
[52] SFEI, 2000(a), p. 53, 61.
[53] SFEI, 2000(a), p. 65.
[54] The pollutants where data were insufficient to calculate loads include: BOD, COD, CBOD, Nitrite-N, Ammonia-N, Total phosphorus, Lead, Mercury, Selenium, Total PCB, Total PAH, Total DDT, Total Chlordane, Dieldrin, Chlorpyrifos, Diazinon, Dioxins, Total coliform, Fecal coliform, Enterococcus, and MTBE. SFEI, 2000 (a). p. 64.

North Bay, and the Sierra Foothills. The largest mercury loadings to the Bay come from sediments transported by the Sacramento River. Additionally, remobilization of historically polluted sediments may be another substantial source of mercury.[55]

According to the 2003 Mercury TMDL Report, about 1,220 kg of mercury enters San Francisco Bay annually from sources including bed erosion (about 460 kilograms per year (kg/yr)), the Central Valley watershed (about 440 kg/yr), urban stormwater runoff (about 160 kg/yr), the Guadalupe River watershed (about 92 kg/yr), direct atmospheric deposition (about 27 kg/yr), non-urban stormwater runoff (about 25 kg/yr), and wastewater discharges (about 19 kg/yr). San Francisco Bay also loses mercury from sediment transport to the ocean through the Golden Gate (about 1,400 kg/yr), from the removal and disposal of dredged material (about 150 kg/yr net) and from evaporation from the Bay surface (about 190 kg/yr).[56]

[55] *Watershed Management of Mercury in the San Francisco Bay Estuary: Total Maximum Daily Load Report to U.S. EPA.*. San Francisco Bay Regional Water Quality Control Board. August 1, 2000. p. 19,20.
[56] *Mercury in San Francisco Bay Total Maximum Daily Load (TMDL) Project Report*. Bill Johnson, Richard Looker. California Regional Water Quality Control Board, San Francisco Bay Region. June 6, 2003. p. S-1, 13.

Table 6. Estimated Annual Pollutant Load to San Francisco Bay From Four Pollutant Pathways[57]

Pollutant	Total Load (kg/year)	Runoff (% and kg/year)	Effluent Discharges (% and kg/year)	Atmospheric Deposition (% and kg/year)	Dredged Material Disposal (% and kg/year)
Suspended Solids	320,000,000	98 % 313,600,000	2.4 % 7,680,000	ND	0
Nitrate-N	4,500,000	33 % 1,485,000	67 % 3,015,000	ND	ND
PO4-P	1,500,000	34 % 510,000	66 % 990,000	ND	ND
Cadmium	2,400	95 % 2,280	3.4 % 81.60	1.5 % 36	0
Chromium	57,000	70 % 39,900	2.3 % 1,311	1.6 % 912	26 % 14,820
Copper	74,000	89 % 65,860	8 % 5,920	1.5 % 1,110	1.6 % 118,400
Nickel	64,000	76 % 48,640	7.5 % 4,800	.95 % 608	15 % 9,600
Zinc	320,000	87 % 278,400	11 % 35,200	ND	2.5 % 8,000

[57] Adapted from SFEI's *Contaminant Loads From Stormwater to Coastal Waters in the San Francisco Bay Region: Comparison to other pathways and recommended approach for future evaluation.* September 2000 (SFEI, 2000(a)). As depicted in this table, runoff refers to all water entering the Bay from local watersheds that results from rains and flows through natural, modified or constructed drainage lines. This table includes results from 14 POTWs and 6 industrial discharges. Many of the pollutants are not depicted on the table because no data is available or the data available is insufficient. ND = no data available or insufficient data. It should be noted that this study included coastal areas discharging to the Pacific Ocean and thus runoff loadings may be biased upward. The relative proportion of pollutants in storm water runoff would likely shift downwards as a result. Also, the estimates are considered ranges rather than point estimates. Due to variation in rainfall, for example, loads in any one year may vary by plus or minus 50 percent. The study also emphasizes a high amount of uncertainty and variability but notes that the load estimates generated are in good agreement with regional estimates previously reported for the Bay.

Table 7. Estimated Annual Pollutant Loads to San Francisco Bay and Delta[58]

Pollutant	Urban Runoff (kg)	Municipal & Industrial Effluent (kg)	San Joaquin River (kg)	Sacra-mento River (kg)	Total Nonurban Runoff[59] (kg)	Atmospheric Deposition (kg)	Dredged Material (kg)
Arsenic	2,700-25,000	1,500-5,500	12,000	ND	27,000-330,000	ND	ND
Cadmium	800-8,200	1,800-4,000	ND	ND	1,400-16,000	400-1,000	20-200
Chromium	8,200-41,000	12,000-13,000	66,000	ND	370,000-4,200,000	ND	ND
Copper	19,000-160,000	19,000-30,000	80,000	ND	140,000-1,600,000	5,200-8,500	1,000-10,000
Lead	82,000-680.000	11,000-16,000	51,000-55,000	ND	85,000-980,000	16,000-57,000	1,000-10,000
Mercury	100-400	200-700	ND	200	400-4,700	ND	10-100
Nickel	ND	19,000-27,000	51,000	ND	ND	ND	2,000-20,000
Selenium	ND	2,100	4,200	1,100	ND	ND	ND
Silver	ND	2,700-7,200	ND	ND	ND	ND	ND
Zinc	93,000-730,000	77,000-80,000	164,000-175,000	ND	350,000-4,000,000	ND	3,000-30,000
PCBs	20-1,100	ND	ND	ND	ND	ND	.67-6.7
PAHs	1,400-14,000	ND	ND	ND	ND	2,200-13,000	50-470
Hydro-carbons	3,100,000-30,000,000	ND[60]	ND	ND	ND	120,000	ND

[58] Adapted from San Francisco Estuary Project Pollution Fact Sheet. March 1999. Spills are not included in this table because no loading data was available for any pollutant except for hydrocarbons, estimated at 26,000 kilograms. ND = no data available or insufficient data.

[59] As depicted in this table, "nonurban runoff" refers to runoff from crop, pasture, park, range and forest lands as well as eroded sediment and acid drainage from mines.

[60] Numbers for oil and grease may be comparable to urban runoff loads.

Table 8: Pollutant Types and Pollutants of Concern in San Francisco Bay

Pollutant Type	Pollutants of Concern in San Francisco Bay
Trace Metals	Mercury, Copper, Nickel, Zinc, Selenium
Organic Chemicals	PCBs, Diazinon, Chlorpyrifos, DDT, Chlordane, Dieldrin, Dioxins, Polyaromatic Hydrocarbons (PAHs)
Biological Pollutants	Bacteria, Viruses
Sediments and Other Particles	Mercury, Copper, Lead, Chromium, Zinc, PCBs, DDTs, Chlordanes and PAHs

Pollutants of Particular Concern. In Chapter 1, the four major pollutant types were introduced and include inorganic chemicals, organic chemicals, biological pollutants and sediments and other particles. In Table 8 the specific pollutants of concern in the San Francisco Bay are listed for each pollutant type.

California's 303(d) List, TMDL Priorities, Beneficial Uses. Under Section 303(d) of the federal Clean Water Act (CWA), states must list surface waters not attaining water quality standards despite implementation of best practicable control technology, and states must perform a Total Maximum Daily Load (TMDL) for all waters on the 303(d) list, which essentially establishes the maximum allowable amount of pollution a waterbody can accept and allocates it among existing and potential sources. Point and nonpoint sources continue to impair the ability of San Francisco waterbodies to support the Regional Board's Basin Plan's formally designated beneficial uses for the Bay such as areas of special biological significance, warm and cold freshwater habitat, wildlife habitat, estuarine habitat, marine habitat, navigation, water contact and non-contact recreation, and municipal and domestic supply, that are the ultimate goals of protecting and achieving high water quality as stated in BCDC's Bay Plan.[61]

[61] *San Francisco Bay Plan*. Water Quality Policy #2, page 17.

Impaired Waterbodies: Pollutants, Sources and TMDL Priorities. The San Francisco Bay is considered to be an impaired waterbody and is included on California's 2002 303(d) list because it exceeds certain water quality standards for trace metals such as mercury and for other contaminants and carcinogens such as polychlorinated biphenyls (PCBs), chlordanes, DDT, diazanon, exotic species, selenium, and pathogens. The list includes water bodies, pollutants/stressors, potential sources, and priorities for developing TMDLs. In the Carquinez Strait, Richardson Bay, central San Francisco Bay, lower San Francisco Bay, south San Francisco Bay, San Pablo Bay, and Suisun Bay, two of the main pollutants/stressors that have a high TMDL priority and are partially attributed to nonpoint sources are mercury and PCBs. Richardson Bay has also been listed for high coliform count. Specifically, Waldo Point Harbor has been identified as the affected area, and substandard sewage systems in some houseboat areas have been identified as the source. This is considered a low TMDL priority due to an extensive local control program in place with significant water quality improvements.[62] The Napa and Petaluma Rivers have been listed for sedimentation/siltation with medium TMDL priorities as well as for nutrients and pathogens, with medium and low TMDL priorities. Sources may include agriculture, construction/land development, and urban runoff/storm sewers. The tidal portion of the Petaluma River has also been listed for nickel, among other pollutants such as tributyl tin and zinc, with potential sources of municipal, urban runoff/storm sewers, and atmospheric deposition. This is considered a low TMDL priority. The Suisun Marsh wetlands are listed for metals, nutrients, organic enrichment/low dissolved oxygen, and salinity, all low TMDL priorities. Sources may include agriculture, urban runoff/storm sewers, and flow regulation/modification.[63] Further, most urban creeks and some sloughs in the Bay Area (e.g., Alameda, Calabazas, Corte Madera, Coyote, Novato, San Francisquito, Saratoga, Stevens, Suisun Slough) have been listed for diazinon with potential sources of urban runoff/storm sewers. These are considered high TMDL priorities. (See Figure 3).

There are currently no existing TMDLs for the San Francisco Bay Region, but many are currently being developed including sediment for Napa River, Sonoma Creek, and San Franciscquito Creek, mercury and PCBs for San Francisco Bay, mercury for Guadalupe River and tributaries, and diazinon for 35 Bay Area urban creeks. Several changes to California's 2002 303(d) list from the 1998 303(d) list included de-listing many segments of the Bay for copper and nickel and listing tidal portions of Petaluma River for nickel; and creating a watch list for pollutants and waterbodies that may have some data, but the data are inadequate to draw conclusions, or where a regulatory program is in place but successes are inconclusive.. As an example, copper, nickel, PAHs, and Polybrominated Diphenyl

[62] California 303(d) list.
[63] California 303(d) list.

Ethers (PBDEs) are included for Carquinez Strait, Lower and South San Francisco Bay, San Pablo Bay and Suisun Bay. Trash is also on the monitoring list for all urban creeks and lakes and shorelines in the San Francisco Bay Area. See the section below on Other Contaminants and Concerns pertaining to the de-listing of copper and nickel.

Significant Water Quality/Watershed Issues. The Regional Board staff, working in each of the Bay Area watersheds on core regulatory programs, nonpoint source management and on other areas such as contracts and grants management, technical assistance, or public education and outreach, have identified significant issues for each of the nine Bay Area county watershed management areas: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma. These issues have been summarized into a table, included in the Regional Board's January 2002 *Watershed Management Initiative Integrated Plan Chapter*, that comprises four main categories of issues and the county watershed management areas affected by each issue. The four categories include: (1) Urban Runoff, (2) Wetlands and Stream Protection, (3) Impacts From Point Source Pollutants, and (4) Nonpoint Source Pollutants. To illustrate, for the category of Nonpoint Source Pollutants, contaminated sediments for Islais and Mission Creeks and resolution of potential sediment impairment are issues for San Francisco and Santa Clara, while pesticides in urban streams is an issue for all nine county watershed areas. For the category Urban Runoff, stream and wetland impacts from new and re-development including erosion, and changes in the hydrograph are issues for all nine county watershed areas. Water quality impacts from industrial and commercial site development is an issue for all of the county watershed areas except San Francisco. This table is included in Appendix A of this report.

Specific Pollutant Categories and Associated Pollutants of Concern. This section describes the specific pollutants of concern in San Francisco Bay and where appropriate, demonstrates evidence of local concern for the following nonpoint source categories: urban runoff, hydromodification and alteration of wetlands and riparian areas.

1. **Urban Runoff**

   a. **Urban Runoff and Trace Metals in San Francisco Bay.** Urban runoff is considered to be a source for many trace elements in the Bay. Many areas within the Bay have particularly high sediment concentrations of copper, lead, chromium, and zinc, including historic military bases and areas adjacent to Publicly Owned Treatment Works (POTWs) and storm sewer outfalls.[64] Copper and cadmium, toxic to many organisms in low concentrations, have been found to be unusually bioavailable in the Bay. Significant amounts of silver have been found in the South Bay. Studies on trace metals in water frequently exceed state water quality objectives for copper, lead, mercury, nickel, and tributyltin, and in sediments, extremely high concentrations of pollutants have been found at some sites, particularly harbors, harbor entrances, marinas, and industrial waterways.[65]

   b. **Urban Runoff and Other Contaminants in San Francisco Bay.** PCBs have been detected in sediments Baywide, with significantly elevated concentrations observed adjacent to historically industrialized areas along the Bay margin. Despite being banned for many years, DDT and its derivatives persist throughout the Bay-Delta ecosystem, and elevated levels of hydrocarbons are found adjacent to POTWs and storm sewer outfalls, as well as some North Bay refinery outfalls and fueling docks.[66] Many pollutants are most concentrated in the South Bay, in the Delta, off the Richmond/Berkeley shore or near effluent discharge sites. Levels of some pollutants (for example, mercury and PCBs) found in animal tissues exceed alert levels.[67] Fecal coliform bacteria are commonly found in urban runoff and may result in health hazards for swimmers and surfers at high concentrations. For example, immediately following storms, bacteria counts in portions of the East Bay shoreline

[64] San Francisco Estuary Project. 1992. Pollution Fact Sheet. Available online at: www.abag.ca.gov/bayarea/sfep/reports/fact/pollute.html., as of May 14, 2001. (SFEP Fact Sheet, 1992).
[65] SFEP, 1992.
[66] SFEP Fact Sheet, 1992.
[67] See for example, Office of Environmental Health Hazard Assessment health advisory on catching and eating fish interim sport fish advisory for SF Bay, due to health concern based on exposure to sport fish from the Bay contaminated with elevated levels of methylmercury, PCBs, dioxins, and pesticides such as DDT. http://www.oehha.ca.gov/fish/nor_cal/int-ha.html.

waters have increased one thousandfold.[68] Studies on stormwater runoff from urbanized locations in the Estuary determined that most samples were toxic to test organisms Toxicity was attributed primarily to residential, business, and local government use of organophosphate pesticides such as diazinon.

c. **Concern Over Urban Runoff in San Francisco Bay.** The most compelling evidence that the U.S. EPA and the State are very concerned about NPS pollutants from urban runoff in the San Francisco Bay is the inclusion of these sources on the State 303(d) and TMDL priority list. For example, for urban creeks in the Bay Area, urban runoff/storm sewers are listed among the sources for diazinon. Additionally, the Regional Board's 1995 Basin Plan cites stormwater runoff, surface runoff and urban runoff as significant sources of water pollution in San Francisco Bay. Although many data gaps exist in the Bay Area on the relative contributions of different sources of pollutants to the Bay, a recent SFEI study concludes that Bay Area stormwater runoff accounts for a large proportion of regional loading of some contaminants to the Bay.[69] Furthermore, beach closures and advisories in the Bay Area have occurred and have been attributed to polluted stormwater runoff among other sources. In the year 2001, there were 68 beach closures/advisories for San Francisco County, including coastal areas, and 30 closures/advisories in the year 2000.[70]

   Increased growth and urbanization in the Bay Area will likely increase the amount of pollution in the Bay. According to the Association of Bay Area Governments (ABAG) 2002 projections, by 2025, the population of the Bay Area will exceed 8.2 million people -- an increase of over 1.4 million from its current level.[71] Land use change in the Bay Area has been and will likely continue to consist of conversion of rural and agricultural lands to urban uses. Greenbelt Alliance reports that as many as 490,000 acres of Bay Area open space may be lost in the next 30 years.[72] One

[68] SFEP, 1992.
[69] SFEI, 2000(a).
[70] July 2002. Natural Resources Defense Council, *Testing the Waters A Guide to Water Quality at Vacation Beaches*, p. 30, 49. In San Francisco, beach closures and advisories are attributed to combined sewer overflows that occur subject to provisions of a NPDES permit.
[71] Available online at: http://www.abag.ca.gov/abag/overview/pub/p2002/summary.html, as of 09/06/02.
[72] Available online at: http://www.greenbelt.org/downloads/resources/report_smartinfill.pdf, as of 09/06/02.

consequence of urban development in the Bay Area is increased impervious land surfaces, which can cause accelerated runoff and increased intensity of flood peaks in stream channels, which can result in greater erosion and pollution entering the Bay (see Chapter 1).[73]

d. **Local Concern Over Urban Runoff in San Francisco Bay.** Local concern over urban runoff is evidenced by programs developed in response to the U.S. EPA Phase I storm water regulations such as Alameda County Clean Water Program (ACCWP), the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCV URPPP), the City of San Jose, and Marin County Stormwater Pollution Prevention Program (MC STOPPP) as well as other local efforts. These county programs represent the primary effort to control nonpoint runoff in the Bay Area. Tests by the ACCWP on creek flows and stormwater runoff throughout Alameda County show that "runoff often contains enough household pesticides (diazinon, chlorpyrifos) to kill the zooplankton that provide food for fish. Some creek waters contain copper, lead, and zinc in concentrations that could possibly affect aquatic life."[74] Studies in Santa Clara County show that except for nutrients, urban runoff is the major source of many trace elements, biochemical oxygen demand, and total suspended solids in South Bay tributaries.[75] The goals and objectives of the City of San Jose's first flush monitoring project included identifying sectors in San Jose with the greatest pollutant loads and collecting and analyzing samples from major storm drain outfalls to identify the presence and relative magnitude of pollutants in different sectors of the stormwater system. As one component of the City of San Jose's Urban Runoff Management Plan, the City has targeted investigations on areas identified as high priority, including construction activities. In its 1999-2000 Annual Report, the City reported incidences of increased construction sediment discharges and anticipated revisions to its grading ordinance in FY 2000-2001. The MC STOPPP's Action Plan 2005 recognizes that various receiving waters adjacent to Marin County, such as Central San Francisco Bay, Richardson Bay and San Pablo Bay are impaired for various pollutants. The Marin County stormwater agencies plan to

[73] SFEP 1992. *The Effects of Land Use Change and Intensification on the San Francisco Estuary*, p. 55.
[74] Alameda County Clean Water Program (ACCWP). Not dated. *The Next Five Years, Stormwater Management Plan Summary, July 1996 through June 2001*. Prepared by EOA, Inc., Oakland, California. (ACCWP Plan).
[75] SFEP, 1992.

participate in the Regional Board's TMDL development and implementation process.[76] Additionally, the fact that there are a number of urban creek programs in the Bay Area, many of which conduct water quality monitoring, also demonstrate this concern. (See Chapter 5 for a description of Oakland's creek program efforts).

