Chapter 3
Hydrology, Water Supply, and Water Quality

This section examines the potential impacts the proposed project would have on water resources. The aspects of water resources that are specifically analyzed are surface water hydrology, groundwater hydrology, and groundwater and surface water quality.

Sources of Information

The key sources of data and information used in the preparation of this chapter are listed and briefly described below:

- National Pollutant Discharge Elimination System (NPDES) permits, which stipulate effluent discharge, monitoring, and reporting requirements for a hatchery by the applicable Regional Water Quality Control Board (RWQCB);
- discharger monitoring reports (DMRs), which each hatchery submits to its RWQCB to document monitoring data and compliance with its NPDES permit monitoring and reporting program (MRP);
- the CWA Section 303(d) list, which is developed by the RWQCBs and approved by the EPA and lists impairments in surface water bodies;
- best management practice (BMP) plans for each DFG hatchery, which outline the general training procedures, material/chemical storage and use, and cleaning procedures implemented during hatchery operations;
- the DWR's individual basin descriptions, which characterize California's groundwater subbasins and provide information related to geology, soils, groundwater quality, and groundwater supplies;
- water quality control plans (basin plans) for the Central Valley, North Coast, San Francisco, Lahontan, and Los Angeles RWQCBs, which describe beneficial uses and water quality objectives for surface waters and groundwater in their jurisdictions;
- the Western Regional Climate Center's *Climate of California* summary (Western Regional Climate Center 2008a), which summarizes and characterizes California's climate and weather patterns and explains factors contributing to California's diverse regional climates;
- the Western Regional Climate Center's *Average Statewide Precipitation for Western United States* (Western Regional Climate Center 2008b), which summarizes the average precipitation for California and other western states;
- DFG's *Atlas of the Biodiversity of California* (California Department of Fish and Game 2003), which provides California climate and topography information; and
- scientific literature containing information on the water quality effects of hatchery discharges.

Existing Conditions

The existing hydrology and water quality–related conditions, including applicable regulations, of DFG's Program area are described below.

Regulatory Setting

Federal

Clean Water Act

Several sections of the CWA pertain to regulating impacts on waters of the United States. The discharge of dredged or fill material into waters of the United States is subject to permitting specified under Section 404 (Discharges of Dredge or Fill Material) of the act. Section 401 (Certification) specifies additional requirements for permit review, particularly at the state level.

Section 303

The State of California adopts water quality standards to protect beneficial uses of state waters as required by Section 303 of the CWA and the Porter-Cologne Water Quality Control Act of 1969 (Porter-Cologne Act). Section 303(d) of the CWA established the total maximum daily load (TMDL) process to guide the application of state water quality standards (see a discussion of state water quality standards below). A TMDL is an estimate of the total load of pollutants from point, nonpoint, and natural sources that a water body may receive without exceeding applicable water quality standards (with a "factor of safety" included). Once established, the TMDL is allocated among current and future pollutant sources to the water body. To identify candidate water bodies for TMDL analysis, a list of water quality–limited surface water bodies was generated. These surface water bodies are impaired by the presence of a pollutant(s) and are more sensitive to disturbance. Section 303(d) listing associated with water bodies in the Program area have been described in the "Environmental Setting" below.

Section 401

Section 401 of the CWA requires that an applicant pursuing a federal permit to conduct any activity that may result in a discharge of a pollutant obtain a water quality certification (or waiver). Water quality certifications are issued by the RWQCBs in California. Under the CWA, the state (the applicable RWQCB) must issue or waive Section 401 water quality certification for the project to be permitted under Section 404. Water quality certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the United States and imposes project-specific conditions on development. A Section 401 waiver establishes standard conditions that apply to any project that qualifies for a waiver.

Section 402

The 1972 amendments to the Federal Water Pollution Control Act established the NPDES permit program to control discharges of pollutants from point sources (Section 402). The 1987 amendments to the CWA created a new section of the CWA devoted to stormwater permitting (Section 402[p]). The EPA has granted the State of California (the State Water Resources Control Board [SWRCB] and the RWQCBs) primacy in administering and enforcing the provisions of the

CWA and NPDES. The NPDES is the primary federal program that regulates point-source and nonpoint-source discharges to waters of the United States.

All of the hatcheries have NPDES permits, with the exception of the Silverado Fisheries Base, the Kern River Planting Base, and the Fillmore Hatchery. The Silverado Fisheries Base and the Kern River Planting Base do not have NPDES permits because the quantity of fish they produce is less than the biomass limit or flow limit that would require an NPDES permit for a cold-water concentrated aquatic animal production (CAAP) facility. The Fillmore Hatchery does not have an NPDES permit because it does not discharge to a surface water body.

Section 404

Dredging and placement of fill materials into the waters of the United States is regulated by Section 404 of the CWA, which is administered by the USACE. Under the CWA, the state (i.e., the SWRCB) must issue or waive Section 401 water quality certification for the project to be permitted under Section 404. Water quality certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the United States.

California Toxics Rule

As part of the California Toxics Rule (CTR), the EPA has promulgated numeric water quality criteria for priority toxic pollutants and other provisions for water quality standards to be applied to waters in California. The EPA promulgated this rule based on the EPA administrator's determination that the numeric criteria are necessary in California to protect human health and the environment.

The rule fills a gap in California water quality standards that was created in 1994, when a state court overturned the state's water quality control plans containing water quality criteria for priority toxic pollutants. Therefore, California was without numeric water quality criteria for many priority toxic pollutants as required by the CWA, necessitating this action by the EPA. These federal criteria are legally applicable in California for inland surface waters, enclosed bays, and estuaries under the CWA.

Federal Antidegradation Policy

The federal antidegradation policy is designed to protect existing uses and the level of water quality necessary to protect existing uses, and provide protection for higher quality and national water resources. The federal policy directs states to adopt a statewide policy that includes the following primary provisions (40 CFR 131.12):

1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.
2) Where the quality of waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. …
3) Where high quality waters constitute an outstanding National resource, such as waters of National and States parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

Executive Order 11988

Executive Order 11988 addresses floodplain issues related to public safety, conservation, and economics. It generally requires federal agencies constructing, permitting, or funding actions to:

- avoid incompatible floodplain development,
- be consistent with the standards and criteria of the National Flood Insurance Program (NFIP), and
- restore and preserve natural and beneficial floodplain values.

