APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

Background

California's Management Measures for Polluted Runoff (CAMMPR) is designed to assist California in improving implementation of the California's Nonpoint Source (NPS) Pollution Control Program (Program). Management measures (MMs) form the core of the State's Plan for California's Nonpoint Source Pollution Control Program 1998-2013 (Program Plan) and provide goals for the management of NPS pollution to which various management practices are applied.[1] The measures are organized into six categories or sectors, all of which are present in California:

1. Agriculture;
2. Forestry (Silviculture);
3. Urban Areas;
4. Marinas and Recreational Boating;
5. Hydromodification Activities; and
6. Wetlands, Riparian Areas, and Vegetated Treatment Systems.

To help states develop sound and effective NPS programs, the U.S. Environmental Protection Agency (USEPA) developed a guidance document pursuant to the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) section 6217(g) titled the *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (g-Guidance)* (USEPA[1993]). USEPA and the National Oceanic and Atmospheric Administration (NOAA) expect state programs to implement MMs "in conformity" with the *g-Guidance*.[2] This MM approach is technology-based rather than water-quality based. Because NPSs of pollution are so diverse and since each individual source may contribute only a small quantity of contaminants, identifying the exact sources of NPS pollution can be very expensive and time-consuming. Implementation of technology-based MMs allows states to concentrate their resources initially on implementing measures that are proven to be effective in preventing and controlling NPS pollution.

[1] MMs are defined in CZARA section 6217(g)(5) as "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives."

[2] USEPA's g-Guidance identifies 56 MMs to control or prevent NPS pollution. The management measures and related practices can be viewed on the Internet at http://www.epa.gov/OWOW/NPS/MMGI.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

Pursuant to the Clean Water Act (CWA) and CZARA, the Program Plan addresses two types of MMs:

Minimum Management Measures

These measures are based on the federal guidance and will apply to the land use activities known to be major causes of NPS pollution. For example, keeping grazing animals out of streams is a minimum MM for agricultural sources of NPS pollution. State programs will ensure that people and organizations conducting these specified land use activities implement the appropriate MMs. The goal of implementing these measures is to protect water quality and habitat.

Additional Management Measures

Where NPS pollution continues to prevent critical areas from meeting CWA requirements, even when minimal MMs are used, additional MMs may be necessary. These measures will be targeted directly at reducing the NPS pollution activities that prevent State waters from meeting appropriate water quality standards, such as ensuring the water is safe for drinking, fishing, or swimming.

Implementation of MMs can be achieved through the implementation of management practices (MPs). MPs are structural and nonstructural solutions, used singularly or in combination, that are aimed at reducing the input of particular NPS contaminants into surface waters. An example of a structural MP is an infiltration basin (a structure that is built to hold runoff and filter contaminants from that runoff before the water is absorbed into the ground). Nonstructural MPs include buffer strips (areas of natural vegetation) that are left as protection between streams or other surface water bodies and farmlands or construction sites.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

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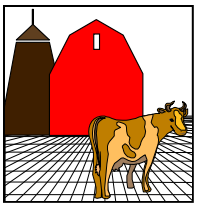
1. Agriculture



The SWRCB, CCC, and other State agencies have identified seven MMs to address agricultural NPSs of pollution that affect State waters. The agricultural MMs include practices and plans installed under various NPS programs in California, including systems of practices commonly used and recommended by the USDA as components of RMS, WQMPs, and Agricultural Waste Management Systems. These RMSs are planned by individual farmers and ranchers using an objective-driven planning process outlined in the NRCS National Planning Procedures Handbook. The RMSs are designed to achieve sustainable use of the different natural resource areas—soil, water, air, plants, animals, and human considerations.

California's MMs to address agricultural sources of NPS pollution in California:

- 1A. Erosion and Sediment Control
- 1B. Facility Wastewater and Runoff from Confined Animal Facilities
- 1C. Nutrient Management
- 1D. Pesticide Management
- 1E. Grazing Management
- 1F. Irrigation Water Management
- 1G. Education/Outreach

According to USEPA (1993), agriculture contributes more than half of the pollution entering the Nation's water bodies; recent studies have identified it as the greatest source of water pollution in the United States. The primary agricultural NPS pollutants are nutrients, sediment, animal wastes, pesticides, and salts. Agricultural activities may also affect habitat through physical disturbances caused by livestock or equipment or through the management of water.