2. **Hydromodification (Waterway Alteration)**

   a. **Concern Over Hydromodification in San Francisco Bay: San Pablo Bay.** There is evidence of concern over the pollutant potential of hydromodification activities, modification of stream and rivers and streambank/shoreline erosion, within San Francisco Bay. The Napa and Petaluma Rivers have been listed for sedimentation/ siltation on California's 303(d) list. A San Pablo Bay Watershed Restoration Study, a joint effort between the Coastal Conservancy, U.S. Army Corps of Engineers, and a San Pablo Bay watershed scoping committee, states that the San Pablo Bay watershed has experienced increased soil erosion, stream channel degradation, loss of riparian and oak woodland habitat, and declining groundwater values, and that declines were in part due to waterway modification and increased pollution. The Study identified dredging and waterway degradation, including waterway modifications such as navigation channels, flood control levees, and armored streambanks and shorelines, and erosion and sedimentation, including soil, surface, and channel erosion, among the issues of highest concern to San Pablo Bay's watershed health.[77]

   b. **Napa River Watershed.** Additionally, the Napa County Resource Conservation District has developed a Napa River Watershed Owner's Manual as an integrated resource management plan to address problems on a watershed basis. The Manual states that "identification of the Napa River by the U.S. EPA and the Regional Board as a priority pollutant contributor to San Pablo Bay has emphasized the need for proper management of the watershed to control sediment and other nonpoint sources of pollution in the watershed. In addition, the implementation of the Coastal Zone Management Act Reauthorization Amendments of 1990, and the State Nonpoint Source Pollution Management Program will address land management practices in the watershed in order to control pollutant loading (chiefly sediment) in the River and San Pablo Bay."[78] The Manual contains two relevant hydromodification objectives: promote stream stabilization using natural processes and reduce soil erosion. As a result of being "incised," or having its channels cut deeply into its

[76] Marin County Stormwater Pollution Prevention Program (MCSTOPPP). *2000. Stormwater Management Action Plan 2005*, first draft, April 24, 2000, prepared by EOA, Inc. California. (MCSTOPP, 2000).
[77] U.S. Army Corps of Engineers. 1999. *San Pablo Bay Watershed Restoration Study* Project Study Plan. Available online at: http://www.spn.usace.army.mil/sanpablobay/, as of August 1, 2002. Coastal Conservancy. California.
[78] Napa County Resource Conservation District. Undated. *Napa River Watershed Owner's Manual: An Integrated Resource Management Plan*. Napa, California. (Napa RCD Plan).

floodplains, many Napa Valley streams have increased water velocity, resulting in increased bank failures and sediment production, as well as widely distributed pollutants in the sediment. Soil erosion and resulting sedimentation are among the most serious threats to the long term health of the ecosystem. Streambank erosion is one of the most significant contributors of sediment to the Napa River and is most relevant to hydromodification. This erosion can be attributed in part to anthropogenic sources such as land management practices, changes in hydrology, changes in infiltration rates, hardened surfaces and diversions.[79] Specific objectives include: reduce streambank instability and erosion; reduce soil erosion resulting from urban and residential development, which is increasingly a significant source of soil erosion and sedimentation; minimize new road construction, which is one of the major sources of soil erosion, sediment production and habitat loss in the watershed; and manage public areas to minimize soil disturbance and threats of erosion.[80] Additionally, Napa County is currently preparing a Storm Water Management Program in response to Phase II storm water regulations.

3. **Alteration of Wetlands and Riparian Areas**

   a. **Concern Over Wetlands and Riparian Areas in San Francisco Bay.** There is clearly concern over the alteration of wetlands and riparian areas and in promoting their preservation and restoration in the San Francisco Bay area. This is best illustrated by the recent sale to the State of 16,500 acres of South Bay salt ponds for restoration. Further concern is evidenced by the 1999 *Baylands Ecosystem Habitat Goals Report,*[81] which was prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project, and is intended to be a guide for restoring and improving the baylands and adjacent habitats of San Francisco Bay, many of which are wetlands. This Goals Report serves as a regional template and vision for habitat restoration and recommends major habitat changes all over the region primarily by protecting and restoring areas of tidal marsh (vegetated wetlands subject to tidal action) within each of the regions, sub-regions (North Bay, Suisun, Central Bay and South Bay) and segments within sub-regions of the Bay. Furthermore, BCDC has been active and continues to be actively involved with the Goals Project as well as other wetland restoration efforts such as the San Francisco Bay Area Wetlands Restoration Program, which seeks to help implement the Goals recommendations by supporting and facilitating the recovery of wetlands and

[79] Napa RCD Plan.
[80] Napa RCD Plan.
[81] Goals Report, 1999. *Baylands Ecosystem Habitat Goals*. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency, San Francisco, CA/San Francisco Bay Regional Water Quality Control Board, Oakland, CA.

streams in the San Francisco Bay Area, and has also issued multiple permits for wetland restoration and marsh creation projects.[82]

BCDC has also stressed the importance of wetlands protection, enhancement and restoration in both unpublished staff planning background reports,[83] prepared for the North Bay Wetlands and Agriculture Protection Program, and in its 2001 Habitat Report[84] as well as in its updated Bay Plan policies on tidal marshes and tidal flats. The North Bay Program was a voluntary partnership between BCDC and eight local governments in the San Pablo Bay area intended to provide local governments with the tools and information needed to ensure the protection, enhancement, and restoration of North Bay wetlands. As evidenced in the polluted runoff report, wetlands play an important role in protecting water quality, "thus we need to protect water quality in order to protect wetlands, and protect wetlands in order to protect water quality."[85] This report indicates the various impacts polluted runoff containing sediment, heavy metals, hydrocarbons, synthetic organic materials and bacteria can have on wetlands and points out the harm from modifying wetlands. For example, new development can impact or destroy wetlands and altering wetlands can contribute to polluted runoff. One of the key strategies the report recommended for reducing polluted runoff is protecting riparian areas and vegetation, which can help reduce the impacts of polluted runoff and erosion, allow surface water to infiltrate the soil, and trap and filter soil particles carried by stormwater runoff.

Additionally, there is clearly local concern over preserving wetlands and riparian areas, as evidenced by such studies and plans as the City of San Jose's Riparian Corridor policy study and draft Riparian Restoration Action Plan, as well as through its stormwater controls and outreach and education programs. The purpose of the Plan is to provide a comprehensive policy framework for restoring degraded portions of the 35 streams located within San Jose's Urban Service Area. The Plan delineates current stream conditions and identifies potential restoration activities to improve riparian corridors for water quality and wildlife habitat enhancement.[86] The City also promotes the use of engineered vegetated treatment systems

---

[82] For example, the Commission issued a permit to CA Department of Fish and Game and East Bay Regional Park District to restore wetlands at the Eden Landing Ecological Reserve in Alameda County to restore 1,000 acres of inactive salt evaporation ponds to tidal marsh and managed seasonal wetlands. The Commission also issued a permit to Montezuma Wetlands, LLC to use dredged materials to restore 1,782 acres of tidal wetlands. BCDC 2001 Annual Report, p. 10.

[83] Planning background reports: 1999. BCDC. *Polluted Runoff in the North Bay Planning Area;* 1997. BCDC. *Wetlands in the North Bay Planning Area.*

[84] BCDC, 2001. *San Francisco Bay Ecology and Related Habitats*. p. 40.

[85] BCDC, 1999.

[86] City of San Jose, 2000. City of San Jose Urban Runoff Management Plan-Annual Report 1999-2000, San Jose, California. p. 44.

such as constructed wetlands or vegetated filter strips (Management Measure 6C) through the incorporation of stormwater controls, such as the use of vegetated swales and inlet filters, into project designs.

Historical and Current Trends. After a brief overview of the historical pollutant trends, this section then describes the top known contamination problems in the Bay followed by some long-term pollutant trends. Historically, efforts to reduce pollution to the Bay have focused on treating discharges rather than on pollution prevention or examining the use of toxic chemicals. Additionally, the focus of pollution control efforts in the Bay has changed over the years. The Federal Water Pollution Control Act of 1948, for example, created programs to build wastewater treatment plants to address pollution caused by untreated industrial and sewage wastes. After World War II, the introduction and increased use of synthetic organic compounds resulted in new threats to the Bay while scientific investigations revealed previously unknown historic pollution impacts.[87] For example, during and after the Gold Rush, over seventy thousand tons of mercury was produced in Coast Range cinnabar mines, and its legacy can still be seen today from remote and local watersheds.[88]

Between 1940 and 1975, little advanced waste treatment was employed to remove contaminants, and contaminant concentrations rapidly increased due to growing discharges from industrial and urban sources. By 1970, high concentrations of sediment-bound mercury, silver, lead, copper, DDT and PCBs were exposing estuarine organisms, and impacts were clearly evident in the food web. Between the mid-1970s and the present, nutrient loading and some contaminant inputs declined, mainly due to advances in wastewater treatment, increased regulation of toxic chemicals and the halting of mining and other industrial practices. However, some historical contamination is still being redistributed. For example, PCB, DDT, and PAH concentrations can still be found in sediments and have not declined to the extent of some other contaminants; PCBs are still found in upper trophic level birds and fish; selenium concentrations are increasing, and contamination problems still threaten upper trophic level birds and fish; and although banned for most uses in California in 1988, TBT still remains a concern due to recent implementation.[89] As of 1991, up to 40,000 tons of at least 65 pollutants were discharged each year into the Bay and Delta from sources such as urban and agricultural runoff, municipal wastewater treatment plants, industrial facilities, dredging, chemical spills, and atmospheric deposition , and this number has presumably increased due to population growth and urbanization.[90] Today, toxic chemicals are of primary concern. The greatest sources are untreated urban and agricultural runoff.

---

[87] SFEP, CCMP, Chapter 2. Available online at: http://www.abag.ca.gov/bayarea/sfep/reports/ccmp/ccmpch2.html, as of August 1, 2002.
[88] San Francisco Estuary: Achievements, Trends and the Future SOE Conference Abstracts, "The View From Downstream: The Past, Present and Future of Mercury in San Francisco Bay, Dr. Khalil E. Abu-Saba. p.15.
[89] SFEP, *State of the Estuary 1992-1997* (SFEP SOE 1992-1997). p.41.
[90] SFEP, Pollution Fact Sheet. March 1999.

Top Known Contamination Problems in San Francisco Bay. Although water quality pollution from odors, algal blooms and low oxygen has largely been eliminated from the Bay due to the reduction of conventional pollutants to the Bay, much of the Bay is threatened or impaired by combinations of different pollutants such as trace elements, organochlorines and other synthetic pesticides, and petrochemical hydrocarbons.[91] Compared to background or reference sites, pollutants occur at elevated levels in the San Francisco Bay's waters, sediments, and biota. The San Francisco Estuary Institute's Regional Monitoring Program (RMP) data suggests that the following contaminants are of the greatest concern in the Bay: mercury, PCBs, diazinon and chlorpyrifos, copper, nickel, DDT, chlordane, dieldrin, dioxins, and PAHs.[92] The San Francisco Estuary Institute (SFEI)'s RMP reports the top known contamination problems as high levels of mercury and PCBs in fish and water and reports that monitoring sites in the lower South Bay, Petaluma and Napa River mouths, San Pablo Bay and Grizzly Bay are more contaminated than other sites, with the South Bay sloughs particularly contaminated.[93] The largest input of mercury is likely from mining and from upstream rivers, with the second largest input likely from erosion and resuspension of contaminated sediments already in the Bay, such as during construction and new development in the Guadalupe River floodplain in the South Bay.[94] As indicated earlier in this section, the majority of mercury loading is believed to come from legacy sources associated with historic mining operations in the South Bay (e.g., New Almaden), the North Bay, and the Sierra Foothills. In fish, PCBs and pesticides were determined to be highest in white croaker and shiner surfperch. PCBs have been known to negatively affect the starry flounder's reproduction in the Central Bay as well as cormorant eggs and harbor seals. Fish from the Oakland Harbor contained higher contaminant concentrations than other locations, especially for PCBs and chlordanes.[95] According to the United States Geological Survey (USGS), 10,000 to 50,000 kilograms of PCBs are already present in Bay sediments, not including hot spots or other sources.[96] Additionally, toxic water and sediments are considered large problems in the Bay. Concentrations of mercury, PCBs, DDTs, chlordanes and PAHs, especially in the North Bay, particularly the mouth of the Petaluma River and San Pablo Bay, and South Bay sloughs frequently exceed water quality guidelines. For sediment, trace elements and organic compounds frequently exceed guidelines indicating possible harm to aquatic life, such as effects on the reproduction of an introduced clam in the Carquinez Strait area. Sediment that has been toxic to organisms "has been found most frequently in Suisun Bay; [and] most consistently in Redwood Creek, the Napa River and at the confluence of the Sacramento and San Joaquin Rivers," although the causes are poorly understood and may be related to the presence of chlordanes at some sites, PAHs at Central Bay sites, metals at rivers,

[91] SFEP, CCMP, Chapter 2.
[92] SFEP, 2000(b), p.14.
[93] SFEI, 2000.
[94] SFEI, 2000.
[95] SFEI, 2000.
[96] SFEI 2000 Update, Pulse of the Estuary.

and complex cumulative effects.[97] Measurements of wetland sediment at Petaluma and China Camp marshes frequently found contaminated sediment concentrations slightly higher and occasionally two to ten times higher than San Pablo Bay.[98] An SFEI study on contaminant loads from stormwater to coastal waters in the San Francisco Bay region found the largest loads of total suspended solids and many other contaminants to be highest for the Napa River hydrologic area, and found more urbanized areas with high estimated runoff volumes including East Bay cities, Palo Alto, Alameda Creek, and San Mateo Bayside, to contribute relatively large proportions of the total pollutant loads, especially for cadmium, lead, zinc, and other trace metals. San Rafael, Berkeley, San Francisco Bayside, and Concord, having high percentages of commercial and industrial development land uses, were considered to contribute high loads of trace metals and phosphate.[99]

High Mercury Levels and Fish Consumption Advisories in San Francisco Bay. According to the Regional Board's 2000 mercury TMDL report for San Francisco Bay, the bases for the 303(d) listing as impaired due to mercury can generally be described by two conditions: (1) the consumption of fish caught from the Bay have mercury levels that may threaten human health; and (2) the concentrations of total recoverable mercury in water particularly in the Lower San Francisco and South San Francisco Bay, exceed the Basin Plan numeric objective of 0.025 micrograms per liter (μg/L). Based primarily on data that came from the San Francisco Estuary's Regional Monitoring Program's 1997 fish contamination study, the California Office of Environmental Health and Hazard Assessment (OEHHA) has issued an interim fish consumption advisory for all of San Francisco Bay, based in part on mercury concentrations in fish caught in the Bay. Median concentrations of fish caught in the Bay, such as halibut, shiner surf perch, white croaker, sturgeon and jacksmelt, range from 0.09 – 0.27 μg /g. [100]The U.S. Food and Drug Administration (FDA) recommends against consumption of fish with mercury concentrations greater than 1 microgram per gram (μg /g). The concentration in leopard sharks, a common Bay fish, frequently exceeds 1 μg /g and in striped bass, concentrations approach 1 μg/g.[101] Due to raised concern over elevated levels of mercury and PCBs in fish from San Francisco Bay and the issuance of a heath advisory recommending that individuals limit their Bay fish consumption, the San Francisco Estuary's Regional Monitoring Program (RMP) and the California Department of Health Services sponsored a survey of San Francisco Bay anglers and their fish consumption habits. The most common Bay fish eaten by anglers

[97] SFEP, SOE 1992-1997. p. 44.
[98] SFEI, 2000.
[99] SFEI, 2000(a).
[100] California Regional Water Quality Control Board, San Francisco Bay Region. 2000. *Watershed Management of Mercury in the San Francisco Bay Estuary: TMDL Report to U.S. EPA*, p.17.
[101] California Regional Water Quality Control Board, San Francisco Bay Region. 2000. *Watershed Management of Mercury in the San Francisco Bay Estuary: TMDL Report to U.S. EPA* (Regional Board, 2000). Because the measurements μg /g and μg /L are unit concentrations by weight and by volume respectively, they are not easily comparable. The FDA action level, 1 μg /g, refers to the maximum recommended concentration of mercury in fish and the WQO 0.025 μg /L refers to the maximum allowable amount of mercury in the water, for example.

were: (in order) striped bass, halibut, jacksmelt, sturgeon, and white croaker. According to the RMP, in 2000, all samples of leopard shark and 30 to 42 percent of all striped bass, California halibut and white sturgeon samples exceeded the mercury guideline (OEHHA screening values). In general, mercury concentrations are higher in the largest fish species in the Bay such as shark, striped bass, and sturgeon and tend to increase in animals higher in the food web.[102] Concentrations of mercury routinely exceed the numeric criteria and water quality objectives established in the Regional Board's Basin Plan due primarily to widespread sediment contamination by mercury remobilized during and after the Gold Rush. San Francisco Bay is a feeding and nesting ground for numerous birds, with resident species most at risk. Mercury levels in the eggs of waterfowl have been shown to be higher in San Francisco Bay compared to other areas that don't have same history of mining sources and suggest impairment of reproductive success.[103]

Other Contaminants of Concern: Pesticides, Hydrocarbons, Trace Metals. Pesticides enter the Bay and Delta through agricultural and urban runoff as well as through atmospheric fallout from aerial spraying. Chemicals applied to rice and orchard crops and row, truck and grain crops turn up in Bay waterways. Although nearly one million pounds of diazinon, chlorpyrifos, malathion, and methidathion are applied to control wood-boring insects on a half-million acres of Central Valley orchards each year, and all have been detected in surface water, diazinon and chlorpryifos appear to pose the greatest threat to aquatic organisms.[104] Pesticides applied by cities to gardens, fruit trees and landscaping are also turning up in streams and stormwater; for example, the City of Palo Alto conducted water quality sampling in 1994 and 1995 in four Palo Alto creeks and detected diazinon concentrations of up to 400 parts per trillion (ppt) (80 ppt is the maximum recommended by the State to protect aquatic life). Approximately 50 percent of Bay Area stream samples in 1995 tests exceeded the State criterion for diazinon and 75 percent exceeded the criterion for chlorpyrifos.[105] Furthermore, diazinon is clearly a contaminant of concern in the Bay Area, evidenced by its inclusion on California's 2002 303(d) list (impaired waterbodies list) for at least 35 urban creeks.