Environmental Protection Agency Effluent Limitation Guidelines and New Source Performance Standards for the Concentrated Aquatic Animal Production Point-Source Category

In August 2004, the EPA promulgated *Effluent Limitations Guidelines and New Source Performance Standards for the Concentrated Aquatic Animal Production Point Source Category* (hereafter "ELG"). The ELG regulation establishes national technology-based effluent discharge requirements for flow-through and recirculating systems and for net pens based on best practicable control technology currently available (BPT); best control technology for conventional pollutants (BCT); best available technology economically achievable (BAT); and new source performance standards (NSPS). In its proposed rule, published on September 12, 2002, the EPA proposed to establish numeric limitations for a single constituent—total suspended solids (TSS)—while controlling the discharge of other constituents through narrative requirements. In the final rule, however, the EPA determined that, for a nationally applicable regulation, it would be more appropriate to promulgate qualitative TSS limitations in the form of solids control BMP requirements. Furthermore, the final ELG does not include numeric effluent limitations for non-conventional and toxic constituents, such as aquaculture drugs and chemicals, but also relies on narrative limitations to address these constituents.

U.S. Food and Drug Administration

The U.S. Food and Drug Administration's (FDA's) Center for Veterinary Medicine (CVM) regulates the manufacture, distribution, and use of animal drugs. CVM approves the use of new animal drugs based on data provided by a sponsor (usually a drug company). To be approved by the CVM, an animal drug must be effective for the claim on the label and safe when used as directed for: treated animals; persons administering the treatment; the environment, including non-target organisms; and consumers.

Approved new animal drugs by the FDA are specified for use on specific fish species, for specific disease conditions, for specific dosages, and with specific withdrawal times. Product withdrawal times must be observed to ensure that any product used on aquatic animals at a CAAP facility does not exceed legal tolerance levels in the animal tissue. These drugs have been screened by the FDA to determine whether they cause significant adverse public health or environmental impacts when used in accordance with label instructions. Approved new animal drugs for use in aquaculture include:

- antibiotics, such as oxytetracycline (Terramycin), sulfadimethoxine-ormetoprim (Romet-30), sulfamerazine, and florfenicol (Aquaflor);
- chorionic gonadotropin (Chorulon), used for spawning;

- tricane methane sulfonate (MS-222, Finquel, and Tricaine-S), an anesthetic;
- formaldehyde (Formalin-F, Paracide-F, and PARASITE-S), used as a fungus and parasite treatment; and,
- hydrogen peroxide (H_2O_2), used to control fungal and bacterial infections.

A second category of chemicals is investigational new animal drugs (INAD) and can be used only under an exemption. INAD exemptions are granted by the FDA to permit the use of unapproved drugs for investigational purposes and must be renewed each year. Numerous FDA requirements must be met for the establishment and maintenance of INAD drugs. The FDA reviews test protocols, authorizes specific conditions of use, and closely monitors drug use under an INAD exemption. Data recording and reporting are required under the INAD exemption in order to support the approval of a new animal drug or an extension of approval for new uses of the drug.

A third category of drugs is unapproved new animal drugs of low regulatory priority (LRP drugs). LRP drugs do not require a new animal drug application (NADA) or INAD exemptions from the FDA. Further regulatory action is unlikely to be taken by the FDA on LRP drugs as long as an appropriate grade of the drug or chemical is used, drugs are used for the prescribed uses and dosages, good management practices are followed, and local environmental requirements are met. Example LRP drugs are:

- acetic acid (parasite dip used on fish);
- PVP iodine (disinfectant for eggs);
- carbon dioxide (CO_2) gas, or sodium bicarbonate (baking soda) to produce carbon dioxide, as an anesthetic; and
- sodium chloride (NaCl) (salt), used indefinitely or for short-term treatments for osmotic regulation and to reduce stress and shock.

A fourth category of chemicals is deferred decision (DD) chemicals. DD chemicals include those already approved by the EPA as algicides in aquaculture settings. Examples of DD chemicals include:

- copper sulfate; and
- potassium permanganate.

The specific use of treatment chemicals for the Program hatcheries is described below in the "Methods," "Chemical Constituents of Concern" section.

State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Act, passed in 1969, implements the CWA. It established the SWRCB and divided the state into nine regions, each overseen by an RWQCB. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies, but much of its daily implementation authority is delegated to the nine RWQCBs, which are responsible for implementing CWA Sections 402 and 303(d). In general, the SWRCB manages both water rights and statewide regulation of water quality, while the RWQCBs focus exclusively on water quality in their regions.

Basin Plan Designated Beneficial Uses and Water Quality Objectives

The DFG hatcheries are located within the jurisdiction of the North Coast, San Francisco Bay, Central Valley, Los Angeles, and Lahontan RWQCBs. Each RWQCB is guided by a basin plan which identifies designated beneficial uses of the surface water bodies and groundwater basins, water quality objectives to protect beneficial uses, and implementation plans and policies for water quality protection. Basin plans are required to be updated every 3 years and provide the technical basis for permitting waste discharges with WDRs and taking enforcement actions.

Beneficial uses of the receiving water bodies of hatchery discharges are described in Table 3-1. The process of designating beneficial uses involves defining the resources, services, and qualities of the aquatic system that are the ultimate goals of protecting and achieving high water quality. The basin plans contain specific numeric surface water quality objectives for bacteria, dissolved oxygen (DO), pH, pesticides, electrical conductivity (EC), total dissolved solids (TDS), temperature, turbidity, and trace elements, as well as numerous narrative water quality objectives, that are applicable to certain water bodies or portions of water bodies. Receiving water bodies of each hatchery are further discussed in the "Environmental Setting" section below.