Management Measures:

A. Erosion and Sediment Control. MM 1A addresses NPS problems associated with soil erosion and sedimentation. Where erosion and sedimentation from agricultural lands affect coastal waters and/or State's inland water bodies, landowners shall design and install or shall apply a combination of practices to reduce solids and associated pollutants in runoff during all but the larger storms. Alternatively, landowners may apply the erosion component of an RMS as defined in the NRCS FOTG. The NRCS FOTG contains standards and specifications for installing these practices.

B. Facility Wastewater and Runoff from Confined Animal Facilities. Pursuant to MM 1B, facility wastewater and contaminated runoff from confined animal facilities must be contained at all times. Storage facilities should be of adequate capacity to allow for proper wastewater use and should be constructed so they prevent seepage to ground water, and stored runoff and accumulated solids from the facility shall be managed through a waste use system that is consistent with MM 1C or shall be removed from the site.

C. Nutrient Management. MM 1C addresses the development and implementation of comprehensive nutrient management plans for areas where nutrient runoff is a problem affecting coastal waters and/or water bodies listed as impaired by nutrients. Such plans would include: (1) a plant tissue analysis to determine crop nutrient needs; (2) crop nutrient budget; (3) identification of the types, amounts, and timing of nutrients necessary to produce a crop based on realistic crop yield expectations; (4) identification of hazards to the site and adjacent environment; (5) soil sampling and tests to determine crop nutrient needs; and (6) proper calibration of nutrient equipment. When manure from confined animal facilities is to be used as a soil amendment and/or is disposed of on land, the plan shall discuss steps to assure that subsequent irrigation of that land does not leach excess nutrients to surface or ground water.

D. Pesticide Management. Implementation of MM 1D is intended to reduce contamination of surface water and ground water from pesticides. Implementation of this measure will primarily occur through cooperation with the CDPR as provided in a MAA with the SWRCB. Elements of this measure include: (1) development and adoption of reduced risk pest management strategies (including reductions in pesticide use); (2) evaluation of pest, crop, and field factors; (3) use of Integrated Pest Management (IPM); (4) consideration of environmental impacts in choice of pesticides; (5) calibration of equipment; and (6) use of anti-backflow devices. IPM is a key component of pest control. IPM strategies include evaluating pest problems in relation to cropping history and previous pest control measures and applying pesticides only when an economic benefit will be achieved. When used, pesticides should be selected based on their effectiveness to control target pests and environmental impacts such as their persistence, toxicity, and leaching potential.

E. Grazing Management. MM 1E is intended to protect sensitive areas (including streambanks, lakes, wetlands, estuaries, and riparian zones) by reducing direct loadings of animal wastes and sediment. This may include restricting or rotationally grazing livestock in sensitive areas by providing fencing, livestock stream crossings, and locating salt, shade, and alternative drinking sources away from sensitive areas. Upland erosion can be reduced by, among other methods: (1) maintaining the land consistent with the California Rangeland WQMP or BLM and Forest Service activity plans or (2) applying the range and pasture components of an RMS (NRCS FOTG). This may include prescribed grazing, seeding, gully erosion control, such as grade stabilization structures and ponds, and other critical area treatment.

F. Irrigation Water Management. MM 1F promotes effective irrigation while reducing pollutant delivery to surface and ground waters. Pursuant to this measure, irrigation water would be applied uniformly based on an accurate measurement of crop water needs and the volume of irrigation water applied, considering limitations raised by such issues as water rights, pollutant concentrations, water delivery restrictions, salt control, wetland, water supply, and frost/freeze temperature management. Additional precautions would apply when chemicals are applied through irrigation.