Polynuclear aromatic hydrocarbons (PAHs), derived primarily from combustion processes such as fossil fuel combustion, historic coal gasification and oil refining, enter the Bay through runoff, spills, rivers and other tributary waterways, atmospheric fallout, wastewater and sediment and often concentrate in the most urban portions of the Bay. Concentrations of PAHs frequently exceeded water-quality criteria at Bay monitoring stations between 1993 and 1995.[106] San Francisco Estuary's Regional Monitoring Program (RMP) 2002 data show that Guadalupe and Coyote Creeks are current pathways of PAHs to the

[102] SFEI, 2000.
[103] Regional Board, 2000.
[104] SFEP, SOE 1992-1997. p.42.
[105] SFEP, SOE 1992-1997. p. 42.
[106] SFEP, SOE 1992-1997. p. 42.

South Bay.[107]

Trace metals including chromium, copper, lead, mercury, nickel, arsenic and selenium are of concern in the water or sediment from the South Bay, Suisun Bay and Delta and have exceeded water quality objectives and/or sediment guidelines/effects range values for sediment indicating possible harm to aquatic life (ERLs) or probable harm to aquatic life (ERMs) in samples taken by the RMP from 1996-2000; however, nickel and chromium are found at naturally high levels in the sediment and are generally not considered to be a problem.[108] The most sediment guideline exceedences for trace elements and organic compounds (e.g., DDTs, chlordanes, PAHs) are from the South Bay, due to widespread use prior to bans, in the case of DDTs or chlordanes, or to continuing use in the case of PAHs. Selenium is a continuing problem in the Suisun Bay and San Joaquin Valley, evidenced by high selenium levels detected in clams and bioaccumulation effects in invertebrates, fish and birds, and is conveyed to the Bay and Delta via agricultural drainage and through North Bay oil refinery waste water discharges. In the South Bay, copper was a concern and was included on the State's 1998 303(d) impaired waterbodies list; its likely sources included discharges from metal finishing, circuit board manufacturing industries and runoff from auto brake pads. However, because reduction of copper pollution has received much attention over the past few years and because monitoring results have indicated consistency with water quality objectives and with the California Toxics Rule criteria for dissolved metals, copper (along with nickel) has been de-listed from the State's 303(d) impaired waterbodies for the Carquinez Strait, Central, Lower and South San Francisco Bays, San Pablo Bay and Suisun Bay, along with the Delta.[109] Along with pollutants such as nickel and PAHs, copper has been placed on a monitoring list for these areas of the Bay (see previous section on impaired waterbodies).

Long-Term Trends. In the past decade, specific problems such as copper in the South Bay, diazinon in orchard and urban runoff, mercury and PCBs in fish, and contaminated water and sediment among others have been targeted for reduction. However, data from sediment analyses and aquatic organisms demonstrate few pollutant reductions. Arsenic at the confluence of the Estuary's main rivers is increasing; PCBs in the central San Francisco Bay water and sediments are decreasing; diazinon is widespread throughout the Bay-Delta ecosystem at concentrations lethal to sensitive organisms; mercury from abandoned mines and selenium from agricultural drainage continue to be problems upstream.[110] Compared to samples collected elsewhere in the State, concentrations of ten trace elements, DDT, and PCB sampled in the Estuary's mussels, clams, fish, and birds are significantly elevated. In general, contaminants of concern in the future will likely shift from trace metals to synthetic organic compounds

[107] SFEI 2000 Update Pulse of the Estuary.
[108] SFEI 2000.
[109] Regional Board, 2001. SF Regional Water Quality Control Board 303(d) Staff report. p. 25.
[110] SFEP, SOE 1992-1997. p. 41.

and to the remobilization of certain metals. The San Francisco Estuary Institute's Regional Monitoring Program data suggest that recovery from pollutant impacts, especially persistent bioaccumulative pollutants will take decades or longer.[111]

Numerous factors will determine the future pollutant loading to the Bay, such as the number of people living in the watershed, the land use patterns, the use and disposal of pollutant-containing products, industrial processes, treatment technologies, and pollution prevention strategies and other controls.[112] More than twelve million people are projected to live in the Bay-Delta watershed within the next two decades. By 2005, at least 725 square miles of urban land is projected to be developed in the watershed (37 percent increase), and without implementation of existing controls and effective pollution prevention strategies, and the development of new controls and strategies as needed, pollutant loading from municipal and industrial effluent, impervious areas, and urban runoff is expected to increase substantially.[113] Agriculture will also continue to contribute to rural runoff without significant changes to and controls on farming practices.

Even if inputs from wastewater discharge, runoff, and other sources decrease, the remobilization of metals in sediments will become increasingly important and greater than inputs by point sources or rivers. This may be one reason why concentrations of trace metals in the North Bay have largely remained unchanged over ten years while concentrations continue to be elevated in the South Bay.[114] Additionally, the concentrations of pollutants may be increased by increased diversion of freshwater inflow from the Bay and Delta to upstream users such as agriculture.

Nonpoint Source Pollution Impacts: Effects on Bay Ecosystems. Chapter 1 described the impacts that various sources of nonpoint source pollution can have on ecosystems and on physical processes. This section briefly covers some of the specific impacts nonpoint source pollutants are having on San Francisco Bay ecosystems. High pollutant levels have produced toxic effects in the Bay's fish, shellfish, bird and mammal species. Few reductions in their concentrations are evident, despite decreases in pollutant loads for many trace elements from POTWs and industrial effluent; for example, DDT, PCBs, dioxin, and selenium have all been found in Bay birds and marine mammals. PCBs, despite bans on production and 20 years of restrictions on its use, are considered to be responsible for a reduction in the reproductive success in the starry flounder in the Eastern portion of the Central Bay and for developmental malformations and reduced breeding success in Bay cormorant eggs. PCBs and DDT have been correlated with decreased embryo size and eggshell thickness in black-crowned night heron eggs. High concentrations of selenium have been found in Suisun Bay diving ducks. Silver, copper, and cadmium

[111] San Francisco Estuary: Achievements, Trends and the Future Abstracts. October 2001. Lessons Learned from Eight Years of Contaminant Monitoring.
[112] SFEP, CCMP, Chapter 2.
[113] SFEP, CCMP, Chapter 2.
[114] SFEP, SOE 1992-1997. p. 41.

have been found in various concentrations in South Bay clams. Low-level exposure to metals in water and sediments has had impacts on the condition and reproductive status of North Bay clams.[115] Bay fish, in addition to containing high levels of PCBs and mercury (see above), also may contain high contaminant concentrations of dioxins, DDT, chlordanes, and dieldrin. Research indicates that fish from the Oakland Harbor contain significantly higher concentrations than those from other locations, while pollutant concentrations appear to be highest in aquatic animals that inhabit harbors, harbor entrances, marinas, and industrial waterways.[116] Analysis of Bay samples from mussels, clams, fish and birds of DDT, PCB and ten trace elements show that concentrations are significantly elevated compared to other samples in the State or exceed the State's maximum allowable residue levels and standards. Indeed, the concentrations of many pollutants in the Bay's waters exceed State water quality objectives and in animal tissues exceed international standards for the protection of aquatic life.[117] Nonpoint source pollution also has effects on plant species in the Bay; for example, studies have shown that pickleweed growing in a marsh receiving drainage discharges from Hamilton runway and maintenance facilities selectively uptakes metals from the soil.[118]

The effect a pollutant has on an organism is determined by such factors as its inherent toxicity to the organism, the chemical form in which it is available, and the dose over a given time period. Scientists studying the Bay have found evidence of toxicity in ambient Bay water, municipal and industrial effluents, storm water runoff, and sediments. Pollutants increase or bioaccumulate through the food chain, beginning with their ingestion in the water by filter feeders such as clams and oysters or taken up by snails and worms grazing on matter in the sediment. Shrimp, clams, fish and other Bay organisms can accumulate pollutants both directly from the water or from the ingestion of contaminated food. Waterfowl such as scoters and marine mammals that eat these organisms have been shown to bioaccumulate pollutants in their tissues and organs. Humans can also accumulate pollutants, for example by ingesting fish with highly elevated concentrations of mercury. Although the effects of pollution on water, sediment and animal tissues can be measured, it is much more difficult to determine the impacts a pollutant may have on an individual organism or animal or on an entire aquatic ecosystem.[119]

Current RMP Research Efforts. The RMP over the past eight years has generated very valuable data on the status of the Bay's contamination and trends and is currently conducting further research and studies on contaminants. For example, the RMP is now trying to predict future trends for PCBs and other pollutants by using tools such as Mass Budgets, which can combine a variety of information from

[115] SFEP, CCMP, Chapter 2; SFEP, SOE 1992-1997.
[116] SFEP, 2000(b), p.14.
[117] SFEP, CCMP, Chapter 2.
[118] SFEP, SOE 1992-1997.
[119] SFEP, SOE 1992-1997, p.48; SFEP, CCMP, Appendix D, Gaps in Knowledge. Available online at: http://www.abag.ca.gov/bayarea/sfep/reports/ccmp/ccmpappd.html, as of August 1, 2002.

different sources and estimate inputs and losses of a pollutant. Food web models are also being developed to link PCB concentrations in sediment and water with concentrations in sport fish. Additionally, SFEI and other interested parties have begun to develop a biological effects pilot study intended to answer management questions related to contaminant effects and exposures with the hope of developing a toolbox of indicators that can be used in RMP monitoring efforts. These efforts will help to answer management questions such as: do contaminants adversely effect: survival reproduction or growth of fish, shellfish, other wildlife, or their prey; or safe consumption of fish, shellfish and other wildlife by humans. Furthermore, in order to manage contaminants proactively, a study began in 2000 to determine past and present distributions of previously unknown and newly identified organic compounds of concern in the Bay, for example, flame retardants, of which the Regional Board began monitoring for one class, polybrominated diphenyl ethers (PBDEs) in 2001, detergent ingredients including nonylphenols and industrial polymer plasticizers, both of which can disrupt hormonal systems and reproductive development.[120]

[120] SFEI 2000.

CHAPTER 3

OVERVIEW OF NONPOINT SOURCE POLLUTION REGULATIONS

This chapter provides a brief overview of the federal, state, regional and local laws, policies, plans and programs that apply to nonpoint source pollution, and the agencies and entities responsible for administering them. As evident in the following chapter (Chapter 4), which provides a separate discussion of BCDC's specific laws and policies governing nonpoint source pollution, BCDC has limited authority and jurisdiction over much of the nonpoint source pollution coming into San Francisco Bay, and therefore must coordinate and work closely with those agencies that do have jurisdiction and authority over water quality in the Bay to ensure the nonpoint source pollution is addressed.

Federal Regulations: Clean Water Act. The principal federal statutes for water quality protection are the Federal Water Pollution Control Act of 1972, along with subsequent amendments legislated in 1977 and 1987, commonly referred to as the Clean Water Act (CWA). The CWA establishes the programs used to control pollution in the Estuary and waters nationwide, and requires states such as California to adopt water quality standards and submit them to the United States Environmental Protection Agency for approval. Section 402 of the CWA authorizes the U.S. EPA administrator to establish a nationwide surface water discharge permit program for municipal and industrial point sources (see Chapter 1 for definition of point source), the National Pollutant Discharge Elimination System (NPDES). The U.S. EPA administrator may also approve the plan of any state attempting to administer its own program. Administration of the NPDES program has been delegated to the State of California through the nine Regional Water Quality Control Boards.

Standard conditions are placed on all NPDES permits. One important condition requires monitoring reports.[121] These reports provide the State and U.S. EPA, as well as the public, with data on pollutant discharges. Provisions in the NPDES permit also address effluent limitations, which are usually expressed as numerical criteria. Effluent limits are generally based on the "Best Available Technology" economically available or BAT. In establishing BAT requirements, the U.S. EPA is required to consider the cost of achieving effluent reduction. Unlike direct dischargers, industrial facilities that discharge into Publicly Owned Treatment Works (POTWs) are regulated under a parallel set of effluent limits for indirect dischargers, included in Section 307(b) of the Clean Water Act.

[121] 40 CFR 122.41(j) and 122.41(1)(4).

States are also required under Section 303(d) of the CWA to list surface waters not attaining water quality standards despite implementation of best practicable control technology, and states must perform a Total Maximum Daily Load (TMDL) for all waters on the 303(d) list, which essentially involves establishing the maximum allowable amount of pollution and allocating the load among existing and potential sources. (See Chapter Two for more detail on TMDLs in San Francisco Bay.)

Until amended in 1987, the CWA did not effectively regulate nonpoint source pollution. In the 1987 amendment, U.S. Congress recognized that nonpoint sources are a large contributor to water pollution. These 1987 amendments expanded the U.S. EPA and states' regulatory authorities to address nonpoint source pollution, by applying the NPDES program to urban runoff discharges into navigable bodies of water from industrial and municipal storm sewer systems.[122] Provisions of the 1987 amendments also addressed discharges associated with construction sites greater than five acres. (See County-wide Stormwater Programs for a brief description.) Section 319 of the 1987 amendments to the CWA required states to develop assessment reports that described the state's nonpoint source problems. Based on the assessment, states are then required to establish nonpoint source management programs proposing management measures to control or prevent the problems identified in the assessment reports, and to provide funding to support program implementation. In 2002, U.S. EPA provided $12.4 million dollars to California under Section 319 of the CWA to support implementation of the State's nonpoint source pollution control program. Under Section 404 of the CWA, disposal of dredged material and placement of fill in navigable waters, including wetlands, is regulated through the U.S. Army Corps of Engineers, who manages the discharges through a permit process. Permit applicants are required to satisfy conditions designed to prevent unacceptable impacts to the aquatic environment, including the release of pollutants during dredging and disposal. U.S. EPA reviews these permits and can object to their issuance.[123]

Federal Regulations: Coastal Zone Management Act. The Coastal Zone Management Act of 1972 established a national framework for effective management, protection, development, and beneficial uses of the coastal zone.[124] In 1990, Congress identified nonpoint source pollution as a significant factor in coastal water degradation, established a clear link between coastal water quality and land use activities on shore, and focused on reducing nonpoint source pollution of the nation's coastal waters, which includes San Francisco Bay. In recognition, in 1990 Congress enacted the federal Coastal Zone Management Act reauthorization amendments (CZARA). Section 6217 of CZARA requires coastal states with an approved

[122] CWA Section 402. The EPA delegated to the State of California, through the Regional Water Quality Control Boards, the authority to adopt and enforce NPDES permits in the Bay Area. Santa Clara Valley Urban Runoff Management Plan, 1997, Appendix B1. Federal regulations define municipal separate storm sewer systems as a "conveyance or system of conveyances including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains…" (SCV URMP 1997, B1, in 40 CFR 122.26 (b)(8)).
[123] CCMP, Chapter 3, Pollution Prevention and Reduction. Available online at: http://www.abag.ca.gov/bayarea/sfep/reports/ccmp/ccmp3po.html, as of August 2, 2002.
[124] California Plan, 2000, p.14.

coastal zone management program, including California, to develop coastal nonpoint pollution control programs, and coastal zone management agencies, such as BCDC, in consultation with state water quality agencies, to develop and implement federally required nonpoint source management measures to restore and protect coastal waters from the adverse impacts of polluted runoff. States are also required (1) to identify land uses which may cause or lead to significant degradation of coastal waters, (2) to identify critical geographic areas (critical coastal areas) adjacent to coastal waters within which any new land uses or substantial expansion of existing land uses are subject to additional management measures and (3) implement additional management measures in identified critical coastal areas to achieve and maintain water quality standards.[125] The coastal nonpoint source program under CZARA serves as an update and expansion of the State's nonpoint source management program developed under section 319 of the CWA, and states were directed to coordinate and integrate existing CZM and water quality plans and programs. Other agencies such as the National Oceanic and Atmospheric Administration (NOAA) also undertake assessment activities such as monitoring ambient levels of pollutants in sediment and water and researching the effects of pollutants on estuarine habitat, organisms, and human health and provide recommendations to state and federal agencies on regulatory decisions.[126]

State Regulations: Porter Cologne Water Quality Control Act (Porter-Cologne Act). The Porter-Cologne Act (Cal. Water Code, Section 13020), passed in 1969 and amended several times, is the principal law governing water quality regulation in California. Section 13000 of the Water Code is a policy that states that:

> The quality of all the waters of the State shall be protected for use and enjoyment by the people of the state…that activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable…that the health, safety and welfare of the people of the state requires that there be a statewide program for the control of the quality of all the waters of the state… that the state must be prepared to exercise its full power and jurisdiction to protect the quality of waters in the state from degradation…[and] that the statewide program for water quality control can be most effectively administered regionally, within a framework of statewide coordination and policy.

[125] CZARA Section 1455b Protecting Coastal Waters (Section 6217); State Board, undated, p.2.
[126] CCMP, Chapter 3, Pollution Prevention and Reduction.