Table 3-1. Beneficial Uses of Surface Water Bodies and Groundwater Underlying the Hatcheries

Hatchery	Existing Beneficial Uses of Receiving Water Body (Nearest Downstream Water Body for Which Beneficial Uses Have Been Determined)[a]	Regional Water Quality Control Board's Jurisdiction
Salmon/Steelhead Hatcheries		
Coyote Valley Fish Facility	MUN, AGR, IND, GWR, NAV, REC-1, REC-2, WARM, COLD, WILD, RARE, MIGR, SPWN (Warm Springs Hydrologic Subarea of Russian River Hydrologic Unit)	North Coast
Feather River Hatchery	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD (Feather River)	Central Valley
Feather River Hatchery Thermalito Annex	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD (Feather River)	Central Valley
Iron Gate Hatchery	MUN, AGR, IND, PRO, GWR, FRSH, POW, REC-1, REC-2, WARM, COLD, WILD, RARE, MIGR, SPWN (Klamath River)	North Coast
Mad River Hatchery	MUN, AGR, IND, GWR, REC-1, REC-2, WARM, COLD, COMM, WILD, RARE, MIGR, SPWN, EST, AQUA (Mad River)	North Coast
Merced River Hatchery	MUN, AGR, PROC, IND, POW, REC-1, REC-2, WARM, COLD, WILD, MIGR, SPWN (Merced River)	Central Valley
Mokelumne River Hatchery	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD (Mokelumne River)	Central Valley
Nimbus Hatchery	MUN, AGR, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD (American River)	Central Valley
Trinity River Hatchery	MUN, AGR, IND, PRO, GWR, FRSH, POW, REC-1, REC-2, FRSH, WILD, MIGR, SPWN (Trinity River)	North Coast
Warm Springs Hatchery	MUN, AGR, IND, GWR, NAV, REC-1, REC-2, WARM, COLD, WILD, RARE, MIGR, SPWN (Warm Springs Hydrologic Subarea of Russian River Hydrologic Unit)	North Coast

Hatchery	Existing Beneficial Uses of Receiving Water Body (Nearest Downstream Water Body for Which Beneficial Uses Have Been Determined)[a]	Regional Water Quality Control Board's Jurisdiction
Trout Hatcheries		
American River Hatchery	MUN, AGR, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD (American River)	Central Valley
Black Rock Rearing Ponds	MUN, AGR, IND, REC-1, REC-2, COMM, COLD, WILD, RARE, SPWN (Los Angeles Aqueduct and Haiwee Reservoir)	Lahontan
Crystal Lake Hatchery	POW, REC-1, REC-2, COLD, SPWN, WILD (Baum Lake)	Central Valley
Darrah Springs Hatchery	MUN, AGR, POW, REC-1, REC-2, WARM, COLD, WILD, MIGR, and SPWN (Battle Creek)	Central Valley
Fillmore Hatchery	N/A[c]	Los Angeles
Fish Springs Hatchery	MUN, AGR, GWR, FRSH, NAV, REC-1, REC-2, COMM, COLD, WILD, RARE, SPWN (Fish Springs Creek and Owens River, below Pleasant Valley Reservoir to the Tinemaha Reservoir)	Lahontan
Hot Creek Hatchery	MUN, AGR, IND, GWR, REC-1, REC-2, COMM, AQUA, COLD, WILD, RARE, MIGR, SPWN (Hot Creek and tributary)	Lahontan
Kern River Planting Base[b]	MUN, POW, REC-1, REC-2, WARM, COLD, WILD, RARE, SPWN, FRSH (Kern River above Lake Isabella)	Central Valley
Moccasin Creek Hatchery	MUN , POW, REC-1, REC-2, WARM, COLD, WILD (Don Pedro Reservoir and Tuolumne River)	Central Valley
Mojave River Hatchery	MUN, AGR, GWR, REC-1, REC-2, WARM, COLD, and WILD (Mojave River)	Lahontan
Mount Shasta Hatchery	REC-1, REC-2, WARM, COLD, WILD, and potentially SPWN (Lake Siskiyou)	Central Valley
Mount Whitney Hatchery	MUN; AGR; IND; GWR; REC-1, REC-2; COMM; AQUA; WARM; COLD; WILD; RARE; and SPWN (Oak Creek)	Lahontan
San Joaquin Hatchery	MUN, AGR, PROC, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD (San Joaquin River from Friant Dam to the Mendota Pool)	Central Valley
Silverado Fisheries Base	AGR, MUN, COLD, MIGR, RARE, SPWN, WARM, WILD, REC-1, REC-2, NAV (Napa River)	San Francisco Bay

Notes:

[a] Beneficial uses are based on the beneficial uses identified in the NPDES permits of each hatchery. If a hatchery did not have an NPDES permit (e.g., Kern River Planting Base and Silverado Fisheries Base), the appropriate basin plan was referenced to determine the beneficial uses of the applicable receiving water body or groundwater subbasin. In addition, if beneficial uses were not specifically identified for a receiving water body, the beneficial uses of the next downstream tributary are identified.

[b] All hatcheries in the Central Valley RWQCB's jurisdiction are within the Sacramento River and San Joaquin River Basins, except for the Kern River Planting Base, which is within the Tulare Lake Basin.

[c] N/A = not applicable. The Fillmore Fish Hatchery does not discharge to a surface water body.

Beneficial Use Codes:

AGR = Agricultural Supply.
IND = Industrial Service Supply.
MUN = Municipal or Domestic Supply.
PRO = Industrial Process Supply.
POW = Hydropower Generation.
REC-1 = Water Contact Recreation.
REC-2 = Non-Contact Water Recreation.
WARM = Warm Freshwater Habitat.
COLD = Cold Freshwater Habitat.
WILD = Wildlife Habitat.
RARE = Rare, Threatened or Endangered Species.
GWR = Groundwater Recharge.
SPWN = Spawning, Reproduction, and/or Early Development.
COMM = Commercial and Sport Fishing.
MIGR = Migration of Aquatic Organisms.
FRSH = Freshwater Replenishment.
BIOL = Preservation of Biological Habitats of Special Significance.
EST = Estuarine Habitat.
AQUA = Aquaculture.
NAV = Navigation.

Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California

In 1994, the SWRCB and EPA agreed to a coordinated approach for addressing priority toxic pollutants in inland surface waters, enclosed bays, and estuaries of California. In March 2000, the SWRCB adopted the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, commonly referred to as the Statewide Implementation Plan, or SIP, for priority toxic pollutant water quality criteria contained in the CTR. The EPA promulgated the CTR in May 2000. The SIP also implements National Toxics Rule (NTR) criteria and applicable priority pollutant objectives in the basin plans. In combination, the CTR and NTR and applicable basin plan objectives, existing RWQCB beneficial use designations, and the SIP compose water quality standards and implementation procedures for priority toxic pollutants in non-ocean surface waters in California.