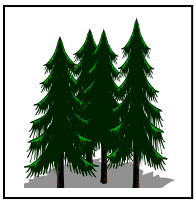
G. Education/Outreach. The goals of MM 1G are to implement pollution prevention and education programs to reduce NPS pollutants generated from the following activities where applicable:

1. Activities that cause erosion and loss of sediment on agricultural land and land that is converted from other land uses to agricultural land;
2. Activities that cause discharge from confined animal facilities to surface waters;
3. Activities that cause excess delivery of nutrients and/or leaching of nutrients;
4. Activities that cause contamination of surface water and ground water from pesticides;
5. Grazing activities that cause physical disturbance to sensitive areas and the discharge of sediment, animal waste, nutrients, and chemicals to surface waters;
6. Irrigation activities that cause NPS pollution of surface and ground waters.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

2. Forestry



There are 12 MMs to address various phases of forestry operations relevant to controlling NPSs of pollution that affect State waters. The forestry MMs are for the most part a system of practices used and recommended by the BOF and CDF in rules or guidance.

Silviculture contributes pollution to 17 percent of the polluted rivers and 21 percent of the polluted lakes in California (SWRCB, 1996). Without adequate controls, forestry operations may degrade the characteristics of waters that receive drainage from forest lands. For example (1) sediment concentrations can increase due to accelerated erosion, (2) water temperatures can increase due to removal of over-story riparian shade, (3) dissolved oxygen can be depleted due to the accumulation of slash and other organic debris, and (4) concentrations of organic and inorganic chemicals can increase due to harvesting and fertilizers and pesticides.

California's MMs to address silvicultural sources of nonpoint pollution:

2A. Preharvest Planning
2B. Streamside Management Areas
2C. Road Construction/Reconstruction
2D. Road Management
2E. Timber Harvesting
2F. Site Preparation/Forest Regeneration
2G. Fire Management
2H. Revegetation of Disturbed Areas
2I. Forest Chemical Management
2J. Wetlands Forest
2K. Postharvest Evaluation
2L. Education/Outreach

Management Measures:

A. Preharvest Planning. Silvicultural activities shall be planned to reduce potential delivery of pollutants to surface waters. Components of MM 2A address aspects of forestry operations, including: the timing, location, and design of harvesting and road construction; site preparation; identification of sensitive or high-erosion risk areas; and the potential for cumulative water quality impacts.

B. Streamside Management Areas (SMAs). SMAs protect against soil disturbance and reduce sediment and nutrient delivery to waters from upland activities. MM 2B is intended to safeguard vegetated buffer areas along surface waters to protect the water quality of adjacent streams.

C. Road Construction/Reconstruction. MM 2C requires that road construction/reconstruction shall be conducted so as to reduce sediment generation and delivery. This can be accomplished by following, among other means, preharvest plan layouts and designs for road systems, incorporating adequate drainage structures, properly installing stream crossings, avoiding road construction in SMAs, removing debris from streams, and stabilizing areas of disturbed soil such as road fills.

D. Road Management. MM 2D describes how to manage roads to prevent sedimentation, minimize erosion, maintain stability, and reduce the risk that drainage structures and stream crossings will fail or become less effective. Components of this measure include inspections and maintenance actions to prevent erosion of road surfaces and to ensure the effectiveness of stream-crossing structures. The measure also addresses appropriate methods for closing roads that are no longer in use.

E. Timber Harvesting. MM 2E addresses skid trail location and drainage, management of debris and petroleum, and proper harvesting in SMAs. Timber harvesting practices that protect water quality and soil productivity also have economic benefits by reducing the length of roads and skid trails, reducing equipment and road maintenance costs, and providing better road protection.

F. Site Preparation and Forest Regeneration. Impacts of mechanical site preparation and regeneration operations—particularly in areas that have steep slopes or highly erodible soils or where the site is located in close proximity to a water body—can be reduced by confining runoff on site. MM 2F addresses keeping slash material out of drainageways, operating machinery on contours, timing of activities, and protecting ground cover in ephemeral drainage areas and SMAs. Careful regeneration of harvested forest lands is important in protecting water quality from disturbed soils.