Section 13369 of the Water Code, entitled Nonpoint Source Pollution Control Program, requires the State Board, Regional Boards and California Coastal Commission and other agencies to prepare a detailed program to implement the State's nonpoint source management plan and to address the CWA, Section 319 and CZARA, Section 6217 provisions on or before February 1, 2001. This program includes non-regulatory implementation of best management practices (BMPs), regulatory-based incentives for BMPs, and the adoption and enforcement of waste discharge requirements that require implementation of BMPs. The Porter-Cologne Act established the State Board and nine Regional Boards, which both share authority in California for implementation of the Act as well as the CWA. The State Board administers water rights, water pollution control, and water quality functions for the State as part of the California Environmental Protection Agency. The Regional Boards conduct planning, permitting, and enforcement activities under the guidance of the State Board. The State and Regional Boards administer the National Pollutant Discharge Elimination System (NPDES) program, which regulates municipal and industrial wastewater discharges, and the Nonpoint Source Program, which develops strategies to eliminate pollutant sources before discharges reach conveyances. The State also establishes water quality numerical criteria for toxic pollutants for which U.S. EPA has published water quality criteria. The San Francisco Bay Regional Board regulates surface water and groundwater quality in San Francisco Bay.[127]

The Porter-Cologne Act provides the Regional Boards more extensive authority to regulate nonpoint sources of pollution compared to the Clean Water Act. The Act contains enforceable permitting provisions that can be applied to nonpoint source discharges and empowers Regional Boards to order the abatement of discharges that produce or could produce pollution. The Act requires any person discharging waste (referring to both point and nonpoint sources of pollution) within a region that could affect the quality of the waters of the state to file a waste discharge report with the Regional Board. The Regional Board is then required to consider whether it must issue waste discharge requirements in order to protect beneficial uses and the water quality objectives required to achieve those beneficial uses. The law allows for conditional waivers for specific discharges when not against the public interest. The Porter-Cologne Act also gives the Regional Board general authority to order cleanup or abatement of waste for any person who has discharged waste into waters of the state in violation of a waste discharge requirement or other prohibition, or even threatens to cause pollution.[128]

[127] State Board, undated, p.1; CCMP, Chapter 3.
[128] Environmental Law Institute. 1998. *Almanac of Enforceable State Laws to Control Nonpoint Source Water Pollution*, p. 21; Cal. Water Code Section 13260(a) (1), 13263. 13264, 13269, 13304(a).

San Francisco Bay Regional Board Basin Plan. The *San Francisco Bay Basin (Region 2) 1995 Water Quality Control Plan* (Basin Plan) is the master policy document that contains the descriptions of legal, technical and programmatic bases of water quality regulation in the Bay region and by law must include the beneficial uses the Regional Board will protect; the water quality objectives needed to protect the uses; and strategies to achieve the water quality objectives, such as an implementation plan that includes nonpoint source control and urban runoff management measures. The Basin Plan illustrates a trend towards a watershed management framework for regional water quality control and emphasizes controlling pollution from urban and agricultural runoff, and pollution prevention and resource management rather than clean-up after-the-fact. The Basin Plan specifies beneficial uses for surface waters, groundwaters, marshes and mudflats, which are the ultimate goals of protecting and achieving high water quality and serve as a basis for establishing water quality objectives and discharge prohibitions. The San Francisco Bay Estuary's beneficial uses include estuarine habitat, industrial service supply, navigation as well as all of the uses for inland streams, such as municipal and domestic supply, groundwater recharge, water contact recreation, non-contact water recreation, wildlife habitat, cold and warm freshwater habitat, fish migration and fish spawning. See Appendix B for a list of the beneficial uses listed in the Basin Plan. See Chapter 5 for a description of some of the Basin Plan's regulatory controls, programs and strategies for pollution prevention and control.

County-Wide Storm Water Programs. In November of 1990, Bay Area municipalities, including counties or cities with populations of 100,000 or more, were required to apply to the San Francisco Bay Regional Water Quality Control Board to obtain NPDES permits for storm water discharges. These permits require local governments to implement certain practices, for example, prohibition of non-storm water discharges in municipal storm sewer systems, public education, municipal activities, e.g., street sweeping, monitoring, local commercial/industrial inspections, and new development review. To respond to these requirements, most larger municipalities in the Bay Area, as well as some of smaller ones with populations under 100,000, have come together to develop joint county-wide storm water management programs. BCDC's *Nonpoint Source Pollution Report and Work Program* included a review of some of the programs and policies of four representative local clean water/stormwater management programs in the East, South and North Bay including the Alameda County-Wide Clean Water Program (ACCWP), Santa Clara Valley Urban Runoff Pollution Prevention Program (SCV URPPP), the City of San Jose, and the North Bay communities that were included as part of the North Bay Wetlands and Agriculture Protection Program.

Although not part of BCDC's review, there are additional county-wide stormwater programs in the Bay Area addressing the discharge of pollution including the San Mateo Countywide Stormwater Pollution Prevention Program, comprised of 20 cities and towns and unincorporated San Mateo County, and the Contra Costa Clean Water Program, comprised of nineteen incorporated cities and the Contra Costa County Flood Control and Water Conservation District. [129] Both of these programs are under joint NPDES permits that contain comprehensive plans to reduce the discharge of pollutants to the "maximum extent practicable." To illustrate, San Mateo 's program has a goal of reducing the discharge of pollutants to creeks, the Bay and the ocean to the maximum extent practicable so that Bay water quality and marine ecosystems will improve. Additionally, the Marin County Stormwater Pollution Prevention Program is a joint effort of Marin's cities, towns and unincorporated areas to prevent stormwater pollution, protect and enhance water quality in creeks and wetlands, to preserve beneficial uses, and to comply with appropriate regulations. Further, county or local programs such as Fairfield-Suisun Urban Runoff Management Program or Napa County Resource Conservation District are not mandated under Phase I storm water regulations, but some areas may be included under Phase II and will include pollution prevention and reduction strategies that help to reduce pollutants to the Bay.[130] (See BCDC's *Nonpoint Source Pollution Report and Work Program*.)

State Policy: Antidegradation Policy. The *Statement of Policy With Respect to Maintaining High Quality of Waters in California* (Antidegradation Policy: Resolution 68-16), adopted by the State Board through resolution in October 1968, requires the continued maintenance of existing high quality waters. It provides that any change "will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies." Furthermore, any waste discharge activity proposed to high quality waters is required to meet waste discharge requirements, "which will result in the best practicable treatment or control of the discharge necessary to assure that (a) pollution…will not occur and (b) the highest water quality…will be maintained."[131]

State Policy: Pollutant Policy Document. The *Pollutant Policy Document* (PPD), adopted by the State Board through resolution in June 1990, establishes State policy for water quality control under Water Code Sections 13140-13147 to be used by the San Francisco Bay and Central Regional Boards as guidance in updating portions of their regional water quality control plans (Basin Plans). The PPD also identifies and characterizes pollutants with the greatest potential biological significance in the Bay-Delta

[129] Contra Costa Clean Water Program Information Page. Available online at: http://www.co.contra-costa.ca.us/depart/pw/cleanwater/cleanwater.html., as of 03/12/02.
[130] The areas of Fairfield and Napa along with other areas of Marin County will likely be subject to Phase II storm water regulations.
[131] State Board. Resolution No. 68-16. Available online at: http://www.epa.gov/ost/standards/wqslibrary/ca/ca_9_68_16.htm., as of March 27, 2002.

Estuary, partially selected for their potential to cause adverse effects on beneficial uses, reviews toxicological effects of pollutants and regulatory standards, provides Regional Boards with specific policy guidance including policies to establish a mass emissions strategy and implement site-specific and general control measures for pollutants as well as developing a water quality monitoring and assessment program. The PPD also addresses issues of importance to the State and Regional Board such as the impacts of dredging spoils, trihalomethanes, and cumulative pesticide loads, and calls for specific actions to address the problems.

2000 *Plan for California's Nonpoint Source Pollution Control Program* (California Plan). The California Plan, developed and administered through the State Board and the California Coastal Commission (Coastal Commission), is intended to protect the State's water quality by expanding its polluted runoff control efforts over the next 15 years. The California Plan specifies 61 management measures, for agriculture, forestry, urban runoff, marinas and recreational boating, hydromodification, and alteration of wetlands to be implemented by 2013 to prevent and control nonpoint source pollution. Management measures are often implemented through management practices. To illustrate, the California Plan's Urban Management Measure 3.2-A, Construction Site Erosion and Sediment Control, is intended to reduce erosion and to the extent practicable, retain sediment on site during and after construction.

The California Resources Agency directed each department, board, and commission under its purview, including BCDC, to create a five-year plan to implement the California Plan. The California Plan lists BCDC as an implementing agency for the following categories of NPS sources: (1) urban; (2) marinas and recreational boating; (3) hydromodification; and (4) wetlands and riparian areas. Moreover, BCDC is specifically listed as an implementing agency for a number of management measures. In response to the directive, Commission staff prepared BCDC's *Nonpoint Source Report and Work Program*, which the Commission adopted in September 2001.

As in the 1988 California Plan, the 2000 California Plan uses a three-tiered approach of voluntary implementation, regulatory based encouragement of management practices and, if those are unsuccessful, effluent limits and enforcement actions, as well as the use of total maximum daily loads (TMDLs). The California Plan is intended to meet a variety of requirements and laws, including the federal Clean Water Act (CWA) and the Coastal Zone Act Reauthorization Amendments (CZARA). In July 2000, U.S. EPA and National Oceanic and Atmospheric Administration (NOAA) approved the California Plan.

Bay-Delta Water Quality Control Plan. The State Board's 1995 *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* provides a coordinated and comprehensive ecosystems approach to the protection of the beneficial uses of the Bay-Delta Estuary. The Plan consists of the beneficial uses and the water quality objectives to protect the uses, which together comprise the water quality standards, and an implementation program to achieve the objectives. The Plan supplements

other State and Regional water quality control plans, such as the Regional Board's Basin Plan, and State policies that establish water quality standards and requirements for toxic chemicals, bacterial contamination, and other parameters that could impair beneficial uses.[132]

Bay Protection and Toxic Cleanup Program (BPTCP). The BPTCP is a comprehensive program within the State Board, mandated in the California Water Code, to protect the existing and future beneficial uses of California's enclosed bays and estuaries and to programmatically link standards development, environmental monitoring, water quality control planning and site cleanup. The BPTCP has four main goals: (1) provide protection of present and future beneficial uses of the bays and estuarine waters of California; (2) identify and characterize toxic hot spots; (3) plan for toxic hot spot cleanup or other remedial or mitigation actions; (4) develop prevention and control strategies for toxic pollutants, and contains seven activities, such as developing and amending California's Enclosed Bays and Estuaries Plan, developing and implementing regional monitoring programs to identify toxic hot spots, developing numeric and narrative sediment quality objectives, and developing toxic hot spot cleanup plans.[133]

Federal and State Regulations: Other. Although this section primarily focuses on the laws and plans described above, other federal laws and portions of the following State codes address nonpoint source pollution: Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act, Cal. Civil Code, Cal. Penal Code, Cal. Health and Safety Code, Cal. Fish and Game Code, Government Code, and Public Resources Code. For example, CERCLA, commonly known as Superfund, was enacted in 1980 and amended in 1986 to protect the public and the environment from toxic pollution threats posed by hazardous waste sites. RCRA, passed in 1976 and amended in 1984 and 1986, is intended to prevent hazardous chemicals from becoming pollutants, and under RCRA, U.S. EPA identifies hazardous chemicals and develops standards and regulations from "cradle to grave" controlling their generation, transport, storage and disposal.[134] The Safe Drinking Water Act, established to protect the quality of drinking water in the U.S., focuses on all above ground and underground source waters actually or potentially designed for drinking use, and authorized EPA to establish safe standards of purity and to require public water system owners and operators to comply with primary (health-related) standards.[135] Portions of many State codes apply to nonpoint source pollution. The Cal. Health and Safety Code, Cal. Penal Code, and Cal. Civil Code contain specific public nuisance prohibitions; for example, Section 374.7(a) of the Cal. Penal Code states: "Every person who litters or causes to be littered, or dumps or

[132] State Board, 1995. *Water Quality Control Plan For The San Francisco Bay/Sacramento-San Joaquin Delta Estuary*.
[133] Available online at State Water Resources Control Board website: http://www.swrcb.ca.gov/bptcp/progdesc.html, as of 03/11/02.
[134] BCDC, 1987. *Water Quality in San Francisco Bay* Staff Report.
[135] U.S. EPA major environmental law summaries. Available online at: http://www.epa.gov/region5/defs/html/sdwa.htm, as of 03/08/02.

causes to be dumped, any waste matter into any bay, lagoon, channel, river, creek, slough, canal, lake or reservoir, or other stream or body of water, or upon a bank, beach, or shore within 150 feet of the high water mark of any stream or body of water, is guilty of a misdemeanor.…" Other provisions such as those contained in the Cal. Fish and Game Code are intended to protect fish from the harmful effects of nonpoint source pollution. Further, Section 1603 of the Fish and Game Code requires any person who proposes a project that will substantially change the bed, channel, or bank of any river, stream, or lake or use materials from a streambed to notify the Department before beginning the project through a Lake or Streambed Alteration Agreement. Section 1601 of the Fish and Game code requires an Agreement from a State, local governmental agency or public utility proposing projects that "will 1) divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake; 2) use materials from a streambed, or 3) result in deposition or disposal of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream or lake."[136] Additionally, provisions contained in the Government Code and Public Resources Code pertaining to land use and environmental regulations, such as CEQA, are relevant to the prevention of nonpoint source pollution from development and earth-disturbing activities. See Appendix C for a summary of enforceable provisions applicable to nonpoint source pollution in California developed by the Environmental Law Institute.

Regional Plans: Comprehensive Conservation and Management Plan (CCMP) (1992). According to the San Francisco Estuary Project, The CCMP offers a blueprint of 145 specific actions to restore and maintain the chemical, physical and biological integrity of the Bay and Delta and is intended to help achieve high water quality standards, to maintain indigenous fish, shellfish and wildlife populations, to support recreational activities, and to protect beneficial uses of the Estuary. One of the program areas in the CCMP is Pollution Prevention and Reduction and the CCMP recommends a comprehensive approach to address the pollution problems including pollution prevention, control and reduction of pollutants that can't be avoided, and remediation of existing contamination and sets out specific goals and actions, such as promote mechanisms to prevent pollution at its source or improve the management and control of urban runoff from public and private sources.[137] These types of strategies are explored in Chapter 5. BCDC staff are members of the "Friends of the Estuary's" Board of Directors, which helps assist the SFEP to implement the CCMP and should continue to be active participants to help achieve the CCMP's pollution prevention and reduction strategy.

Regional Programs: CalFed. Reducing nonpoint source pollution in San Francisco Bay and the Delta is an essential element of the CALFED Bay-Delta Program. For example, a primary objective of

[136] California Department of Fish and Game webpage. Available online at: http://www.dfg.ca.gov/1600/qa1.shtml, as of 04/03/03.
[137] SFEP, CCMP. Available online at: http://www.abag.ca.gov/bayarea/sfep/reports/ccmp/ccmpexec.html. and CALFED Annual Report-2001. Available online at: http://www.calfed.water.ca.gov/AnnualReport2001.html p. 9., as of 3/12/02.

CALFED's Water Quality Program is to ensure continuous improvements and maintenance in the water quality of the Bay-Delta for all beneficial uses, which will result in improved ecosystem health. One way CALFED proposes to achieve this objective is through the identification and control of nonpoint sources of pollution, for example, the Program will work to reduce impacts from urban and agricultural pesticide use, trace metals, mercury, selenium, turbidity and sedimentation, salinity, low dissolved oxygen, and other toxic pollutants, as well as improving drinking water quality by reducing the amounts of pathogens, nutrients, salinity and turbidity, in addition to other measures. The goals of the Water Quality Program include collaborating and funding projects that improve source quality, seeking advancements in treatment technology, researching and monitoring Bay-Delta drinking water quality, and looking for ways to improve water management and delivery.[138] BCDC is an active member of CALFED and should continue to keep abreast of and review studies and project proposals that may improve water quality in the Bay and Delta.

Regional Programs: San Francisco Estuary Regional Monitoring Program For Trace Substances (RMP). The San Francisco Estuary Institute's RMP is a regional program, funded by seventy seven public and private NPDES-permitted dischargers in the Bay area as well as by in-kind services from some state and federal agencies, that monitors contaminant concentrations in water, sediments and fish and shellfish tissue in the San Francisco Estuary and is designed to obtain data that describes the concentration of toxic trace elements and organic contaminants. The RMP seeks to answer the questions, "How are contaminant concentrations in the estuary responding to pollution prevention and reduction measures," and "Is the Estuary as clean as it should be?" Some of the RMP's objectives include: describing patterns and trends in contaminant concentration and distribution and general sources and loadings of contamination; measuring the effects of contaminants on selected ecosystem parts; and comparing monitoring information to relevant water quality objectives and other guidelines. The RMP has two dozen sampling stations throughout the Estuary and at its major tributaries, from the mouths of the Guadalupe River and Coyote Creek in the extreme southern portions of the Estuary, to the confluence of the Sacramento and San Joaquin Rivers and collects five different types of samples at least two to three times per year such as conventional water quality parameters, water toxicity (effect on lab organisms), sediment characteristics and chemistry, sediment toxicity, and contaminant bioaccumulation in shellfish. In addition to monitoring, the RMP also conducts special and pilot studies, such as the fish tissue contamination studies, conducted since 1997.[139] BCDC might benefit from increased coordination with the RMP, for example by attending annual meetings and keeping informed on special studies with significance for the Bay, such as the fish tissue contamination study.

---

[138] August, 2000. CALFED Bay-Delta Program, Program Summary p.18. Available online at: http://calfed.water.ca.gov/adobe_pdf/2000/program_summary.pdf, as of 3/12/02.
[139] SFEI. Regional Monitoring Program Fact Sheet. Available online at: http://www.sfei.org/rmp/Fact_Sheets/98factsheet.html., as of 3/12/02.