State Water Resources Control Board Resolution No. 68-16 (Statement of Policy with Respect to Maintaining High Quality Waters in California)

The goal of SWRCB Resolution No. 68-16 ("Statement of Policy With Respect to Maintaining High Quality Waters in California") is to maintain high-quality waters where they exist in the state. SWRCB Resolution No. 68-16 states, in part:

1) Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State 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.

2) Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

The SWRCB has interpreted Resolution No. 68-16 to incorporate the federal antidegradation policy, which is applicable if a discharge that began after November 28, 1975, will lower existing surface water quality.

Environmental Setting

California's climate is regionally variable as a result of its size and diverse topography statewide, with both the lowest point in the United States (Death Valley, at 276 feet below mean sea level [msl]) and the highest point in the contiguous 48 states (Mount Whitney, at 14,495 feet above msl) occurring in California. Another factor affecting California's climate is the constant interaction between continental and maritime air masses. Areas west of the mountain chains paralleling the California coast have climates that are dominated by the Pacific Ocean, with warm winters, cool summers, and small daily and seasonal temperature fluctuations. Farther inland, the climates are more typical of a continental climate, with warmer summers, colder winters, greater daily and seasonal temperature ranges, and lower relative humidity (Western Regional Climate Center 2008a). Areas east of the Sierra Nevada range are generally more arid, with a greater range of temperatures.

The valleys, high deserts, coastal areas, and mountain areas of California can be divided into 10 different regions: Klamath/North Coast, Bay/Delta, Central Coast, South Coast, Colorado Desert, Mojave, Sierra, San Joaquin Valley, Sacramento Valley, and Modoc. Based on the modified Koppen climate classification system, the climate in these regions includes desert, continental, highland, steppe, and Mediterranean climate types. In the desert climates, topography also is a factor, with higher elevations receiving more precipitation and having cooler temperatures. For the continental and highland climates, slope, aspect (the direction a slope faces), and elevation are additional important factors that determine the local climate conditions. Southern slopes generally are warmer and drier because they receive more of the sun's rays and heat. A steppe climate has high temperatures like a desert climate but has enough moisture to support grasslands and other vegetation not commonly found in a desert. Three variations of the Mediterranean climate exist in California: cool summer and winter, cool winter with frequent summer fog, and hotter summer with cooler winter (California Department of Fish and Game 2003).

Precipitation in California generally occurs as rainfall in the valley and desert regions of California and as snow in the mountain regions, particularly the Sierra Nevada. Average annual precipitation in California ranges from 21.27 to 22.18 inches (Western Regional Climate Center 2008b), with the majority of the precipitation occurring in the northern region of the state and in the mountain areas. Precipitation is heavier on the coastal or western slopes of the Coast Range and the Sierra Nevada than on the eastern slopes of these mountain ranges because most storms originate from the Pacific Ocean (Western Regional Climate Center 2008a). In addition, there is significant variability in precipitation between the different climate regions. For example, the average annual precipitation in the Modoc and Colorado regions' desert and steppe climates is 5 inches, while the average annual precipitation in the Klamath/North Coast region's Mediterranean climate can be as high as 120 inches (California Department of Fish and Game 2003).

A summary of the elevations and applicable climate region of the hatcheries is provided in Table 3-2. DFG's stocking Program locations occur throughout the state at numerous locations and likely occur in most of the climate regions described above. Elevations of the stocking locations range from approximately sea level to over 10,000 feet in some alpine lakes.

Table 3-2. Climatological Conditions near the DFG Hatchery Locations

Hatchery	Elevation (feet above mean sea level)	California Region[a]	General Climate Region(s)[b]
Salmon/Steelhead Hatcheries			
Coyote Valley Fish Facility			
Feather River Hatchery	171	Sacramento Valley, Sierra	Mediterranean/hot summer
Feather River Hatchery Thermalito Annex	115	Sacramento Valley, Sierra	Mediterranean/hot summer
Iron Gate Hatchery	2,169	Klamath/North Coast	Mediterranean/cool summer, cool continental/dry summer
Mad River Hatchery	161	Klamath/North Coast	Mediterranean/cool summer, Mediterranean/hot summer
Merced River Hatchery	341	San Joaquin Valley, Sierra	Semi-arid steppe, Mediterranean/hot summer
Mokelumne River Hatchery	112	Bay/Delta	Mediterranean/hot summer
Nimbus Hatchery	102	Sacramento Valley, Sierra	Mediterranean/hot summer
Trinity River Hatchery	1,844	Klamath/North Coast	Mediterranean/hot summer
Warm Springs Hatchery	217	Klamath/North Coast, Bay/Delta	Mediterranean/hot summer
Trout Hatcheries			
American River Hatchery	102	Sacramento Valley, Sierra	Mediterranean/hot summer
Black Rock Rearing Ponds	3,826	Sierra	Cool continental, semi-arid steppe, arid mid latitude desert
Crystal Lake Hatchery	3,022	Modoc	Mediterranean/cool summer
Darrah Springs Hatchery	961	Sacramento Valley	Mediterranean/hot summer
Fillmore Hatchery	469	Central Coast, South Coast	Mediterranean/hot summer, Mediterranean/cool summer
Fish Springs Hatchery	3,878	Sierra	Cool continental, semi-arid steppe, arid mid latitude desert
Hot Creek Hatchery	7,064	Sierra	Cool continental/dry summer

Hatchery	Elevation (feet above mean sea level)	California Region[a]	General Climate Region(s)[b]
Kern River Planting Base	2,700	Sierra	Semi-arid steppe, Mediterranean/hot summer
Moccasin Creek Hatchery	935	San Joaquin Valley, Sierra	Mediterranean/hot summer
Mojave River Hatchery	2,812	Mojave	Semi-arid steppe
Mount Shasta Hatchery	3,468	Klamath/North Coast	Mediterranean/hot summer, Mediterranean/cool summer, cool continental/dry summer
Mount Whitney Hatchery	4,295	Sierra	Cool continental, semi-arid steppe, arid mid latitude desert
San Joaquin Hatchery	312	San Joaquin Valley, Sierra	Semi-arid steppe, Mediterranean/hot summer
Silverado Fisheries Base	184	Bay/Delta	Mediterranean/cool hot summer

Notes:

[a] As defined in the *Atlas of the Biodiversity of California* (California Department of Fish and Game 2003).

[b] Based on the modified Koppen climate classification system as described in the *Atlas of the Biodiversity of California* (California Department of Fish and Game 2003).