G. Fire Management. MM 2G requires that prescribed fire practices for site preparation and methods to suppress wildfires should be conducted as feasible in a manner that limits loss of soil organic matter and litter and that reduces the potential for runoff and erosion. Prescribed fires on steep slopes or adjacent to streams and that remove forest litter down to mineral soil are most likely to impact water quality.

H. Revegetation of Disturbed Areas. MM 2H addresses the rapid revegetation of areas disturbed during timber harvesting and road construction—particularly areas within harvest units or road systems where mineral soil is exposed or agitated (e.g., road cuts, fill slopes, landing surfaces, cable corridors, or skid trails) with special priority for SMAs and steep slopes near drainageways.

I. Forest Chemical Management. Application of pesticides, fertilizers, and other chemicals used in forest management should not lead to surface water contamination. Pesticides must be properly mixed, transported, loaded, and applied; and their containers must be disposed of properly. Fertilizers must also be properly handled and applied since they also may be toxic depending on concentration and exposure. Components of MM 2I include applications by skilled workers according to label instructions, careful prescription of the type and amount of chemical to be applied, use of buffer areas for surface waters to prevent direct application or deposition, and spill contingency planning.

J. Wetland Forest Management. Forested wetlands provide many beneficial water quality functions and provide habitat for aquatic life. Under MM 2J, activities in wetland forests shall be conducted to protect the aquatic functions of forested wetlands.

K. Postharvest Evaluation. The goals of MM 2K are to incorporate postharvest monitoring, including: (a) implementation monitoring to determine if the operation was conducted according to specifications and (b) effectiveness monitoring after at least one winter period to determine if the specified operation prevented or minimized discharges.

L. Education/Outreach. The goals of MM 2L are to implement pollution prevention and education programs to reduce NPS pollutants generated from applicable silvicultural activities.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

3. Urban Areas

The SWRCB, CCC, and other State agencies have identified 15 MMs to address urban NPSs of pollution that affect State waters. With approximately 80 percent of the nation's population living in coastal areas, controlling polluted runoff in urban areas is a challenge. Negative impacts of urbanization on coastal and estuarine waters are well documented in a number of sources, including California's CWA section 305(b) and section 319 reports and the Nationwide Urban Runoff Program.

California's MMs to address urban sources of nonpoint pollution:

- 3.1 Runoff from Developing Areas
  - A. Watershed Protection
  - B. Site Development
  - C. New Development
- 3.2 Runoff from Construction Sites
  - A. Construction Site Erosion and Sediment Control
  - B. Construction Site Chemical Control
- 3.3 Runoff from Existing Development
  - A. Existing Development
- 3.4 On-site Disposal Systems (OSDSs)
  - A. New OSDSs
  - B. Operating OSDSs
- 3.5 Transportation Development (Roads, Highways, and Bridges)
  - A. Planning, Siting, and Developing Roads and Highways
  - B. Bridges
  - C. Construction Projects
  - D. Chemical Control
  - E. Operation and Maintenance
  - F. Road, Highway, and Bridge Runoff Systems
- 3.6 Education/Outreach
  - A. Pollution Prevention/Education: General Sources

Major pollutants found in runoff from urban areas include sediment, nutrients, oxygen-demanding substances, road salts, heavy metals, petroleum hydrocarbons, pathogenic bacteria, and viruses. Suspended sediments constitute the largest mass of pollutant loadings to receiving waters from urban areas. Construction is a major source of sediment erosion. Petroleum hydrocarbons result mostly from automobile sources. Nutrient and bacterial sources include garden fertilizers, leaves, grass clippings, pet wastes, and faulty septic tanks. As population densities increase, a corresponding increase occurs in pollutant loadings generated from human activities. Many of these pollutants enter surface waters via runoff without undergoing treatment.

Urban runoff management requires that several objectives be pursued simultaneously. These objectives include the following (American Public Works Association, 1981):

- Protection and restoration of surface waters by the minimization of pollutant loadings and negative impacts resulting from urbanization;
- Protection of environmental quality and social well-being;
- Protection of natural resources, e.g., wetlands and other important aquatic and terrestrial ecosystems;
- Minimization of soil erosion and sedimentation problems;
- Maintenance of the predevelopment hydrologic conditions;
- Protection of ground water resources;
- Control and management of runoff to reduce or prevent flooding; and
- Management of aquatic and riparian resources for active and passive.