CHAPTER 4

NONPOINT SOURCE POLLUTION AND BCDC'S EXISTING REGULATORY AND PLANNING FRAMEWORK

This chapter first provides an overview of BCDC's jurisdiction and authority. Next, the *San Francisco Bay Plan* Water Quality findings and policies are described, followed by nonpoint source and water quality permitting conditions. Finally, BCDC's planning program efforts are discussed. These sections have been adapted from BCDC's *Nonpoint Source Pollution Report and Work Program*.

The Commission's Jurisdiction: An Overview. In general, the Commission's jurisdiction includes (1) San Francisco Bay from the south end of the Bay to the Golden Gate to approximately the Delta to mean high tide and including all marshland between mean high tide and five feet above mean sea level; (2) the first 100 feet inland from the shoreline around San Francisco Bay; (3) the portion of the Suisun Marsh-including levees, waterways, marshes and grasslands below the ten-foot contour line; (4) portions of certain tributaries that flow into San Francisco Bay; and (5) salt ponds, duck hunting preserves, game refuges and other managed wetlands that have been diked off from San Francisco Bay.

The types of activities that require a permit include the placement of fill, extraction of materials and any substantial change in the use of any water and/or structure in the Commission's jurisdiction including development in the Primary Management area of the Suisun Marsh. Examples of activities include: (1) placing solid material, building or repairing docks, pile-supported or cantilevered structures; (2) dredging or extracting material from the Commission's jurisdiction; (3) substantially changing the use of any structure or area; (4) constructing, remodeling or repairing a structure; and (5) subdividing property or grading land.

The Commission has no authority over the vast majority of nonpoint source pollution coming into San Francisco Bay. The watershed for the San Francisco Bay-Delta Estuary drains approximately 40 percent of the State, and the Commission's jurisdiction generally extends only 100 feet landward from the mean high water line of the Bay and five feet above mean sea level in the Bay's tidal marshes and to tidal portions of certain tributaries to the Bay, and ends at the west end of the Delta. Thus, for example, the construction of a new residential subdivision in the foothills of the Sierras might generate erosion, increase the amount of runoff by covering the land with hard (impervious) surfaces, and change the amount and type of pollution by bringing more people to the area (for example, homeowners in the new subdivision may improperly use

and dispose of garden fertilizer or pesticides). All of these processes would lead to nonpoint source pollution, some of which might ultimately reach the Bay. The Commission, however, would have no jurisdiction over that subdivision and could not control the type or amount of polluted runoff it may generate.

Furthermore, even within the Commission's jurisdiction, the Commission's regulatory authority over the prevention and control of nonpoint source pollution is complex and depends in part on the location and context of particular projects. The laws and policies that apply to the Suisun Marsh, for example, may be different from those that apply to the Commission's jurisdiction under the McAteer-Petris Act. The analysis in this chapter focuses primarily on the Commission's authority in the Bay and Suisun Marsh. However, the reader should keep in mind that the analysis is a generalization and specific authority depends on the context of a particular project. Within the Bay and shoreline band, the Commission's jurisdiction derives primarily from the McAteer-Petris Act. The Commission's regulatory authority over pollution prevention and control in the shoreline band may be limited and is briefly discussed below.

The McAteer-Petris Act and *San Francisco Bay Plan*. The Commission's authority to consider the water quality impacts of Commission-approved projects and to require appropriate permit conditions stems from its regulatory authority set forth in the McAteer-Petris Act. The Commission is required, by Section 66632 of the McAteer-Petris Act, to issue a permit for a proposed project if the project is either (1) necessary to the health, safety, or welfare of the public in the entire Bay Area, or (2) consistent with the provisions of the McAteer-Petris Act and policies of the Bay Plan. The latter provision is the one the Commission usually relies upon when granting or denying a permit. Section 66632(f) of the McAteer-Petris Act empowers the Commission to grant a permit subject to reasonable terms and conditions including the uses of land or structures, intensity of uses, construction methods and methods for dredging or placing of fill.

When the Commission exercises its permitting authority pursuant to Section 66632(f) of the McAteer-Petris Act, it must consider two sets of provisions containing water quality policies: Section 66605 of the Act itself, and the water quality provisions of the Bay Plan. Section 66605(d) of the Act provides that the Commission shall authorize fill for a project only if specific conditions, including the following, are met:

> ….The nature, location and extent of any fill should be such that it will minimize harmful effects to the bay area, such as, the reduction or impairment of the volume, surface area, or circulation of water, water quality, fertility of marsh or fish or wildlife resources, or other conditions impacting the environment….

The McAteer-Petris Act contains specific provisions that apply to the 100-foot shoreline band. Section 66632.4 of the Act states that within any portion of the shoreline band located outside of a water-oriented priority use area, fixed and established pursuant to Section 66611 of the Act, the Commission may deny a permit application for a proposed project only if the project fails to provide maximum feasible public access, consistent with the proposed project. The Commission has interpreted this provision to mean that it cannot condition a permit for a project in such areas unless the condition is related to the provision of public access. In light of that understanding, the Commission could neither deny nor condition a permit for a project in the non-priority use area of the shoreline band based on potential water quality impacts solely. For projects in the Bay or for projects partly in the Bay, however, the Commission can condition projects to protect against water quality impacts or deny permit applications based on a project's potential water quality impacts.

The Bay Plan water quality policy section (Water Quality Policies, pages 17-18) includes several nonpoint source pollution-related policies:

1. To the greatest extent feasible, the Bay marshes, mudflats, and water surface area and volume should be maintained and, whenever possible, increased. Fresh water inflow into the Bay should be maintained at a level adequate to protect Bay resources and beneficial uses. *Bay water pollution should be avoided* (italics added).
2. Water quality in all parts of the Bay should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the Regional Water Quality Control Board's Basin Plan. The policies, recommendations, decisions, advice and authority of the State Water Resources Control Board and the Regional Water Quality Control Board, should be the basis for carrying out the Commission's water quality responsibilities.
3. Shoreline projects should be designed and constructed in a manner that reduces soil erosion and protects the Bay from increased sedimentation through the use of appropriate erosion control practices.
4. Polluted runoff from projects should be controlled by the use of best management practices in order to protect the water quality and beneficial uses of the Bay, especially where water dispersion is poor and near shellfish beds and other significant biotic resources. Whenever possible, runoff discharge points should be located where the discharge will have the least impact. Approval of projects involving shoreline areas polluted with hazardous substances should be conditioned so that they will not cause harm to the public or the beneficial uses of the Bay.

Moreover, the Bay Plan's water quality policies explicitly encourage the use of best management practices (BMPs) for polluted runoff, and explicitly identify the State Board and the Regional Board as the primary agencies to address water quality issues in the Bay (due to their

legislative purpose and greater technical expertise and resources). The policies in the water quality section were amended by the Commission following a Bay-wide study of water quality conducted in 1987. Some additional policies in other sections of the Bay Plan also address water quality and are included in Appendix D.

Overall, the McAteer-Petris Act and the Bay Plan policies give the Commission authority and a policy basis to consider the water quality impacts and to require appropriate permit conditions for most bay-related Commission-approved projects.

The Suisun Marsh Preservation Act and Suisun Marsh Protection Plan. The Commission applies different standards to proposed marsh development within the primary management area and secondary management area of Suisun Marsh in Southern Solano County. For marsh development proposed within the primary management area, the Commission has direct permit authority. Under Section 29501 of the Marsh Act, the Commission must approve a marsh development project if it is consistent either with the policies contained in the Suisun Marsh Preservation Act (Marsh Act) and in the *Suisun Marsh Protection Plan (*Protection Plan*)*[140] or with the policies contained in the Suisun Marsh Local Protection Program, and if the marsh development project is also consistent with the policies contained in the *San Francisco Bay Plan*. If the policies contained in the Bay Plan are inconsistent with policies contained in the Marsh Act or Protection Plan or the Local Protection Program, the policies contained in the Marsh Act, Protection Plan, or Local Protection Program prevail. If a proposed marsh development is inconsistent with the policies contained in both the Marsh Act and Protection Plan and the Local Protection Program, the Commission can deny the application. If a proposed marsh development is inconsistent with any policies contained in the Bay Plan, and those Bay Plan policies are not inconsistent with the Marsh Act, Protection Plan, or Local Protection Program, the Commission can deny the application. For marsh development proposed in the secondary management area, the local government having jurisdiction decides whether or not to issue the marsh development permit, subject to a right of appeal to the Commission. If appealed to the Commission and the Commission determines that a substantial issue exists, the Commission reviews the proposed marsh development project as if it was a new project for compliance with the policies of the Local Protection Program. Section 29506 of the Marsh Act provides the basis for the Commission to condition permits to protect against water quality impacts and states that any permit that is issued or any development or action approved on appeal shall be subject to such reasonable terms and conditions as the Commission determines will ensure that such development or action will be in accordance with the

[140] It is important to note that "the appropriate policies of both the San Francisco Bay Plan and the Suisun Marsh Protection Plan shall apply within any area that is within the commission's jurisdiction, as defined in Section 66610 of the Government Code, and that is also within the marsh, as defined in Section 29101 of this code except where the San Francisco Bay Plan and the Suisun Protection Plan may conflict. If a conflict occurs, the policies of the Suisun Marsh Protection Plan shall control" (Section 29008 of the Suisun Marsh Preservation Act). The Commission has jurisdiction under the Suisun Marsh Preservation Act over Suisun Marsh including levees, waterways, marshes and grasslands below the ten-foot contour line.

provisions of this division and the Protection Plan.

When exercising its marsh development permit authority, the Commission considers several policies set forth in the Marsh Act, Protection Plan, and Local Protection Program. Many Marsh Act and Protection Plan policies concern water quality. Section 29003 of the Marsh Act, for example, identifies a need for provisions for establishment and maintenance of adequate water quality. Water quality policies Number 7 and 8 in the *Suisun Marsh Protection Plan* specify that riparian vegetation in the immediate watershed should be preserved, and stream modification minimized; and that local governments should adopt ordinances to control runoff. Finally, the Marsh is also governed by the Suisun Marsh Local Protection Program and Solano County's *Policies and Regulations Governing the Suisun Marsh*. To illustrate, Water Quality Policy Number 4 of Solano County's Policies and Regulations states that the development of industrial facilities adjacent to or upstream from the Marsh should be planned to eliminate significant adverse environmental impacts on the water quality of the Suisun Marsh, and that activities that could significantly alter the temperature, salinity or turbidity of the water should be prohibited.

Legislative Authority and Jurisdiction. As mentioned above, the Commission's authority is multi-faceted and complex. One facet of this complexity stems from the federal Coastal Zone Management Act (CZMA). The CZMA requires federal activities, federal development projects, federally funded projects or projects requiring federal permits to be consistent to the maximum extent practicable with BCDC's coastal zone management program. Projects are subject to the CZMA if they occur within the coastal zone or if they would affect the coastal zone, even if the projects are located outside of the coastal zone. Federal agencies submit consistency determinations for their proposed activities, and applicants for federal permits, licenses, other authorization, or federal financial assistance submit consistency certifications. BCDC then has the opportunity to review the consistency determinations and certifications and to either concur with or object to them. For a project with federal involvement, the Commission could object to a consistency determination or certification on the grounds that the project does not meet the Commission's policies, including those that protect water quality in the *San Francisco Bay Plan* or Suisun Marsh Preservation Act and *Suisun Marsh Protection Plan*. Thus, the CZMA would allow the Commission to look at polluted runoff issues in a federal or federally funded or approved project in the same manner that it could for a non-federal project. In performing such review, however, the Commission has only two options: (1) advise the federal agency that a project is consistent to the maximum extent practicable; or (2) advise the federal agency that a project is not consistent to the maximum extent practicable. The Commission has no power to grant, deny or condition permits as part of its federal consistency review.

The *San Francisco Bay Plan* Policies. The Bay Plan's Water Quality policy section contains the findings and policies most directly related to nonpoint source pollution, described in detail below.

Proposed revisions to the Water Quality findings and policies precede this report's introduction. Other sections of the Bay Plan, including Water Surface Area and Volume, Recreation, Dredging, and Fresh Water Inflow also include water quality-related findings or policies, but have not been reviewed in conjunction with this report. Some of these policies, such as Water Surface Area and Volume and Fresh Water Inflow, are intended to be reviewed as a future task in the Commission's work program. Other policies, such as Dredging, were recently amended, and the amendments address water quality concerns. Recreation findings and policies pertaining to marina-related nonpoint source pollution are also not addressed in this report as BCDC is currently undertaking extensive efforts as part of its Nonpoint Source Work Program to work collaboratively to identify and address marina-related issues in San Francisco Bay and to help determine whether and to what extent marina-related nonpoint source pollution is a problem in San Francisco Bay.

Water Quality. The Bay Plan findings on water quality state (page 17):

a. San Francisco Bay receives a variety of wastes from numerous sources throughout its tributary drainage area. These include industrial and municipal waste, urban and agricultural surface runoff, sedimentation from upland erosion, vessel wastes, oil and chemical spills, and leachate from landfills and toxic dumps. Pollution occurs when waste discharges unreasonably interfere with, damage, or destroy one or more of the beneficial uses of the waters of the Bay. Pollutants include substances that are toxic, that unduly stimulate organic growth in the Bay, or that deplete dissolved oxygen. Polluted waters may be offensive to the senses, unsafe for human contact or use, damaging or lethal to aquatic life, or unsuitable for industrial use.

b. Pollution from past waste discharges resulted in harm to fish and wildlife and the Bay's beneficial uses. Implementation of state and federal water pollution control programs by public agencies, particularly the U.S. Environmental Protection Agency, the State Water Resources Control Board, and the San Francisco Bay Regional Water Quality Control Board, have decreased significantly the pollutant levels in waste discharges to the Bay, resulting in dramatic improvements in the quality of Bay waters. However, water pollution still impairs Bay water quality and the beneficial uses of the Bay. Of particular concern is the potential for cumulative long-term effects on the Bay from toxic pollutants. Water quality varies significantly within the Bay due to the pattern of waste discharges and the varying capability of the Bay to dis-

perse, flush, and assimilate pollutants. Certain localized areas are seriously polluted with toxic substances. Additionally, toxic disposal sites on the shoreline threaten both Bay water quality and the development and use of certain areas of the shoreline by the public.

c. Many strategies can be used to reduce the discharge of pollutants to the Bay, including: (1) assuring adequate treatment of wastes discharged to the Bay and its tributaries in compliance with standards set by the State Water Resources Control Board, San Francisco Bay Regional Water Quality Control Board, and the U.S. Environmental Protection Agency; (2) directing treated waste discharges to the ocean (after assuring that the marine environment will be protected); (3) eliminating discharge of toxic substances into the Bay; (4) cleaning up existing toxic sites in the Bay, on the shoreline, or in upland areas that drain into the Bay; and (5) preventing increased sedimentation of the Bay by controlling upland soil erosion, particularly during the land development process.

d. The harmful effects of pollutants reaching the Bay can be reduced by maximizing its capacity to assimilate, disperse, and flush pollutants. Key elements that affect the Bay's natural capacity to assimilate, disperse, and flush wastes are: (1) the volume and circulation of water flowing in and out with the tides and in fresh water inflow; (2) the rate of oxygen interchange at the surface of the Bay; and (3) the extent and distribution of tidal marshes.

e. The State Water Resources Control Board is responsible for formulating and adopting state policy for water quality control pursuant to the state Porter-Cologne Water Quality Control Act and federal Clean Water Act. The State Water Resources Control Board is responsible for approving the water quality control plans of the nine regional water quality control boards, and establishing salinity standards for the Bay and Delta to protect the beneficial uses of these waters. The San Francisco Bay Regional Water Quality Control Board is charged with designating, protecting, and enhancing the beneficial uses of the waters of the San Francisco Bay Basin. The San Francisco Bay Regional Water Quality Control Board states the beneficial uses of the Bay waters and the water quality objectives and waste discharge standards in its Water Quality Control Plan, San Francisco Bay Basin, which it carries out through adoption and enforcement of waste discharge requirements and certification of Army Corps of Engineers' permits.

The Bay Plan policies on water quality state (pages 17-18):

1. To the greatest extent feasible, the Bay marshes, mudflats, and water surface area and volume should be maintained and, whenever possible, increased. Fresh water inflow into the Bay should be maintained at a level adequate to protect Bay resources and beneficial uses. Bay water pollution should be avoided.

2. Water quality in all parts of the Bay should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the Regional Water Quality Control Board's Basin Plan. The policies, recommendations, decisions, advice and authority of the State Water Resources Control Board and the Regional Water Quality Control Board, should be the basis for carrying out the Commission's water quality responsibilities.

3. Shoreline projects should be designed and constructed in a manner that reduces soil erosion and protects the Bay from increased sedimentation through the use of appropriate erosion control practices.
4. Polluted runoff from projects should be controlled by the use of best management practices in order to protect the water quality and beneficial uses of the Bay, especially where water dispersion is poor and near shellfish beds and other significant biotic resources. Whenever possible, runoff discharge points should be located where the discharge will have the least impact. Approval of projects involving shoreline areas polluted with hazardous substances should be conditioned so that they will not cause harm to the public or the beneficial uses of the Bay.

BCDC's Permit Conditions. In addition to the Bay Plan policies, BCDC also addresses water quality and nonpoint source pollution in its permits. The type of water quality condition the staff imposes varies depending on the Commission's authority, jurisdiction and on the potential water quality impacts of a particular project. A description of the types of permits that often require water quality nonpoint source conditions and those that do not, and examples of those permit conditions are included below, followed by a brief description of interactions with the Regional Board.