Hydrology

Streams in the southern part of California are generally small and intermittent because precipitation in the southern regions is typically in the form of rain and substantially less than in the northern regions (Western Regional Climate Center 2008a). Much of the precipitation in the Sierra region occurs as snow. In California, peak runoff events, and the potential for flooding, occur primarily during the months of October–April and are usually most extreme between November and March. From April to July, the rain/flood season is followed by a period of moderately high runoff from snowmelt in watersheds that receive a substantial snowpack. When the Sierra Nevada's snowpack annually melts, it generally provides surface water flows into or throughout the summer months in the major streams and rivers located downstream in the Sacramento Valley, San Joaquin Valley, and Bay/Delta regions (Western Regional Climate Center 2008a).

Many rivers are controlled by dams and levees for a variety of purposes, including flood control, water storage and transport, and recreation. Rivers and streams in the Klamath/North Coast region are largely uncontrolled, with the exception of the Trinity River, where Lewiston Reservoir provides substantial storage and flows are diverted into the Sacramento River basin (Western Regional Climate Center 2008a). Most of the rivers on the west side of the Sierra Nevada are controlled to some degree by dams and diversions.

The ultimate endpoint for most surface water flows in California is the Pacific Ocean. However, the extreme northeastern portion of the Modoc region and the desert regions east of the mountain ranges (Mojave and Colorado Deserts regions) have no surface drainage to the ocean (Western Regional Climate Center 2008a). In addition, much of the runoff in the southern one-third of the San

Joaquin Valley drains internally, is used for irrigation, or evaporates to terminal basin areas known as the Tulare and Buena Vista Lakes (Western Regional Climate Center 2008a).

Hatchery Hydrology

Table 3-3 summarizes the water source of each hatchery, the receiving water body, the upstream water body/dam, and the maximum discharge flows as defined in each applicable NPDES permit. Generally, water enters each hatchery through an intake pipe and is then distributed to provide flows to fish ladders (if present), raceways, brood ponds and fish holding tanks, and hatchery and spawning buildings. After water has circulated through the hatchery facilities, the majority of water that has accumulated waste products (e.g., fish feces and uneaten feed) is typically diverted to settling ponds to remove readily settleable particulates. On occasion, some hatcheries discharge directly to receiving waters, such as from ladder flows, when reared fish are released to the receiving water, and specific facility discharges may contain wastes. Discharges from settling ponds may directly enter the receiving water; however, the settling ponds at several hatcheries (Mad River, Feather River, Nimbus, and American River Hatcheries) are located in the permeable floodplain gravels and cobbles where the discharges infiltrate to the underlying groundwater and rarely, if ever, result in a direct discharge from pond overflows. In one case (Mad River Hatchery), surface water discharges also are seasonally restricted by the NPDES permit and only allowed during the October 1–May 14 period, and all wastewater discharges must be less than 1 % of the Mad River flows.

Table 3-3. Summary of the DFG Hatcheries' Hydrologic Uses

Hatchery	Receiving Water Body of Hatchery's Discharge	Upstream Water Body (Dam)	Hatchery Water Source	Maximum Permitted Hatchery Discharge Flows (million gallons per day [mgd])
Salmon/Steelhead Hatcheries				
Feather River Hatchery	Feather River (directly and indirectly through seepage)	Lake Oroville (Oroville Dam)	Feather River (at Thermalito Diversion Dam)	47.3
Feather River Hatchery Thermalito Annex	Thermalito Afterbay	N/A	Groundwater	7.8
Iron Gate Hatchery	Klamath River	Iron Gate Reservoir (Iron Gate Dam)	Iron Gate Reservoir	16.1 to 31.9
Mad River Hatchery	Mad River (directly and indirectly through seepage)	N/A	Groundwater	7.5
Merced River Hatchery	Merced River	Merced River impounded at the Crocker-Huffman Diversion Dam	Merced River	5.2
Mokelumne River Hatchery	Mokelumne River	Camanche Reservoir (Camanche Dam)	Camanche Reservoir	46

Hatchery	Receiving Water Body of Hatchery's Discharge	Upstream Water Body (Dam)	Hatchery Water Source	Maximum Permitted Hatchery Discharge Flows (million gallons per day [mgd])
Nimbus Hatchery	American River (directly and indirectly through seepage)	Lake Natoma (Nimbus Dam)	Lake Natoma	Up to 90 mgd but typically 39 to 45 mgd (combined with American River Hatchery)
Trinity River Hatchery	Trinity River	Lewiston Reservoir (Trinity Dam)	Lewiston Lake/Reservoir	60.66
Warm Springs Hatchery	Dry Creek, a tributary to the Russian River	Lake Sonoma (Warm Springs Dam)	Lake Sonoma	15.5
Trout Hatcheries				
American River Hatchery	American River (directly and indirectly through seepage)	Lake Natoma (Nimbus Dam)	Lake Natoma	Up to 90 mgd but typically 39 to 45 mgd (combined with Nimbus Hatchery)
Black Rock Rearing Ponds	Los Angeles Aqueduct, a tributary to Haiwee Reservoir	N/A	Groundwater	12.3
Crystal Lake Hatchery	Baum Lake, located on Hat Creek, a tributary to the Pit River	Crystal Lake	Crystal Lake and Rock Creek Springs	Up to 17.4 (typically 12.4 mgd from Rock Creek Springs; approximately 4.0 mgd from Crystal Lake)
Darrah Springs Hatchery	Darrah Creek and Pacific Power Ditch, which are tributaries to Coleman Canal and Battle Creek	N/A	Darrah Springs, Darrah Creek, and Pacific Power Ditch	26.7
Fillmore Hatchery	None[a]	N/A	Groundwater	Approximately 11.6
Fish Springs Hatchery	Owens Valley Groundwater Basin and Fish Springs Creek, a tributary to the Owens River	N/A	Groundwater	18.1
Hot Creek Hatchery	A tributary to Hot Creek and Hot Creek, which is a tributary to the Owens River	N/A	Hot Creek springs	19.7