Management Measures:

The control of urban NPS pollution requires the use of two primary strategies: (1) the prevention of pollutant loadings and (2) the treatment of unavoidable loadings. California's urban MMs are organized to

parallel the land use development process in order to address the prevention and treatment of NPS pollution loadings during all phases of urbanization. This strategy relies primarily on the watershed approach, which focuses on pollution prevention and source reduction practices. Emphasizing pollution prevention and source reduction practices over treatment practices is favored because conducting education practices and incorporating pollution prevention practices into project planning and design activities are generally more effective, require less maintenance, and are more cost-effective in the long term than treatment strategies. Treatment strategies should only be used to address unavoidable loadings or where they are truly cost-effective.

The major opportunities to control NPS loadings occur during the following three stages of development: (1) the siting and design phase, (2) the construction phase, and (3) the post-development phase. Before development occurs, land in a watershed is available for a number of pollution prevention and treatment options, such as setbacks, buffers, or open space requirements, as well as wet ponds or constructed urban runoff wetlands that can provide treatment of the inevitable runoff and associated pollutants. In addition, siting requirements and restrictions and other land use ordinances, which can be highly effective, are more easily implemented during this period. After development occurs, these options may no longer be practicable or cost-effective. MMs 3.1A through 3.1C address the strategies and practices that can be used during the initial phase of the urbanization process.

The control of construction-related sediment loadings is critical to maintaining water quality. The implementation of proper erosion and sediment control practices during the construction stage can significantly reduce sediment loadings to surface waters. MMs 3.2A and 3.2B address construction-related practices.

After development has occurred, lack of available land severely limits the implementation of cost-effective treatment options. MM 3.6A focuses on improving controls for existing surface water runoff through pollution prevention to mitigate NPSs of pollution generated from on-going domestic and commercial activities.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

4. Marinas and Recreational Boating Management Measures[3]

Recreational boating and marinas are increasingly popular uses of coastal areas and inland surface water bodies (e.g., lakes and delta). And, they are an important means of public access, and California must balance the need for protecting the environment and the need to provide adequate public access (USEPA, 1993). Because marinas and boats are located at the water's edge, pollutants generated from these sources are less likely to be buffered or filtered by natural processes. When boating and adjunct activities (e.g., marinas and boat maintenance areas) are poorly planned or managed, they may pose a threat to water quality and the health of aquatic systems and may pose other environmental hazards. Sources of pollution associated with marinas and boating include:

- Poorly flushed waterways;
- Pollutants discharged from boats (recreational boats, commercial boats, and "live-aboards");
- Pollutants carried in storm water runoff;
- Physical alteration of wetlands and of shellfish/ other benthic communities during construction of marinas, ramps, and related facilities;
- Pollutants generated from boat maintenance activities on land and in the water.

There are 16 MMs to address marina and boating sources of nonpoint pollution. Effective implementation of these MMs can (1) avoid impacts associated with siting marinas and boat maintenance areas, (2) ensure the best available design and construction practices (for new and expanding facilities), (3) ensure appropriate operation and maintenance practices to prevent and/or reduce the delivery of NPS pollutants to State waters, and (4) encourage the development and use of effective pollution control and education efforts. The MMs cover the following operations and facilities:

- Any facility that contains ten or more slips, piers where ten or more boats may tie up, or any facility where a boat for hire is docked;

California's marina and recreational boating MMs:

4.1 Assessment, Siting and Design
- A. Water Quality Assessment
- B. Marina Flushing
- C. Habitat Assessment
- D. Shoreline Stabilization
- E. Storm Water Runoff
- F. Fueling Station Design
- G. Sewage Facilities
- H. Waste Management Facilities