Permits Types That Do And Do Not Require Water Quality/Nonpoint Source Conditions. The Commission issues permits for projects within its Bay, 100-foot shoreline band, salt pond, managed wetlands, and certain waterways jurisdictions, and in the primary management area of the Suisun Marsh. The size, location, and impacts of a project often determine which type of permit is appropriate for a particular project. Generally, there are three types of permits that the Commission regularly issues. In the case of an emergency, any of the three types of permits can be issued almost immediately if a project is needed to protect life, health, or property. These permits include *Regionwide* or *Abbreviated Regionwide* permits, *Administrative* permits, and *Major* permits. Additionally, for projects in the primary management area of the Suisun Marsh, the Commission issues *Marsh Development* permits. Regionwide or Abbreviated Regionwide permits usually involve routine maintenance work that qualifies for approval under an existing Commission regionwide permit, and can be authorized in a very short period of time by the Commission's executive director without Commission review or a public hearing. These permits are already issued and further conditions can not be imposed on them; however, these permits do include some standard conditions that address water quality (see Appendix E). An Administrative permit can be issued for an activity that qualifies under BCDC's regulations as a minor repair or improvement in a relatively short period of time and without a public hearing on the application. The proposed project must be reviewed against the same policies that are used to determine whether a major permit can approved. Because administrative permits typically include smaller projects than major permits, those projects may not require the same amount of scrutiny as projects considered under a major permit. However, the staff reviews each application separately, and if the staff believes a project is likely to have significant impacts on water quality, it may impose one or more special water quality permit conditions. These are often the same conditions that are imposed on major permits. A Major permit is issued for work that is more

extensive than a minor repair or improvement. A public hearing is held on an application for a major permit and the application may be reviewed at hearings held by the Commission's advisory Engineering Criteria Review Board and Design Review Board. Within the primary management area of the Suisun Marsh, the Commission issues Marsh Development permits, which authorize development that is consistent with the applicable certified local protection program or, in the absence of a certified program, with the provisions of the Suisun Marsh Preservation Act and the policies of the Suisun Marsh Protection Plan. These acts, plan and programs require that existing land and water uses should continue and be protected and managed to enhance the quality and diversity of aquatic and wildlife habitat.

The staff considers various factors to help it decide whether or not to impose one or more special water quality permit conditions on a project, in addition to the standard permit conditions that are imposed. For example, as part of the analysis of the permit application, the staff often consults the Environmental Impact Report or other environmental documentation prepared for that project for potential water quality impacts. The staff also relies on their experience with past projects of a similar nature to include similar permit conditions. Before issuing a permit, the Commission considers any information that may be brought up at public hearings on the project, such as potential water quality impacts that may have been originally overlooked. The Commission also considers any input on projects from the Regional Water Quality Control Board or other relevant agencies, prior to issuing a permit.

From its review of some recent BCDC permits, the staff determined that major permits, reflecting certain types of projects in the Commission's various jurisdictions, often contain water quality and/or nonpoint source pollution conditions. Typical projects that include these permit conditions are large fill projects such as the construction or expansion of marinas, bridges, or shipping terminals; marsh or wetland restoration; dredging; and waste discharge or clean up of hazardous waste. A brief description of each of the project types that the staff reviewed is included in Appendix F.

Sample Types of Polluted Runoff Permit Conditions. The Commission imposes various special permit conditions for projects that could have impacts on water quality, depending on the type of project and the nature or significance of the impacts. Additionally, two of the standard permit conditions included with every permit issued address water quality. Special conditions are often specialized to address the needs of a particular project. Typical requirements include discharge prohibitions, structural and non-structural best management practices, performance standards, plan review, reporting requirements, and other governmental approvals. The staff identified several water quality-related permit conditions from its review of permits. These conditions include: (1) directly-related special conditions (water quality, nonpoint source pollution control, dredging, marinas, marsh protection, diked wetlands protection, marsh restoration, Emergency Release Response Plan and Lease Agreement, control of invasive species-ballast water, creosote-treated wood, and sealing abandoned pipelines); (2) indirectly-related special conditions (shoreline protection, construction operations, debris removal, and soil removal); and (3) standard

conditions (required permissions, and performance). Appendix E contains several examples of the types of polluted runoff-related permit conditions that the Commission has previously required.

The Regional Board staff, in conjunction with BCDC staff, reviewed BCDC's existing permit conditions related to water quality and nonpoint source pollution and suggested some specific changes to ensure the conditions reflect current best management practices, such as incorporating additional measures to protect water quality from construction activities and erosion. Additionally, BCDC staff is setting up a process to keep the permit conditions updated, including working with the Regional Board to provide workshops and training on best management practices and other nonpoint source issues; for example, the Regional Board staff recently conducted a training specifically for BCDC's regulatory staff on construction and erosion control BMPs, discussed actual permits the Commission issued and suggested some modifications to special permit conditions to better address potential impacts of erosion and sediment from projects.

Regional Board Interactions on Permits, MOUs. The staff interacts with the Regional Board in different ways on various projects that may have water quality impacts, such as dredging, waste discharge or cleanup of hazardous wastes. For dredging projects, for example, the Regional Board is required to act (for example, by issuing water quality certifications or waste discharge requirements) before the Commission files an application as complete. For outfall projects in the Bay and for the discharge of any gaseous, liquid, or thermal waste in the Suisun Marsh, Regional Board approval may be required before BCDC can issue its permit. For construction projects that disturb five or more acres of land, the Regional Board requires a National Pollutant Discharge Elimination System (NPDES) general permit and Storm Water Pollution Prevention Plan (SWPPP). These types of permits and plans typically need to be secured before

BCDC can issue its permits. Section 66632(e) of the McAteer-Petris Act requires the Regional Board, within 30 days of receiving a copy of a filed Commission permit application, to provide the Commission with a report indicating the effect of the proposed project on Bay water quality.

For other types of projects, the Regional Board and BCDC coordinate at various stages of the permit application process. For example, for major permit applications, the staff sends a copy of the permit application to the Regional Board for review and comment at least 28 days before the Commission public hearing on the permit is scheduled. As noted earlier, the Regional Board is required to file a report with the Commission within 30 days of receiving a copy of the filed BCDC application. For administrative permit applications, the Regional Board receives a copy of BCDC's listing of administrative permits[141] two weeks before the Commission is scheduled to act on the proposed project. Additionally, under the McAteer-Petris Act, a member of the Regional Board is appointed to the Commission and can inform the Commission and staff about any particular water quality concerns with a project. The Regional Board also receives a copy of any permit the Commission issues.

Furthermore, the Commission has an Memorandum of Understanding (MOU) with the Regional Board and State Board, last updated in 1988, that establishes the Regional Board as the lead agency with regard to water quality issues in San Francisco Bay, including nonpoint source pollution; and states that the policies, decisions, advice and authority of the State Board and the Regional Board should be the primary basis for BCDC to carry out its water quality responsibilities but also notes that the Commission must, under its state McAteer-Petris Act authority, independently consider the water quality impacts of fill projects on San Francisco Bay. The State Board and Regional Board, however, have the primary role in regulating water quality under state and federal statues. The MOU also incorporates attachments specifically regarding vessel wastes discharges, houseboat waste discharges, toxic sites, and delta outflow, enforcement and surveillance, and non-point source procedures. The Non-Point Source Procedures (Attachment F) specify that the Regional Board agrees "to determine the acceptability of control or treatment alternatives for non-point source pollutants, and agrees to provide BCDC with information on any proposed treatment or control alternatives for non-point source pollution, including recommended permit conditions." The MOU also specifies that BCDC will require in its permits the use of BMPs, treatment alternatives, and measures recommended by the Regional Board and contained in ABAG's manual of erosion control, consistent with its law and policies, in order to control non-point source pollution. This attachment has not been updated to reflect current trends (e.g., use of ABAG's manual is outdated) and recommended pollution prevention techniques and practices (as opposed to only treatment and end-of-the pipe controls). One of BCDC's Nonpoint Source Work Program tasks is to work

[141] After the Commission staff determines that an application is complete, the Commission's executive director summarizes the application on a listing that is sent to the Commission, state agencies, and the general public. On this listing, the executive director indicates whether the staff proposes to approve or deny the application.

with the Regional and State Board to update the nonpoint source attachments to the MOU.

BCDC's Planning Program. Several planning efforts the Commission has undertaken, such as developing issue plans or scientific reports or participating in ongoing educational and collaborative efforts, have involved nonpoint source pollution or general water quality issues. To illustrate, in August 2001, in response to a directive from the Resources Agency, the Commission staff developed a *Nonpoint Source Pollution Report and Work Program*, which provides a succinct review of the Commission's current nonpoint source authority and strategy, identifies areas where more Commission efforts may be appropriate and includes a proposed Work Program to address them. The five-year Work Program includes four primary components: (1) reviewing *San Francisco Bay Plan* findings and policies pertaining to nonpoint source pollution; (2) holding public nonpoint source workshops for interested agencies and organizations such as recreational boating groups, marina operators, stormwater programs, and environmental groups; (3) increasing coordination with federal, State and local agencies, stormwater programs, recreational boating organizations, environmental groups, and other interested parties; and (4) identifying procedures for implementing the California Plan (tracking, monitoring, training). Additionally, pursuant to the Commission's Nonpoint Source Work Program, Commission staff participate in various collaborative, interagency efforts such as the State's Interagency Coordinating Committee (IACC) and Critical Coastal Areas Committee (CCA), to help implement the California Plan for nonpoint source pollution control.

In another effort, Commission staff developed an unpublished background report on polluted runoff for the North Bay Wetlands and Agricultural Protection Program.[142] This report described the general causes and impacts of polluted runoff, examined the sources of polluted runoff in the North Bay, and highlighted local efforts to manage polluted runoff, ranging from technical assistance programs to erosion control ordinances. The report also contained a number of recommendations to help local governments improve their polluted runoff strategies. These efforts allow the Commission to strategically address polluted runoff within its jurisdiction, and to provide education when the critical issue is outside of its jurisdiction.

[142] BCDC, 1999. *Polluted Runoff in the North Bay*. Unpublished Staff Report.

The Commission staff should continue to participate in interagency efforts such as the IACC, continue to implement its existing Nonpoint Source Work Program, and continue to develop five-year plans to implement the California Plan. After the next five-year plan is developed, the Commission staff should evaluate its Nonpoint Source Work Program and the Commission should modify it as appropriate to reflect any substantial changes or new directions and activities.

CHAPTER 5

POLLUTION PREVENTION AND REDUCTION STRATEGIES AND CONTROLS

This chapter discusses various pollution prevention strategies and controls currently being used or proposed to address nonpoint source pollution and identifies areas where BCDC may play a role. First, some general pollution prevention and reduction strategies are described followed by some of the regulatory controls, such as the Regional Board's Basin Plan and Watershed Management Initiative Chapter, and some local controls that are being used to reduce and prevent nonpoint source pollution. Next, some of the specific management measures identified in the California Plan to reduce or control pollution from urban runoff, hydromodification and wetlands are discussed, and other strategies or best management practices that are being or could be applied to reduce and control pollution are presented. Where appropriate, the chapter provides suggestions for possible actions and for water quality findings and policy revisions, especially regarding the implementation of management measures.

General Strategies For Controlling Pollution: Prevention, Control, Remediation. The protection of Bay ecosystems and human health from toxic, persistent pollutants requires a comprehensive approach that includes the following goals, listed in the *Comprehensive Conservation and Management Plan for the Bay and Delta* (CCMP): first, promoting mechanisms to prevent pollution at its source; second, where pollution prevention is not possible, controlling and reducing unavoidable pollutants to the Estuary; third, remediation and clean up of existing contaminants throughout the Estuary; and finally, protecting against toxic effects, including bioaccumulation and toxic sediment accumulation. Sixteen specific actions, ranging from pursuing a mass emissions strategy or developing a comprehensive strategy to reducing pesticides in the Estuary to improving the management and control of urban runoff from public and private sources, are set out in the CCMP's pollution section to achieve these goals (see Appendix G).

In recent years there has been a move toward pollution prevention at the source, involving such strategies as source reduction and waste minimization. While source reduction uses raw material substitution, good housekeeping, and technological improvements to eliminate toxic wastes at the source, before entering treatment systems and the Bay, waste minimization works to reduce the overall volume and toxicity of wastes through waste treatment, reuse and recycling.[143] Pollution prevention techniques, such as those currently being implemented by county-wide stormwater programs, may be a viable strategy to help achieve reductions in pollutant loads given the environmental problems and costs associated with new treatment technologies.

The Commission should recognize a comprehensive approach is needed to prevent and control nonpoint source pollution, and pollution prevention, source reduction, and materials substitution, where

[143] SFEP, 1992. Estuarywise, p.5; SFEP, 1999, Pollution Fact Sheet.

appropriate and within the Commission's authority, should be incorporated into site planning and construction design. Where pollution prevention is not possible, unavoidable pollutants to the Bay should be controlled, reduced, or remediated consistent with the advice of relevant state and federal water quality or hazardous materials management agencies.

CCMP Implementation. According to the September 2001 Bay-Delta Environmental Report Card, developed by San Francisco Estuary Project to measure regional progress towards implementing the CCMP's 145 actions, minimizing or eliminating pollution of the Estuary from all sources is one of the eight top priorities for the coming years. Many of these actions are being implemented through voluntary initiatives or partnerships or through regulatory controls (see section below); for example, in support of Public Involvement and Education Action 2.5, Increase long-term educational programs designed to prevent pollution of the Estuary's ecosystem, SFEP has organized ten to twelve erosion control workshops per year for developers, builders and local governments to educate about construction site planning BMPs, to help prevent erosion and sediment problems and to improve water quality. To help implement Pollution Prevention and Reduction Action 2.5, Develop control measures to reduce pollutant loadings from energy and transportation systems, a Brake Pad Partnership, a cooperative effort between brake manufactures, agencies, and environmental groups, has been working to understand and minimize impacts of vehicle brakes on surface waters with a particular focus on copper.[144] Some additional Pollution Prevention and Reduction actions/strategies such as pursuing a mass emissions strategy and improved management and control of urban runoff from public and private sources are discussed in the section below on regulatory controls.

The Commission staff should continue to support in the San Francisco Estuary Project's Friends of the Estuary program to help minimize and eliminate pollution in the Bay.

Watershed Management Activities. Another general strategy and also a top priority for CCMP implementation that is being used to control pollution is promoting watershed management, to ensure all sources of pollution as well as issues such as erosion, habitat loss, stream protection, water supply and flood management are coordinated and considered together within distinct hydrologic units. As illustrated in the Bay-Delta Report Card summary, in the City of San Jose, there has been a growth of watershed management activities aimed at reducing runoff and protecting stream environments and wetlands, evidenced by the City including sustainable city policy strategy in its General Plan and by the completion of the City's Riparian Restoration Pilot Project in March 2001. Other examples include the implementation of a Watershed Improvement Program to protect 15 creeks in Oakland, and flood protection and watershed planning in the Santa Clara Basin by the Santa Clara Basin Watershed Management Initiative (WMI), a broad stakeholder-based, voluntary initiative committed to pollution

[144] SFEP, 2001. Bay-Delta Environmental Report Card, 1999-2001, p.17.

control and watershed protection. The WMI published a *Watershed Characteristics Report* in 2000 and is preparing an assessment focused on three sub-basin watersheds as well as an action plan. These types of activities support the watershed management actions included in the Report Card (Land Use (LU) 1.1 and LU 3.1) that state "local General Plans should incorporate watershed protection plans to protect wetlands, stream environments, and reduce pollutants in runoff," and "prepare and implement Watershed Management Plans that include…wetlands protection, stream environment protection; and reduction of pollutants in runoff." Furthermore, Regional Boards have been working cooperatively with local interests to develop draft watershed management plans for watersheds such as the Napa River and Santa Clara Valley.[145]

The Regional Board also completed a revised *Watershed Management Initiative Integrated Plan Chapter* in January 2002, which is intended to be a regularly updated planning tool to protect water resources and activities in San Francisco Bay within a watershed management approach and to identify priorities and priority tasks for funding (see section below). Whereas the past State and Regional Board programs were reasonably effective in controlling point source pollution and tended to be directed at site-specific problems, today, the control of diffuse nonpoint pollutant sources requires a coordinated watershed management approach.

The Regional Board's Basin Plan also illustrates the trend towards a watershed management framework for regional water quality control. The Regional Board incorporates three levels of programs in its watershed approach directed at: 1) the larger San Francisco Bay; 2) smaller segments within the Estuary, and 3) individual watersheds draining into the larger system. As stated in the implementation component of the Basin Plan, Chapter 4.1, a major part of the Board's water quality control plan focuses on managing the influx of toxic pollutants to the Estuary, and the "overall goal of these programs is to limit the total amount of pollutants in the entire system to ensure protection of beneficial uses."

The Commission should continue to support the efforts of federal, State, and local agencies in developing nonpoint source pollution control programs, including watershed management programs, to ensure all sources of pollution that will benefit the Bay's water quality control including erosion and flood management are coordinated and considered together.

Regulatory Controls: Basin Plan. The Regional Board's 1995 Basin Plan sets out the general structures and programs the Regional Board uses to address point and nonpoint sources of pollution and includes the beneficial uses the Regional Board will protect; the water quality objectives needed to protect the uses; and strategies to achieve the water quality objectives; for example, the implementation chapter of the Basin Plan describes the Waste Discharge Permitting Program the Board uses to control point source discharges to surface waters. These discharge requirements are usually issued under a NPDES

[145] SFEP, SOE 1992-1997, p.24.

permit and contain components such as discharge prohibitions, effluent limitations, and provisions ensuring proper treatment, storage and disposal of waste, as well as a monitoring program component. These permits are referred to as Waste Discharge Requirements (WDR) and often set limits on what may be discharged. Although mostly point sources such as treated municipal sewage or treated industrial wastewater are covered by the permitting program, some nonpoint sources with a physically identifiable point of discharge are also included such as stormwater discharges, whose permits often include requirements to prevent or reduce discharges of pollutants that contribute to water quality objective violations. Compliance is often achieved through implementation of control measures or best management practices identified in the discharger's stormwater management plan or pollution prevention plan. The Regional Board also requires Water Quality Certifications for filling and dredging projects and can waive these requirements for small projects if the Regional Board determines the water quality standards are being met.

The Basin Plan also describes the Regional Board's strategy for managing nonpoint source pollution as follows: (1) changes in existing operating practices to minimize the potential for untreated wastes to reach aquatic systems, (2) collection and treatment of wastes, and (3) prohibition of waste-generating practices. These strategies are implemented through programs such as urban runoff management, industrial activity control, construction activity control, erosion and sediment control, dredging, wetland protection, etc. For example, to prevent any increase of pollutants entering storm drain systems, local agencies such as special districts with maintenance responsibility for storm drain systems are encouraged to voluntarily develop and implement baseline control programs. The Basin Plan also describes a Comprehensive Control Program strategy, intended to remediate existing water quality problems and prevent new problems associated with urban runoff, and implemented through the NPDES stormwater permit process. To reduce pollutant loading to the maximum extent practicable, the Program includes the following permit components: characterization of urban runoff discharges, elimination of illicit connections and illegal dumping, development and implementation of measures to reduce

pollutant runoff associated with pesticides and herbicides, development and implementation of operation and maintenance measures for public highways to reduce polluted runoff, and effective pollution reduction measures. Municipalities are required to submit annual reports to the Regional Board describing the programs and evaluating their effectiveness.