Hatchery	Receiving Water Body of Hatchery's Discharge	Upstream Water Body (Dam)	Hatchery Water Source	Maximum Permitted Hatchery Discharge Flows (million gallons per day [mgd])
Kern River Planting Base	Kern River	Kern River Powerhouse	Kern River	22.5
Moccasin Creek Hatchery	Moccasin Creek, a tributary to Don Pedro Reservoir and the Tuolumne River	Moccasin Reservoir (Moccasin Dam)	Moccasin Reservoir	21.3
Mojave River Hatchery	Mojave River	N/A	Groundwater	Up to 16.7 mgd discharged (9 mgd to the Mojave River and up to 7.7 mgd used for land irrigation or for Spring Valley Lake)
Mount Shasta Hatchery	Cold Springs and Big Springs Creeks, tributaries to Wagon Creek and Lake Siskiyou	N/A	Big Springs Creek	13.8
Mount Whitney Hatchery	Oak Creek	N/A	North Fork and South Fork Oak Creek	3.5
San Joaquin Hatchery	San Joaquin River	Millerton Lake (Friant Dam)	Millerton Lake	23.2
Silverado Fisheries Base	Rector Creek, a tributary to the Napa River	Rector Reservoir (Rector Dam)	Rector Reservoir	1.6

Notes:
N/A = not applicable or no dams are immediately upstream.
[a] Wastewater from this hatchery is used to irrigate fields and is not directly discharged to a receiving water body.

The groundwater subbasins identified by the DWR as underlying the hatcheries, and their groundwater level and quality characteristics, are summarized in Table 3-4. Some of the hatcheries do not overlie defined groundwater subbasins. Historically, groundwater levels in the underlying subbasins generally declined or experienced wide seasonal fluctuations based on the precipitation and pumping quantities. However, an increase or relatively stable historic groundwater levels occurred in the Healdsburg, Long Valley, Owens Valley, and Fillmore aquifers. Groundwater level trends varied geographically within the North American Subbasin (California Department of Water Resources 2003). Groundwater quality characteristics of the subbasins are further described in the "Water Quality" section below.

Specific groundwater levels near hatcheries that rely on groundwater as a primary or supplemental water source are further characterized. Three wells near the Feather River Hatchery Thermalito

Annex facility indicated historically stable groundwater levels ranging from approximately 2 to 8 feet below the ground surface (bgs). Groundwater levels near the Mojave River Hatchery were relatively stable at two wells historically (water level elevations ranging from approximately 2 to 24 feet bgs) but generally declined from approximately 16 to 42 feet bgs at another nearby well. No wells were located in the vicinity of the Darrah Springs Hatchery.

Table 3-4. Summary of Characteristics of Groundwater Subbasins Underlying Hatcheries

Hatchery	Groundwater Subbasin (California Department of Water Resources Subbasin Number)	Groundwater Surface Area (acres)	Estimated Groundwater Storage Capacity (acre-feet)	Groundwater Level Trends in Subbasin	Existing Groundwater Impairments
Salmon/Steelhead Hatcheries					
Feather River Hatchery	East Butte (5-21.59)	265,390	3,128,959	Wide seasonal groundwater level fluctuations (4 feet to 30 feet of fluctuations); groundwater recharging at the Thermalito Afterbay system results in localized groundwater level fluctuations south of the system	Manganese, iron, magnesium, total dissolved solids, conductivity, and calcium, primary inorganics, nitrates
Feather River Hatchery Thermalito Annex	East Butte (5-21.59)	265,390	3,128,959	Wide seasonal groundwater level fluctuations (4 feet to 30 feet of fluctuations); groundwater recharging at the Thermalito Afterbay system results in localized groundwater level fluctuations south of the system	Manganese, iron, magnesium, total dissolved solids, conductivity, and calcium, primary inorganics, nitrates
Iron Gate Hatchery	N/A	N/A	N/A	N/A	N/A
Mad River Hatchery	Mad River Hatchery operated with groundwater; however, groundwater conditions are unknown				
Merced River Hatchery	Merced (5-22.04)	491,000	21,100,000 (to a depth of 300 feet)	Average groundwater level declines of 30 feet from 1970 to 2000	Hardness, iron, nitrate, chloride, radiological, nitrates, pesticides, secondary

Hatchery	Groundwater Subbasin (California Department of Water Resources Subbasin Number)	Groundwater Surface Area (acres)	Estimated Groundwater Storage Capacity (acre-feet)	Groundwater Level Trends in Subbasin	Existing Groundwater Impairments
					inorganics, volatile organic compounds, and semi-volatile organic compounds
Mokelumne River Hatchery	Eastern San Joaquin (5-22.01)	707,000	42,400,000	Fairly continuous decline in groundwater levels over the 1960s to 2000s; overdraft of groundwater has led to significant groundwater depressions	Salinity, nitrate, primary and secondary inorganics, radiological, nitrates, pesticides, volatile organic compounds, and semi-volatile organic compounds
Nimbus Hatchery	North American (5-21.64)	351,000	4,900,000	Generally decreased in northern Sacramento and south Placer County; in Sutter and northern Placer counties the levels have remained relatively stable	Primary and secondary inorganics, volatile organic compounds, semi-volatile organic compounds, radiological; elevated levels of total dissolved solids/specific conductance, chloride, sodium, bicarbonate, boron, fluoride, nitrate, iron manganese, and arsenic in some locations
Trinity River Hatchery	N/A	N/A	N/A	N/A	N/A

Hatchery	Groundwater Subbasin (California Department of Water Resources Subbasin Number)	Groundwater Surface Area (acres)	Estimated Groundwater Storage Capacity (acre-feet)	Groundwater Level Trends in Subbasin	Existing Groundwater Impairments
Warm Springs Hatchery	Healdsburg (1-55.02)	15,400	489,000	Groundwater levels have remained relatively constant	No major impairments identified; some Secondary inorganic impairments
Trout Hatcheries					
American River Hatchery	North American (5-21.64)	351,000	4,900,000	Generally decreased in northern Sacramento and south Placer County; in Sutter and northern Placer Counties, the levels have remained relatively stable	Primary and secondary inorganics, volatile organic compounds, semi-volatile organic compounds, radiological; elevated levels of total dissolved solids/specific conductance, chloride, sodium, bicarbonate, boron, fluoride, nitrate, iron manganese, and arsenic in some locations
Black Rock Rearing Ponds	Owens Valley (6-12)	661,000	30,000,000	Water levels generally remain below the levels of the mid-1980s	Boron, fluoride, primary and secondary inorganics
Crystal Lake Hatchery	N/A	N/A	N/A	N/A	N/A
Darrah Springs Hatchery	N/A	N/A	N/A	N/A	N/A
Fillmore Hatchery	Fillmore (4-4.05)	20,800	7,330,000	Vary cyclically based on pumping and precipitation with a range of 30 feet over the 1970s to 2000; high levels in the 1990s	Radiological, nitrates, salts, volatile organic compounds, semi-volatile organic compounds, and secondary inorganics