4.2 Operation and Maintenance
- A. Solid Waste Control
- B. Fish Waste Control
- C. Liquid Material Control
- D. Petroleum Control
- E. Boat Cleaning and Maintenance
- F. Maintenance of Sewage Facilities
- G. Boat Operation

4.3 Education/Outreach
- A. Public Education

[3] Commercial and military ports are not targeted in this Program Plan because they are subject to the storm water NPDES permits regulating industrial and construction activities. Commercial ports are also required to submit a port master plan (PMP) for certification by the CCC. The PMP must include the conditions contained in Coastal Act section 30711. An NPS-related condition is "an estimate of the effect of development on habitat areas and the marine environment, a review of existing water quality, habitat areas, and quantitative and qualitative biological inventories, and proposals to minimize and mitigate any substantial adverse impact." Section 30711 further states that, "each city, county, or city and county which has a port within its jurisdiction shall incorporate the certified [PMP] in its [LCP]." In addition, activities in military ports are subject to federal consistency review by the CCC, affording the State an opportunity to ensure that appropriate NPS pollution prevention and control measures are in place. Ports located in the San Francisco Bay are under the jurisdiction of SFBCDC and subject to regulations of the MPA.

- Any residential or planned community marina with ten or more slips;
- Any mooring field where ten or more boats are moored;
- Public or commercial boat ramps;
- Boat maintenance or repair yards that are adjacent to the water and any federal, State, or local facility that involves recreational boat maintenance or repair on or adjacent to the water.

The Implementation Plan involves targeting implementation of six of the 16 marina and boating MMs, specifically those measures for water quality assessment, sewage facilities, boat cleaning and maintenance, hazardous waste management, and public education. These MMs and related actions were identified by representatives of the marina and boating community at four meetings held between December 1998 and April 1999 and by the SWRCB, RWQCBs, and CCC. The 1994 Marina TAC Report provided additional recommendations. The 16 MMs are summarized below.

Assessment, Siting, And Design Management Measures:

41.A **Water Quality Assessment.** Consider impacts to water quality in siting and designing new and expanding marinas.

41.B **Marina Flushing.** Site and design marinas to provide for maximum flushing and circulation of surface waters, which can reduce the potential for water stagnation, maintain biological productivity, and reduce the potential for toxic accumulation in bottom sediment.

41.C **Habitat Assessment.** Site and design marinas to protect against adverse impacts on fish and shellfish, aquatic vegetation, and important locally, State, or federally designated habitat areas.

41.D **Shoreline Stabilization.** Stabilize shorelines where shoreline erosion is a pollution problem.

41.E **Storm Water Runoff.** Implement runoff control strategies to remove at least 80 percent of suspended solids from storm water runoff coming from boat maintenance areas (some boatyards may conform to this provision through NPDES permits).

41.F **Fueling Station Design.** Locate and design fueling stations to contain accidental fuel spills in a limited area; and provide fuel containment equipment and spill contingency plans to ensure quick spill response.

41.G **Sewage Facilities.** Install pump out, pump station, and restroom facilities at new and expanding marinas where needed to prevent sewage discharges directly to State waters.

41.H **Waste Management Facilities.** Install facilities at new and expanding marinas where needed for the proper recycling or disposal of solid wastes (e.g., oil filters, lead acid batteries, used absorbent pads, spent zinc anodes, and fish waste as applicable) and liquid materials (e.g., fuel, oil, solvents, antifreeze, and paints).

Operation And Maintenance Management Measures:

4.2A **Solid Waste Control.** Properly dispose of solid wastes produced by the operation, cleaning, maintenance, and repair of boats to limit entry of these wastes to surface waters.

4.2B **Fish Waste Control.** Promote sound fish waste management where fish waste is an NPS problem through a combination of fish cleaning restrictions, education, and proper disposal.

4.2C **Liquid Material Control.** Provide and maintain the appropriate storage, transfer, containment, and disposal facilities for liquid materials commonly used in boat maintenance; and encourage recycling of these materials.

4.2D **Petroleum Control.** Reduce the amount of fuel and oil that leaks from fuel tanks and tank air vents during the refueling and operation of boats.