The Basin Plan also specifies that for construction activities that disturb five or more acres of land, or part of a larger project that disturbs more than five acres, the Regional Board requires a general NPDES permit for the discharge of stormwater from those activities, including the preparation and implementation of a Stormwater Pollution Prevention Plan, effectiveness monitoring, and post-construction control of stormwater pollutants. Pursuant to Phase II regulations, this requirement will also extend to construction activities that disturb one or more acres (see section describing Other Regulatory Controls).

Additionally, the nonpoint source pollution control strategy includes an Erosion and Sediment Control Program, which has a goal of reducing and preventing accelerated (human caused) erosion to the level necessary to restore and protect beneficial uses of receiving waters significantly impaired or threatened by sediment, and which is to be implemented through means such as proper soil management practices, reliance on local government erosion and sediment control ordinances and programs, encouraging implementation of appropriate BMPs, and requiring erosion control plans with statewide general NPDES permits.[146]

To better understand the most effective practices for avoiding or minimizing water quality impacts, in its permit application the Commission should request Storm Water Pollution Prevention Plans (SWPPP), stormwater management plans, or other water pollution or erosion and sediment control plans showing best management practices as available as part of its application requirements as required by the Regional Board and Stormwater Management Agencies, or local governments.[147]

WMI Chapter Programs. The Regional Board's January 2002 *Watershed Management Initiative Integrated Plan Chapter* (WMI Chapter) identifies the structure, priorities and programs the Regional Board is employing to address water quality issues, including nonpoint source pollution and is intended to be consistent with both the Basin Plan and CCMP. Surface water programs are divided into three main areas, Watershed Management, Policy and Planning, and National Pollutant Discharge Elimination System (NPDES) Permits, which focuses primarily on reissuance of permits for wastewater programs. Environmental compliance is included as part of Watershed Management, and basin planning and policy development, monitoring and assessment, Bay dredging and dredge material disposal, and TMDLs are

[146] Regional Board, 1995. Basin Plan, Chapter 4.

[147] Some of these documents, e.g. SWPPPs will not be available until immediately prior to construction and thus the permit could require submittal prior to construction, for example. Contract specifications for erosion or stormwater control could also or alternately be requested.

included as part of Policy and Planning. The Regional Board identified 14 high-priority water quality management issues through a priority setting process in 1997 and refined those issues in 2001 into the following five high-priority issues to be addressed over the next several years: (1) urban runoff, (2) TMDLs, (3) wetlands and stream protection, (4) rural nonpoint source, and (5) rural wastewater (listed below), along with three potential future priorities: grazing via erosion/sediment TMDLs, water quantity where it has a deleterious effect on water quality, and temperature and nutrients via new TMDLs. Understanding these regional management priorities may better enable the Commission to know where best to put additional efforts (e.g., urban runoff and wetlands) and to ensure BCDC's efforts are consistent with these priorities as appropriate.

Top Regional Board Priority Water Quality Management Issues[148]

1. Urban Runoff
   a. New Development
   b. Watershed Monitoring
   c. Industrial Stormwater
   d. Compliance Status
   e. Trash TMDLs (via municipal stormwater permits)

2. Total Maximum Daily Loads (TMDLs)
   a. Mercury
   b. Erosion/Sedimentation (including vineyards in Napa and Sonoma Counties)
   c. Sediment Hot Spots/Sediment Management/Beneficial Reuse
   d. Watershed Monitoring
   e. Pesticides

3. Wetlands and Stream Protection
   a. Wetlands
   b. Waterway Management and Stream Protection
   c. Exotic Species

4. Rural Nonpoint Source (NPS)
   a. Confined animals (dairies, horse boarding, and other)
   b. Vineyards

5. Rural Wastewater and non-Chapter 15 Waste Discharge Requirements (WDRs)

As stated in the WMI Chapter, the Regional Board addresses these priorities through regionwide programs/activities including Basin Planning (planning and policy development), monitoring and assessment, nonpoint source, wetlands and stream protection, field team/environmental compliance, core regulatory programs, groundwater resource management, geographic information system (GIS), and TMDLs; for example, under planning and policy development, in support of the long term planning objective refine existing regulations, policies, and implementation measures to define limits and

[148] Regional Board, WMI Chapter.

requirements appropriate for local conditions, there is a task to resolve copper and nickel issues by developing Basin Plan amendments to include site specific objectives for copper and nickel in South San Francisco Bay, and to develop pollutant-specific strategies for mercury, PCBs, and selected pesticides. In support of this objective, a draft mercury strategy was prepared and released for public comment to set the stage for TMDL development and Basin Plan amendments, and sampling information on PCBs has been collected through the San Francisco Estuary Regional Monitoring Program.[149] The regionwide programs that are most applicable to this report and to BCDC's jurisdiction and authority are briefly described below.

Planning and Policy Development. In addition to the planning objective discussed above, other objectives are included in the WMI Chapter to help manage water quality on a watershed basis; for example, in support of Planning Objective 3, develop local policies and regulatory approaches for watershed management, the Regional Board is developing a stream protection policy to enhance the ability to protect the functions of streams that are necessary to preserve the beneficial use of the stream. Planning Objective 4 is development of TMDLs for pollutants and stressors of concern (in addition to those noted in other tasks (copper, nickel, mercury, and PCBs). In support of this objective, among other tasks, draft TMDLs are being developed for all water bodies and stressors included on the 2002 303(d) list, and an initial action plan for the control of exotic species has been completed. This objective will also involve the development of a regional strategy for sediment TMDLs with initial focus on the Napa River and Sonoma Creek watersheds.

Monitoring and Assessment. The WMI Chapter also describes the various monitoring programs the Regional Board participates in such as the Surface Water Ambient Monitoring Program (SWAMP). The SWAMP is being used in this Region to perform ambient monitoring to implement the regional Monitoring and Assessment Strategy, developed in 1999 in cooperation with many stakeholders, and intended to provide information for all waterbodies in the Region to support federal CWA requirements (e.g., 305(b) report and 303(d) list). The SWAMP program is partially intended to identify reference sites, identify impacted sites or impaired sites or waterbodies to determine if beneficial uses are being protected, identify the cause of impacts, determine if these impacts are associated with specific land uses and evaluate monitoring tools. The approach for those planning watersheds that will be monitored includes monitoring fish for contaminant levels in reservoirs and coastal areas, watershed monitoring to assess water quality impacts and establish regional reference site conditions. The Regional Board also participates in such monitoring efforts as the RMP, Mussel Watch Program, Toxic Substances Monitoring Program and continues to coordinate with efforts such as Bay Area Stormwater Management Agencies Association and San Francisco Estuary Institute.

[149] Regional Board, WMI Chapter, p. 16-18.

Nonpoint Source Program. The WMI Chapter emphasizes three goals and objectives for nonpoint source management in this Region:

1. Encourage development and implementation of watershed management plans that address nonpoint source pollution by working internally and with outside stakeholders in the Region,
2. Ensure effective implementation of high priority management measures for confined animal facilities, urban runoff, and hydromodification, and
3. Educate, inform, and provide technical assistance to the public, agencies, and private landowners about prevention and correction of nonpoint source pollution problems.

The Regional Board bases its approach to control nonpoint sources of pollution upon the three nonpoint source regulatory management options defined in the *Plan for California's Nonpoint Source Pollution Control Program* (California Plan). Two of the options involve Regional Board-issued waivers and are defined as non-regulatory implementation (requiring the use of Regional Board-prescribed management practices (MPs)/best management practices (BMPs) or their equivalent). The third option involves Regional Board use of waste discharge requirements and Basin Plan prohibitions. Prevention and control of nonpoint source pollution depends on the effective implementation of MPs/BMPs, and the State Board and Regional Boards provide a broad outreach and education program to educate dischargers regarding MP/BMP implementation. These programs have focused on new development and construction-related activities, management of confined animal facilities, vineyard management and dredging operations, among others. The State Porter-Cologne Water Quality Control Act also provides the Regional Board with a range of enforcement options, from an informal Notice of Violation to referrals to the Attorney General and, in rare cases, criminal prosecution.

Wetlands and Stream Protection. In addition to the programs within the various divisions related to wetlands and stream protection, such as SWAMP, Mussel Watch, and the RMP, the Regional Board also issues Water Quality Certifications for federally permitted activities affecting wetlands and streams and Waste Discharge Requirements to regulate discharges of waste to waterways (including fill material, sediment and changes in flow). Some of the key objectives for the wetlands program include assigning a Baylands Advisor, developing Regional General Permits (WDRs) for wetland fill/impacts with limited water quality threats, and complete a Basin Plan Amendment that provides guidelines for determining wetland monitoring requirements and a new beneficial use definition. The Regional Board is also developing a Stream Protection Policy to describe how protecting stream functions will protect beneficial uses and will focus on riparian corridors, floodplains, buffer zones, instream structures, and hydrograph changes.[150] The Regional Board is also developing guidelines for best management practices for

[150] Regional Board, WMI Chapter, p. 42-48.

maintenance activities involving bank stabilization, vegetation, sediment removal and repair of in-stream structures and has recently produced a technical reference circular (October 2002 and revised April 2003) entitled, *A Primer on Stream amd River Protection for the Regulator and Program Manager*.

Core Regulatory Programs: Stormwater NPDES Permits. Among other priorities for the municipal storm water program is a focus on TMDLs and 303(d) listed pollutants, new development, and monitoring and assessment; for example, new development permit amendments for Alameda, Contra Costa and San Mateo Counties among others will be added based on the recent adoption of enhanced performance standards in Santa Clara Valley Urban Runoff Pollution Prevention Program's NDPES permit.

Total Maximum Daily Loads (TMDLs). One of the CCMP actions, Pollution Prevention and Reduction 2.1, is to "pursue a mass emissions strategy (TMDLs) to reduce pollutant discharges into the Estuary from point and nonpoint sources and to address the accumulation of pollutants in estuarine organisms and sediments." In response, the Regional Board is developing TMDLs for pollutants for all listed 303(d) water bodies and has developed a draft TMDL for Mercury.[151] The TMDL process includes various elements such as a problem statement, numeric targets, source analysis, allocations and an implementation plan. The Regional Board's strategy is to look at TMDLs as the means to improving water quality, not as the goal itself, thus for each TMDL, resources will be focused on critical tasks, and effective stakeholder participation will be encouraged. Because of the many challenges involved in solving the myriad water quality problems in San Francisco Bay, such as limitations to existing models, complex fate and transport processes, legacy pesticides, and sources outside the Regional Board's jurisdiction, it is essential that priorities are set and resources allocated within the watershed framework, and through integration with key agencies and entities both involved in and affected by the process. TMDLs around the San Francisco Bay region are tentatively planned or in progress between 2002 and 2010 (and some still to be determined) for such pollutants as Mercury, Exotic Species, Copper, Nickel, PCBs, Diazinon, Pathogens, Siltation, Nutrients, Sediment, Chlordane, DDT, Dieldrin, Salinity, Selenium, and Dioxins among others. The Suisun Marsh, for example, lists Metals, Nutrients, Low DO, Organic Enrichment and Salinity as pollutants, has a projected start date of July 2004 and a completion date of June 2007 for a TMDL with an implementation plan. A list of TMDL projects and timelines for the San Francisco Bay Region is included in Appendix H.[152]

Commission Support of Regional Pollution Prevention Programs. The Commission's nonpoint source pollution management priorities should be consistent with the Regional Board's top priority water quality issues to the extent possible and to the extent that the Commission has authority and jurisdiction

[151] SFEP, 2001. Bay-Delta Environmental Report Card, p.16.
[152] Regional Board, WMI Chapter, p.122-125.

over them.[153] The Commission should support regional programs for the prevention and control of nonpoint source pollution such as urban runoff management, wetlands and stream protection, nonpoint source management, and monitoring and assessment. The Commission should coordinate with the Regional Board, EPA and other agencies and entities, such as the Bay Area Stormwater Management Agencies Association (BASMAA),[154] as appropriate on urban runoff issues to assure that the Commission's permit requirements are consistent with and help carry out programs that will improve the Bay's water quality. The Commission staff should keep informed on TMDL development in the region as appropriate. The Commission should also work with the Regional Board to jointly identify specific areas where collaboration would further both agencies' nonpoint source pollution efforts and stay informed on the types of guidelines and practices that the Regional Board and other agencies develop that might help to further the Commission's nonpoint source efforts as called for in the Commission's MOU with the State and Regional Boards.

Other Regulatory Controls. In addition to the Basin Plan and WMI Chapter, other regulatory controls are also being used to address pollution sources. Local controls such as General Plan Land Use and Conservation elements may address water quality and the land uses with the potential for impacting water resources related to new development. The City of Oakland, for example, included preservation language in their Open Space and Recreation elements of their General Plan. The City of Oakland (community members and policy makers) also created a Creek Protection Permit included as part of their Stormwater Ordinance. The Ordinance includes permitting guidelines for development and construction projects taking place near creeks and may require the submittal of a permit application and site plans, notices, creek protection plans and hydrology reports for different categories of development or construction.[155] Local ordinances can require the use of pollution prevention practices on new road, highway and bridge construction projects. As an example, the eight North Bay communities, Napa, Marin, Solano, and Sonoma Counties, and the Cities of American Canyon, Novato, San Rafael, and Vallejo, that along with BCDC comprised the North Bay Wetlands and Agriculture Protection Program, employ various local strategies and tools to address pollution including: education and technical assistance projects; general plans; specific plans; project review procedures; zoning and subdivision regulations; ordinances; design guidelines; voluntary waste minimization, household hazardous waste and water conservation programs; watershed-based plans; and baseline urban runoff programs. To illustrate, the programs that appear to address erosion control include general plan policies for erosion control;

[153] For example, the Commission has no or limited authority over two of the issues, rural nonpoint source and rural wastewater.

[154] BASMAA is a consortium of municipal stormwater programs representing more than 90 agencies, including 79 cities and 6 counties, and the bulk of the watershed immediately surrounding San Francisco Bay, intended to promote regional consistency, information sharing and resources.

[155] Guide to Oakland's Creek Ordinance, available online from: http://www.oaklandpw.com/creeks/guide.htm, as of 03/14/03.

grading/erosion ordinances and required plans or reports; design guidelines or development standards; project review including discretionary review for all new development, Notice of Intent (NOI) and Storm Water Pollution Prevention Plans (SWPPPs) for projects greater than 5 acres, BMPs for new projects, plan review for post-construction water quality impacts, and inspections; baseline urban runoff programs (BURP), and watershed-based plans. An example of a BURP is the Marin County Stormwater Pollution Prevention Program (MCSTOPP), which incorporates region-wide educational programs, new development requirements, street sweeping programs, a legal framework, and other measures to control polluted runoff. An example of watershed-based plan is the Napa River Watershed Owner's Manual, which, among other things, includes recommendations for adopting measures to decrease and eliminate sedimentation from construction sites. Programs that appear to address protection of wetlands and riparian areas include: project review, SWPPPs, BMPs, design review guidelines and development standards, riparian protection and wetland protection ordinances and watershed-based plans.[156]

In addition to local controls, other controls are being used; for example, to address the source of pesticides in the Central Valley and Delta, the U.S. EPA began implementing agreements with manufacturers of diazinon and chlorpyrifos, pesticides known to cause aquatic toxicity, to decrease their use.[157] To further address urban runoff, U.S. EPA expanded its Phase I NPDES Stormwater program, which requires NPDES permits for stormwater discharges from municipal separate storm sewer systems (MS4s) that generally serve populations greater than 100,000, from specific industrial activities, and from construction activities disturbing five or

more acres of land, to include a Phase II (March 2003). Under EPA's Phase II program, many small MS4s (those serving under 100,000) are required to have an approved comprehensive program for managing urban runoff and improving water quality. Construction sites that disturb between one and five acres are also included in the Phase II program.

Additionally, new urban runoff regulations that have been included as part of Los Angeles County's municipal stormwater permit have set a precedent for future NPDES permits issued in the State of California, including counties in the San Francisco Bay Area. To illustrate, Santa Clara Valley Urban Runoff Pollution Prevention Program's NPDES permit, amended in February 2001, specifies conditions for new and redevelopment projects requiring the design, implementation and operation and maintenance of stormwater treatment BMPs to reduce stormwater pollution to the maximum extent practicable. These requirements apply to specific types of projects, for example, Group 1 projects, which include any development project that creates or replaces one acre or more of impervious surfaces including public or private commercial industrial residential projects; new streets, roads, highways and freeways under a

[156] BCDC, 2001. *Nonpoint Source Pollution Report and Work Program,* p.60-61.
[157] SFEP, 2001. Bay-Delta Environmental Report Card, p.13.

discharger's jurisdiction; and redevelopment projects.[158]

The Commission staff should stay informed on urban runoff regulations and federal, State and local stormwater management program requirements (e.g. Phase II program requirements).

California Plan Management Measures. This section first lists and then discusses the specific management measures identified in the California Plan for the three categories of nonpoint source pollutants over which BCDC has some jurisdiction and authority: Urban Runoff, Hydromodification, and Wetlands and Riparian Areas (See Table 9).[159]

Urban Runoff Measures. According to the California Plan, controlling urban nonpoint source pollutants requires two primary strategies: preventing pollution and treating unavoidable pollution. The State's urban management measures are designed to address prevention and treatment of pollutants during all phases of urbanization and parallels land use development processes, emphasizing pollution prevention and source reduction over more costly, higher maintenance treatment practices. Major opportunities to control nonpoint source pollutants occur during three stages of development: siting and design, construction, and post-construction implementation and maintenance of best management practices. New development can be sited and designed to: (a) minimize the introduction of pollutants to waterways and incorporate best management practices to reduce pollutant loading from urban runoff; (b) minimize increases of impervious surfaces and maximize permeability; (c) protect areas that provide important water quality benefits such as wetlands and riparian areas; (d) minimize land disturbance activities to reduce erosion and sediment loss; and (e) minimize disturbance of natural drainage features and vegetation.