Hatchery	Groundwater Subbasin (California Department of Water Resources Subbasin Number)	Groundwater Surface Area (acres)	Estimated Groundwater Storage Capacity (acre-feet)	Groundwater Level Trends in Subbasin	Existing Groundwater Impairments
Fish Springs Hatchery	Owens Valley (6-12)	661,000	30,000,000	Water levels generally remain below the levels of the mid-1980s	Boron, fluoride, hydrogen sulfide primary and secondary inorganics
Hot Creek Hatchery	Long Valley (6-11)	71,800	160,000	Water levels generally stable in the 1990s, with fluctuations of up to 2 feet	Boron, fluoride, radiological, secondary inorganics
Kern River Planting Base	Kern Valley	74,000	N/A	N/A	Iron/manganese, and fluoride
Moccasin Creek Hatchery	N/A	N/A	N/A	N/A	N/A
Mojave River Hatchery	Upper Mojave River Basin (6-42)	413,000	10,800,000	Generally groundwater level declines	Nitrate, iron, manganese, benzene, toluene, trichloroethane, ethylbenzene, xylene, and methyl tertiary butyl ether (MTBE), primary inorganics, radiological, secondary inorganics
Mount Shasta Hatchery	N/A	N/A	N/A	N/A	N/A
Mount Whitney Hatchery	Owens Valley (6-12)	661,000	30,000,000	Water levels generally remain below the levels of the mid-1980s	Boron, fluoride, primary and secondary inorganics
San Joaquin Hatchery	Madera (5-22.06)	394,000	18,500,000 (to a depth of 300 feet)	Water levels declined approximately 40 feet between 1970 and 2000	Localized areas of hardness, iron, nitrate, chloride, pesticides, and secondary inorganics
Silverado Fisheries Base	Napa Valley (2-2.01)	[a]	[a]	[a]	[a]

Notes:

N/A = Hatchery not underlying a defined groundwater basin.

[a] A description of this subbasin is not available in the DWR's *Individual Basin Descriptions* online database (California Department of Water Resources 2008).

Water Quality

The water quality of surface waters and groundwater varies throughout California. Potential sources of water quality impairments include point sources (direct discharges to water bodies) and nonpoint sources. Pollutants from nonpoint sources are transported via surface water runoff. In urban areas, typical nonpoint pollutant sources include city streets, parking lots, lawns, gardens, and industrial areas. Runoff from roads and parking lots carry oil and other gasoline-related contaminants. Typical pollutants in stormwater runoff from lawns and agricultural areas include pesticides (i.e., insecticides, herbicides, and fungicides) and nutrients from fertilizers. The SWRCB's 2006 303d list and the NPDES permits of the hatcheries were used to characterize the surface water quality of the hatchery water sources, of the hatcheries' receiving water bodies, and of the stocked water bodies. Existing identified 303d-list surface water quality impairments of the hatchery receiving water bodies are summarized in Table 3-5. Identified sources of each pollutant are provided when available. The Iron Gate, Nimbus, American River, Mokelumne River, and Merced River Hatcheries' surface water sources are identified as impaired per the 303d.

Groundwater quality impairments are identified by each RWQCB and the DWR and summarized in Table 3-4, with primary or secondary inorganics impairments identified in all of the subbasins (California Department of Water Resources 2008). Other types of impairments in specific groundwater basins include: metals, hardness, pesticides, radiological constituents, nitrates, salts, and semi-volatile and volatile organic compounds. The groundwater subbasins supplying water for the Feather River Hatchery Thermalito Annex, Warm Springs Hatchery, Fillmore Hatchery, Mojave River Hatchery, Hot Creek Hatchery, Fish Springs Hatchery, and Black Rock Rearing Ponds have water quality impairments.

Table 3-5. Existing Water Quality Impairments of Hatchery Receiving Water Bodies

Hatchery	Existing Water Quality Impairment[a]	Identified Potential Sources of Impairment[a]
Salmon/Steelhead Hatcheries		
Feather River Hatchery	Chlorpyrifos, Group A pesticides, mercury, and unknown toxicity Diazinon[cd]	Chlorpyrifos and Unknown Toxicity Source unknown Group A Pesticides Agriculture Mercury Resource extraction Diazinon Agriculture
Feather River Hatchery Thermalito Annex	No specific impairments for the Thermalito Afterbay listed on 303d 2006 list	N/A
Iron Gate Hatchery	Nutrients, water temperature, organic enrichment/low DO (Klamath River reach Iron Gate Dam to Scott River) Microcystin toxins[b] (Klamath River reach including the Copco and Iron Gate Reservoirs)	Nutrients and Organic Enrichment/Low Dissolved Oxygen (DO) Out-of-state source; and nonpoint/point source Water Temperature Hydromodification Upstream impoundment Flow regulation/modification Habitat modification Removal of riparian vegetation Nonpoint source Microcystin Toxins (Blue-green algae) Nutrient loading
Mad River Hatchery	Sedimentation/siltation, water temperature, turbidity	Sedimentation/Siltation and Turbidity Silviculture Resource extraction Nonpoint source Water Temperature Upstream impoundment Flow regulation/modification Habitat modification Removal of riparian vegetation Nonpoint source Unknown nonpoint source
Merced River Hatchery	Chlorpyrifos, diazinon, Group A pesticides, mercury	Chlorpyrifos, Diazinon, Group A Pesticides Agriculture Mercury Resource extraction
Mokelumne River Hatchery	Zinc, copper (Mokelumne River, Camanche Reservoir)	Copper and Zinc Resource extraction