4.2E **Boat Cleaning and Maintenance.** Minimize the use of potentially harmful hull cleaners and bottom paints and prohibit discharges of these substances to State waters.

4.2F **Maintenance of Sewage Facilities.** Maintain pumpout facilities in operational condition and encourage their use so as to prevent and control untreated sewage discharges to surface waters.

4.2G **Boat Operation.** Prevent turbidity and physical destruction of shallow-water habitat resulting from boat wakes and prop wash.

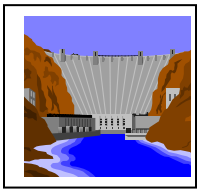
Education and Outreach Management Measures:

4.3A **Public Education.** Institute public education, outreach, and training programs to prevent and control improper disposal of pollutants into State waters.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

5. Hydromodification Management Measures



The SWRCB, CCC, and other State agencies have identified seven MMs to address hydromodification sources of nonpoint pollution affecting State waters. Hydromodification includes modification of stream and river channels, dams and water impoundments, and streambank/shoreline erosion.

California's MMs to address sources of nonpoint pollution related to hydromodification activities:

- 5.1 Channelization/Channel Modification
  - A. Physical and Chemical Characteristics of Surface Waters
  - B. Instream and Riparian Habitat Restoration
- 5.2 Dams
  - A. Erosion and Sediment Control
  - B. Chemical and Pollutant Control
  - C. Protection of Surface Water Quality & Instream and Riparian Habitat
- 5.3 Streambank and Shoreline Erosion
  - A. Eroding Streambanks & Shorelines
- 5.4 Education/Outreach
  - A. Educational Programs

Channel modification activities are undertaken in rivers or streams to straighten, enlarge, deepen, or relocate the channel. These activities can affect water temperature, change the natural supply of fresh water to a water body, and alter rates and paths of sediment erosion, transport, and deposition. Hardening the banks of waterways with shoreline protection or armor also accelerates the movement of surface water and pollutants from the upper reaches of watersheds into coastal waters. Channelization can also reduce the suitability of instream and streamside habitat for fish and wildlife by depriving wetlands and estuarine shorelines of enriching sediments, affecting the ability of natural systems to filter pollutants, and interrupting the life stages of aquatic organisms (USEPA, 1993).

Dams can adversely impact hydrology and the quality of surface waters and riparian habitat in the waterways where the dams are located. A variety of impacts can result from the siting, construction, and operation of these facilities. For example, improper siting of dams can inundate both upstream and downstream areas of a waterway. Dams reduce downstream flows, thus depriving wetlands and riparian areas of water. During dam construction, removal of vegetation and disturbance of underlying sediments can increase turbidity and cause excessive sedimentation in the waterway.

The erosion of shorelines and streambanks is a natural process that can have either beneficial or adverse impacts on riparian habitat. Excessively high sediment loads resulting from erosion can smother submerged aquatic vegetation, cover shellfish beds and tidal flats, fill in riffle pools, and contribute to increased levels of turbidity and nutrients.

Management Measures:

Channelization/Channel Modification. California's MMs for channelization and channel modification promote the evaluation of channelization and channel modification projects. Channels should be evaluated as a part of the watershed planning and design processes, including watershed changes from new development in urban areas, agricultural drainage, or forest clearing. The purpose of the evaluation is to determine whether resulting NPS changes to surface water quality or instream and riparian habitat can be expected and whether these changes will have a detrimental (or negative) impact. Existing channelization and channel modification projects can be evaluated to determine the NPS impacts and benefits associated with the projects. Modifications to existing projects, including operation and maintenance or management, can also be evaluated to determine the possibility of improving some or all of the impacts without changing the existing benefits or creating additional problems. In both new and existing channelization and channel modification projects, evaluation of benefits and/or problems will be site specific.

Dams. The second category of MMs addresses NPS pollution associated with dams. Dams are defined as constructed impoundments that are either: (1) 25 feet or more in height *and* greater than 15 acre-feet in capacity or (2) six feet or more in height *and* greater than 50 acre-feet in capacity. MMs 5.2A and 5.2B address two problems associated with dam construction: (1) increases in sediment delivery downstream resulting from construction and operation activities and (2) spillage of chemicals and other pollutants to the waterway during construction and operation. MM 5.2C addresses the impacts of reservoir releases on the quality of surface waters and instream and riparian habitat downstream.