As previously indicated, the Commission has no control over the vast majority of nonpoint source pollution coming into San Francisco Bay, as the watershed for the San Francisco Bay-Delta Estuary drains approximately 40 percent of the State, and the Commission's jurisdiction generally extends only 100 feet landward from the mean high water line of the Bay and five feet above mean sea level in the Bay's tidal marshes and to tidal portions of certain tributaries to the Bay, and ends at the west end of the Delta. The Commission would also have little authority over implementation of most of the urban management measures pertaining to construction and transportation (see Table 8) as they are primarily intended to reduce erosion and sediment loss during and after construction that would likely occur outside the Commission's Bay or certain waterways jurisdiction.

BCDC currently addresses urban runoff measures through Bay Plan Water Quality and Shoreline

[158] California Regional Water Quality Control Board, San Francisco Bay Region. ORDER NO. 01-119 NPDES PERMIT NO. CAS029718. p.7.

[159] This does not include the marinas and recreational boating category, over which BCDC also had jurisdiction and authority.

Protection as well as Transportation, Fish, Other Aquatic Organisms and Wildlife and Tidal Marshes and Tidal Flats findings and policies and through permit application review and permit conditions. For example, Water Quality Policy #3 states that "shoreline projects should be designed and constructed in a manner that reduces soil erosion and protects the Bay from increased sedimentation through the use of appropriate erosion control practices.

As indicated above, the NPDES Phase I program requires a general stormwater permit and SWPPP for all construction projects over five acres (and under Phase II, for projects over one acre).[160] The Regional Board also expects construction projects to minimize water quality impacts from land development and requires implementation of effective erosion and sediment measures and BMPs regardless of a project's size. For smaller projects, local jurisdictions often require applicants to develop and implement erosion and sediment-related plans specifying appropriate BMPs. To help small municipalities comply with the NPDES Phase II regulations, as well as CZARA requirements, the Coastal Commission developed a Model Urban Runoff Program (MURP) manual and workshops to guide municipalities along the coast in the assessment, development, implementation and evaluation of their own comprehensive URP. The MURP manual includes an implementation section that covers six program elements: (1) public education and outreach, (2) public participation /involvement, (3) illicit discharge detection and elimination, (4) construction site runoff control, (5) post-construction runoff, and (6) pollution prevention/good housekeeping, control, and sample BMPs to address the elements.[161] These are the minimum control measures under the Phase II program. In the San Francisco Bay area, parts of the North Bay municipalities of Marin, Napa, Solano, and Sonoma, and San Francisco are subject to the Phase II regulations.

[160] Additionally, construction of sites less than five acres that are part of a larger project that covers more than five acres must also apply for a general stormwater permit, as do projects less than one acre that are part of larger projects.

[161] California Coastal Commission. Model Urban Program (MURP) Manual Chapter 1 –Overview Available at: http://www.coastal.ca.gov/la/docs/murp/chapter1.pdf, as of May 2, 2002.

Table 9. Management Measures Identified in the California Plan for BCDC Implementation

Urban Runoff Measures
Runoff From Construction Sites (3.2) **Construction Site Erosion and Sediment Control (3.2-A)** (1) Reduce erosion and to the extent practicable, retain sediment on site during and after construction; (2) Prepare and implement prior to land disturbance, an effective, approved erosion and sediment control plan or similar administrative document that specifies erosion and sediment control provisions
Onsite Disposal Systems (OSDSs) (3.4) **New Onsite Disposal Systems (OSDSs) (3.4-A)** (1) Ensure OSDSs are located, designed, installed, operated, inspected, and maintained to prevent discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground water; (2) Direct placement of OSDSs away from unsuitable areas. Where not practicable, ensure that the OSDS is designed or sited at a density as not to adversely affect surface waters or ground water; (3) Establish protective setbacks from surface waters, wetlands and floodplains for conventional as well as alternative OSDS; (4) Establish protective separation distances between OSDS system components and groundwater; (5)Where conditions indicate that nitrogen-limited surface waters may be adversely affected by excess nitrogen loadings from ground water, prohibit the installation of OSDSs or require the installation of OSDS that reduce total nitrogen loadings to meet water quality objectives.
Transportation Development (Roads, Highways and Bridges) (3.5) **Planning, Siting, and Developing Roads and Highways (3.5-A)** Plan, site, and develop roads and highways to: (1) Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss; (2)Limit land disturbance such as clearing and grading and cut and fill to reduce erosion and sediment loss; (3)Limit disturbance of natural drainage features and vegetation.
Bridges (3.5-B) Site, design, and maintain bridge structures so that sensitive and valuable aquatic ecosystems and areas providing important benefits are protected from adverse effects.
Construction Projects (Roads, Highways and Bridges) (3.5-C) (1) Reduce erosion and, to the extent practicable, retain sediment on site during and after construction; (2) Prior to land disturbance, prepare and implement an approved erosion control plan or similar administrative document that contains erosion and sediment control provisions.

Table 9. Management Measures Identified in the California Plan for BCDC Implementation

Hydromodification Measures
Channelization/Channel Modification (5.1) **Physical and chemical characteristics of surface waters (5.1-A)** 1) Evaluate the potential effects of proposed channelization and channel modification on the physical and chemical characteristics of surface waters; (2) Plan and design channelization and channel modification to reduce undesirable impacts; (3) Develop an O&M program for existing modified channels that includes identification and implementation of opportunities to improve physical and chemical characteristics of surface waters in those channels.
Instream and Riparian Habitat Restoration (5.1-B) (1) Evaluate the potential effects of proposed channelization and channel modification on instream and riparian habitat; (2) Plan and design channelization and channel modification to reduce undesirable impacts; (3) Develop an O&M program with specific timetables for existing modified channels that includes identification of opportunities to restore instream and riparian habitat in those channels.
Streambank and Shoreline Erosion (5.3) **Eroding Streambanks and Shorelines (5.3-A)** (1) Where streambank or shoreline erosion is a nonpoint source pollution problem, streambanks/ shorelines should be stabilized; vegetative stabilization methods preferred over structural stabilization methods; (2) Protect streambank and shoreline features with the potential to reduce NPS pollution; (3) Protect streambanks and shorelines from erosion due to uses of either the shorelands or adjacent surface waters.
Wetlands, Riparian Areas, Vegetated Treatment Systems Measures
Protection of Wetlands and Riparian Areas (6-A) Protect from adverse effects wetlands and riparian areas that serve to reduce NPS pollution; maintain this function while protecting the other existing functions of these wetlands and riparian areas as measured by characteristics such as vegetative species composition, diversity, and cover, hydrology and quality of surface water and ground water, geochemistry of the substrate, and fauna species composition, diversity, and abundance.
Restoration of Wetlands and Riparian Areas (6-B) Promote the restoration of the pre-existing functions in damaged and destroyed wetlands and riparian systems in areas where the systems will serve to reduce NPS pollution.
Vegetated Treatment Systems (6-C) Promote the use of engineered vegetated treatment systems such as constructed wetlands or vegetated filter strips where these systems will serve to reduce NPS pollution.
Education/Outreach (6-D) Implement educational programs to provide greater understanding of watersheds, to raise awareness and increase the use of applicable management measures and practices for wetlands and riparian areas, and to promote projects which retain or re-establish natural hydrologic functions.

Onsite Disposal Systems (Urban MM 3.4) such as septic tanks are typically situated outside of the 100-foot shoreline band and projects that come before the Commission are typically served by sewer systems, rendering the issue of nonpoint source pollution from OSDS a low priority issue for the Commission. The Regional Board regulates large facilities directly and other OSDSs through delegation to the counties. Each county has an MOU with the Regional Board setting forth appropriate conditions for OSDS permitting. OSDSs are also often regulated by local health control or sanitation departments. The Regional Board informally recommends that OSDSs be placed 100 feet from any waterbody, including the Bay. There is an existing statewide effort to develop regulations and establish uniform performance standards for onsite sewage treatment systems including minimum siting and design criteria.[162] Should OSTS prove to be an issue in the future, the Commission may wish to require that permit applicants site OSTSs consistent with the upcoming State siting and design guidelines.

The Commission should recognize that opportunities to control nonpoint source pollutants from urban areas occur during three stages of development and that urban management measures can be implemented to address prevention and treatment of pollution during all phases of urbanization. Pollution prevention and source reduction should be emphasized over more costly, higher maintenance pollution treatment practices. To minimize impacts to Bay water quality from nonpoint source pollution, new development should be sited and designed consistent with standards in municipal stormwater permits and State and regional stormwater management guidelines, where applicable. To best protect water quality, new development can also be sited and designed to: (1) protect areas that provide important water quality benefits such as wetland and riparian areas; (2) minimize increases of impervious surfaces and maximize permeability; (3) minimize land disturbance activities to reduce erosion and sediment loss; and (4) minimize disturbance of natural drainage features and vegetation. Measures such as creating vegetated swales, using permeable pavement materials, preserving existing trees and vegetation or planting native vegetation should be evaluated and implemented to offset impacts from increased impervious areas and land disturbances.

The Commission staff should participate on the IACC"s Urban Runoff Subcommittee to collaborate with other agencies who have authority over these sources.

Hydromodification Measures. The California Plan's management measures for hydromodification (waterway alteration) address channelization, dams, streambank and shoreline erosion and education and outreach. Measures for channelization, for example, are intended to promote the evaluation of channelization and modification projects as part of watershed planning and design to determine whether nonpoint source changes to surface water quality or riparian habitat are expected. Measures for

[162] Current efforts to develop Statewide standards have resulted in a change of terms from "OSDS," Onsite Disposal Systems, to "OSTS," Onsite Wastewater Treatment Systems, to emphasize the treatment aspects.

streambank and shoreline erosion apply primarily to eroding shorelines and streambanks that constitute a nonpoint source problem in surface waters.

Many hydromodification projects would not likely come within BCDC's purview because they are not within the physical boundaries of BCDC's jurisdiction. Due to BCDC's limited jurisdiction, it does not confront projects related to dams. BCDC also does not have an education and outreach program; therefore, it is more appropriate for BCDC to implement management measures to address nonpoint source pollution related to channelization/channel modification (Hydromodification MM 5.1) and streambank and shoreline erosion (Hydromodification MM 5.3). However, BCDC only has authority to require permit conditions in connection to a new permit for fill, dredging, and changes in use. In the absence of a new project, the Commission may not impose new conditions on an existing project. Therefore, for MM 5.1-A-3 and 5.1-B-3, which refer to developing O&M programs for existing modified channels, as well as MM 5.3-A-1 for existing streambanks or shorelines, the Commission would have no authority.

Although BCDC does not have specific policies pertaining to nonpoint source pollution problems related to hydromodification, BCDC currently addresses some of the hydromodification measures (e.g., streambank and shoreline erosion, instream and riparian habitat restoration) through Bay Plan Shoreline Protection, Water Quality, Water Surface Area and Volume, Fish, Other Aquatic Organisms and Wildlife, Tidal Marshes and Tidal Flats findings and policies, Special Area Plans, and through permit review and required permit conditions. To illustrate, the Bay Plan does not specifically address the effects of proposed channelization, but it does provide policies to protect sensitive ecosystems. The need for evaluation (Hydromodification MM 5.1-A) is also discussed in Water Surface Area and Volume Policy #2. The Richardson Bay Special Area Plan also addresses channelization.

Additionally, the Regional Board requires permits for all hydromodification projects and is currently working on a set of stream protection policies that will minimize impacts and maximize protection of natural resources. Furthermore, according to the State Board/Coastal Commission's five year nonpoint source implementation plan, the State Board will be developing a technical assistance manual to help applicants avoid impacts to wetlands and riparian areas in 2003 and will adopt general Waste Discharge Requirements that prescribe channel maintenance activities with minimal threat to water quality.

The Commission Staff should continue to coordinate with the Regional Board on hydromodification measures that will improve Bay water quality.

Wetlands, Riparian Areas and Vegetated Treatment Systems Management Measures. To best control nonpoint source pollution, the California Plan includes four management measures intended to promote the protection and restoration of wetlands and riparian areas and the use of vegetated treatment systems: (1) protection of existing water quality improvement functions of wetlands/riparian areas

(Wetlands MM 6A); (2) restoration of wetlands/riparian areas by reestablishing hydrology, vegetation, structure characteristics, and other functions to significantly abate polluted runoff (Wetlands MM 6B); (3) promotion of vegetated treatment systems (e.g., artificial or constructed wetlands) in areas that serve a polluted runoff abatement function (Wetlands MM 6C); and (4) promotion of programs to develop and disseminate scientific information on wetlands and riparian areas and greater understanding of hydrologic systems (Wetland MM 6D).

Although not expressly intended to promote water quality improvement functions or abate nonpoint source pollution, BCDC does address most of the wetlands management measures (Wetlands MM 6A, 6B, 6C) through its Bay Plan Fish, Other Aquatic Organisms and Wildlife, Tidal Marshes and Tidal Flats, Water Quality, and Shoreline Protection findings and policies, permit conditions and permit application review process, and planning efforts. For example, Finding d. of the Bay Plan's Tidal Marshes and Tidal Flats states that "wetlands can alter and moderate flood flows, recharge groundwater, maintain stream flows, reduce and prevent shoreline erosion by minimizing wave energy, and improve water quality by filtering surface runoff from surrounding lands. In addition they trap sediments…help absorb available nitrogen, atmospheric sulfur, carbon dioxide and methane…" Finding f. of Tidal Marshes and Tidal Flats states that tidal marshes and tidal flats are important for "retaining stormwater runoff and flood water; [and] filtering sediments and pollutants from stormwater flowing to the Bay." Further, Shoreline Protection policies promote nonstructural methods such as marsh vegetation where feasible in shoreline protective projects, but do not expressly promote vegetated treatment systems to serve a polluted runoff-abatement function. However, it is unclear what types of nonpoint source measures should be put in place when creating, enhancing, preserving or restoring wetlands or what types of impacts are imposed by these activities.

Regarding Education/Outreach MM 6D, the Commission has the authority to engage in regional educational efforts, but does not appear to have the authority to require educational efforts from its project applicants, since a nexus between the project's impacts and educational impacts is unlikely. For example, as part of its planning efforts, BCDC actively participates in regional planning efforts such as the Baylands Ecosystem Habitat Goals Project and North Bay

Wetlands and Agriculture Program. The Commission also has policies to encourage the continued support and expansion of scientific information on the arrival and spread of invasive plants and animals and on the Bay's subtidal areas (see Tidal Marshes and Tidal Flats Policy 7 and Subtidal Policy 5).

Various State efforts also address wetlands management measures. The Regional Board encourages and requires wetlands protection through its Clean Water Act Section 401 Water Quality Certification Program and works to protect wetlands by participating in regional efforts such as the Habitat Goals Project. The State Board and Coastal Commission's five-year polluted runoff plan establishes an objective of developing a technical assistance manual in 2003 that will help project proponents avoid wetlands and riparian areas and establishes an objective for the Regional Board to develop a regional wetlands plan that would implement habitat goals and monitoring protocols. Commission staff should continue to coordinate Regional Board staff on wetland management measures.

The Commission should participate in the Wetlands subcommittee of the IACC to gain a better understanding of the types of nonpoint source pollution impacts that are posed by, and types of management measures that are appropriate to address, wetland creation, restoration, enhancement or preservation, and to best determine whether and where collaboration with other agencies is appropriate. The commission staff should continue to be active in the San Francisco Bay Area Wetlands Restoration Program. Tidal marshes, tidal flats and riparian areas should be conserved, enhanced and restored. Whenever practicable, projects should include maintenance of existing or creation of new native vegetation buffers that protect or expand riparian areas and wetlands to control nonpoint sources of pollution.

Other Strategies: Education, Outreach, Technical Assistance, Collaboration, Coordination. As included in the State's nonpoint source management measures, an effective strategy for preventing nonpoint source pollution is education and outreach, as well as technical assistance. An excellent example for the San Francisco Bay region is the San Francisco Estuary Project, Friends of the Estuary and Regional Board's joint Erosion Control Workshops and Training for local municipal staff and contractors. During FY01-02, 10 construction and erosion control workshops were held for municipalities and contractors with over 500 attendees. These workshops cover many of the federal, State and local regulations and responsibilities and recommend effective sediment and erosion control BMPs. Additionally, various State interagency efforts have developed to help implement the California Plan and management measures for nonpoint source pollution control. For example, along with State agencies such as the State Board and Regional Board, Coastal Commission, and other Resource Agency and Cal EPA staff, BCDC staff participates on the Interagency Coordinating Committee (IACC) and on the Critical Coastal Areas Committee (CCA). To illustrate, staff has attended bi-monthly IACC meetings in Sacramento and reviewed and commented on numerous documents produced as part of these efforts. Increased interagency coordination is important to ensure that multiple agencies are not duplicating

efforts and to offer opportunities for partnerships or collaboration to implement various nonpoint source work program tasks most efficiently.

Through its participation on the State's Interagency Coordinating Committee (IACC), the Commission staff should identify management measures that will help protect the Bay from further water quality degradation and where consistent with the Commission's authority, recommend conditions as part of the Commission permits that will improve Bay water quality. The Commission should continue to participate on the State's Critical Coastal Areas Committee (CCA), convened by the Coastal Commission, whose efforts are helping to identify and direct attention to critical coastal areas of biological, social and environmental significance including portions of San Francisco Bay. To educate the Commission's staff on pollution prevention techniques, especially for the types of projects the Commission frequently permits, the Commission staff should compile existing guidance on management measures and effective best management practices developed by Regional Board, the State Board and others as appropriate that permit analysts could use when reviewing a project with potential water quality impacts. The Commission should continue to coordinate with the Regional Board staff to conduct annual training of BCDC's regulatory staff on best management practices, applicable water quality laws and regulations, Regional Board practices and other topics as appropriate, and make the existing Regional Board training and erosion control workshops available to BCDC regulatory staff..