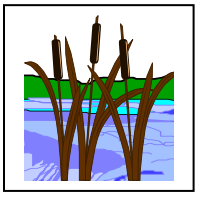
Streambank and Shoreline Erosion. The third category of hydromodification measures addresses the stabilization of eroding streambanks and shorelines in areas where streambank and shoreline erosion creates a polluted runoff problem. Bioengineering methods such as marsh creation and vegetative bank stabilization are preferred. Streambank and shoreline features that have the potential to reduce polluted runoff shall be protected from impacts, including erosion and sedimentation resulting from uses of uplands or adjacent surface waters. This MM does not imply that all shoreline and streambank erosion must be controlled; the measure applies to eroding shorelines and streambanks that constitute an NPS problem in surface waters.

Education/Outreach. MMs 5.4A focuses on the development and implementation of pollution prevention and education programs for agency staffs and the public, as well as the promotion of assistance tools that emphasize restoration and low-impact development. Education, technical assistance, incentives, and other means can be used to promote projects that: (1) reduce NPS pollutants, (2) retain or reestablish natural hydrologic functions (e.g., channel restoration projects and low-impact development projects), and/or (3) prevent and restore adverse effects of hydromodification activities.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)

6. Wetlands, Riparian Areas, and Vegetated Treatment Systems



The SWRCB, CCC, and other State agencies have identified four MMs to promote the protection and restoration of wetlands and riparian areas and the use of vegetated treatment systems as means to control NPSs of pollution. Wetlands and riparian areas reduce polluted runoff by filtering out runoff-related contaminants, such as sediment, nitrogen, and phosphorus, thus maintaining the water quality benefits of these areas is important. These areas also help to attenuate flows from higher-than-average storm events. This protects downstream areas from adverse impacts, such as channel scour, erosion, and temperature and chemical fluctuations. Changes in hydrology, substrate, geochemistry, or species composition can impair the ability of wetland or riparian areas to filter out excess sediment and nutrients and therefore can result in deteriorated water quality. The following activities can cause such impairment: drainage of wetlands for cropland, overgrazing, hydromodification, highway construction, deposition of dredged material, and excavation for ports and marinas.

California's MMs to protect and restore wetlands and riparian areas and use vegetated treatment systems as means to control pollution from nonpoint sources:

6A. Protection of Wetlands & Riparian Areas

6B. Restoration of Wetlands & Riparian Areas

6C. Vegetated Treatment Systems

6D. Education/Outreach

Management Measures:

6A **Protection of Wetlands/Riparian Areas.** Implementation of MM 6A is intended to protect the existing water quality improvement functions of wetlands and riparian areas as a component of NPS Programs.

6B **Restoration of Wetlands/Riparian Areas.** Restoration of wetlands and riparian areas (MM 6B) refers to the recovery of a range of functions that existed previously by reestablishing hydrology, vegetation, and structure characteristics. Damaged or destroyed wetland and riparian areas should be restored where restoration of such systems will significantly abate polluted runoff.

6C **Vegetated Treatment Systems.** MM 6C promotes the installation of vegetated treatment systems (e.g., artificial or constructed wetlands) in areas where these systems will serve a polluted runoff-abatement function. Vegetated filter strips and engineered wetlands remove sediment and other pollutants from runoff and wastewater and prevent pollutants from entering adjacent water bodies. Removal typically occurs through filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization.

6D **Education/Outreach.** MM 6D promotes the establishment of programs to develop and disseminate scientific information on wetlands and riparian areas and to develop greater public and agency staff understanding of natural hydrologic systems—including their functions and values, how they are lost, and the choices associated with their protection and restoration.

APPENDIX 9

CALIFORNIA'S MANAGEMENT MEASURES FOR POLLUTED RUNOFF (CAMMPR)