Hatchery	Existing Water Quality Impairment[a]	Identified Potential Sources of Impairment[a]
Nimbus Hatchery	Mercury and unknown toxicity (American River); Lake Natoma is also impaired for mercury	American River-Mercury Resource extraction American River—Unknown Toxicity Source unknown Lake Natoma—Mercury Resource extraction
Trinity River Hatchery	No impairments for Lewiston Reservoir or the Trinity River downstream of Lewiston Reservoir listed on the 303d 2006 list.	N/A[c]
Warm Springs Hatchery	No specific impairments for Dry Creek specifically; however, entire Russian River watershed is listed for sedimentation/siltation and water temperature; in addition, Lake Sonoma is listed for mercury	Sedimentation/Siltation Agriculture Agriculture-storm runoff Silviculture Logging road construction/maintenance Construction/land development Highway/road/bridge construction Disturbed sites (land development) Hydromodification Channelization Dam construction Upstream impoundment Flow regulation/modification Habitat modification Removal of riparian vegetation Streambank modification/destabilization Drainage/filling of wetlands Channel erosion Erosion/siltation Nonpoint source Water Temperature Hydromodification Upstream impoundment Flow regulation/modification Habitat modification Removal of riparian vegetation Streambank modification/destabilization Nonpoint source
Trout Hatcheries		
American River Hatchery	Mercury and unknown toxicity (American River); Lake Natoma is also impaired for mercury	American River—Mercury Resource extraction American River—Unknown Toxicity Source unknown Lake Natoma—Mercury Resource extraction
Black Rock Rearing Ponds	Copper (Haiwee Reservoir)	Other (related to algicide used to prevent taste/odor problems in drinking water supplies)

Hatchery	Existing Water Quality Impairment[a]	Identified Potential Sources of Impairment[a]
Crystal Lake Hatchery	Nutrients, organic enrichment/low DO, temperature (Pit River)	Nutrients, Organic Enrichment/Low Dissolved Oxygen, Water Temperature Agriculture Agriculture-grazing
Darrah Springs Hatchery	No impairments listed on 303d 2006 list	N/A
Fillmore Hatchery	N/A	N/A
Fish Springs Hatchery	No impairments listed on 303d 2006 list	N/A
Hot Creek Hatchery	No impairments listed on 303d 2006 list	N/A
Kern River Planting Base	No impairments listed on 303d 2006 list.	N/A
Moccasin Creek Hatchery	Diazinon, Group A pesticides, and unknown toxicity (Tuolumne River reach Don Pedro Reservoir to San Joaquin River); also, the Don Pedro Reservoir is impaired for mercury	Don Pedro Reservoir- Mercury Resource extraction Tuolumne River—Diazinon and Group A Pesticides Agriculture Tuolumne River—Unknown Toxicity Source unknown
Mojave River Hatchery	No impairments listed on 303d 2006 list	N/A
Mount Shasta Hatchery	No impairments listed on 303d 2006 list	N/A
Mount Whitney Hatchery	No impairments listed on 303d 2006 list	N/A
San Joaquin Hatchery	Exotic species (Friant Dam to Mendota Pool)	Source unknown
Silverado Fisheries Base	No impairments listed on 303d 2006 list for Rector Creek; however, Napa River is impaired for nutrients, pathogens, and sedimentation/siltation	Nutrients Agriculture Pathogens Agriculture Urban runoff/storm sewers Sedimentation/Siltation Agriculture Construction/land development Land development Urban runoff/storm sewers

Notes:

[a] Water quality impairments and potential sources are as identified on the 2006 CWA 303(d) list of water quality limited segments (State Water Resources Control Board 2007).

[b] Listing of this impairment is based on U.S. Environmental Protection Agency 2008a, 2008b. The Klamath River, specifically the Oregon to Iron Gate reach, which includes the Copco and Iron Gate reservoirs, is impaired due to the presence of elevated concentrations of microcystin toxins. These toxins are produced by cyanobacteria or blue-green

algae and may induce skin rashes, sore throat, oral blistering, nausea, gastroenteritis, fever, and liver toxicity. The EPA added microcystin toxins to the 2006 303d list of water quality limited segments in March 2008 (U.S. Environmental Protection Agency 2008a, 2008b).N/A = Not applicable because no listed 303d impairments and/or no discharge to a surface water body.

[c] Not available.

[d] Constituent is being addressed by an EPA-approved total maximum daily load (TMDL) (State Water Resources Control Board 2008).

Environmental Consequences

Methods

The operation of each fish hatchery could have localized effects on the hydrology and water supply upstream and downstream of each facility, and effects on groundwater and surface water quality. The potential for the project to affect surface water hydrology and water quality consists of:

- localized alterations in hydrology and water supply associated with hatchery-related water diversions and discharges,
- effects on water quality associated with discharges of hatchery water to surface waters,
- effects on groundwater quality associated with discharges of hatchery waters to percolation ponds, and
- the effects on water quality associated with DFG's fish stocking Program.

The potential effects listed above are assessed for the state's hatchery Program, and findings have been compared with thresholds of significance to make impact determinations. The approach and methodology for assessing each of these categories of potential effects are discussed below.

Effects of Hatchery Operations on Hydrology and Water Supply

This assessment considered the potential effects of hatchery water supply operations (i.e., surface water and groundwater use) on the hydrology of surface waters and groundwater resources, and the related effects to these resources, as described below.

- Surface water diversions, and groundwater withdrawals that are used for hatchery operations, were evaluated qualitatively for potential effects on in-stream flows and water supply, changes in erosion and sedimentation, and changes in potential flooding that could result from hatchery water discharges to surface water. The assessment considers the relative amount of water diverted from surface waters, total hatchery water discharges (i.e., surface and groundwater) to the receiving water body, and the site-specific factors that influence the severity of these effects.
- Groundwater withdrawals at hatcheries also were evaluated for the potential effects on groundwater resources. The assessment considered the amount of groundwater pumping at each facility, seepage from settling/percolation ponds, and the condition of the source aquifers (e.g., the state of overdraft).

Effects of Hatchery Operations on Surface Water and Groundwater Quality

Operation of fish hatcheries requires that fish be produced in ponds/raceways, fed, and protected from pathogens. These activities alter the quality of the water that was initially diverted from the neighboring surface water or underlying aquifer. The following sections describe the factors that were considered, and the analytical methods used, to assess the environmental impacts of these activities on surface and groundwater hydrology and water quality.

Chemical Constituents of Concern

The water quality assessment involved identifying all potential chemical constituents that might be discharged in hatchery water. Pollutants of concern were identified from review of the NPDES permits for the facilities, descriptions of products used as provided by the hatchery managers, and common knowledge of pollutants produced in hatchery environments. Table 3-6 shows the list of diseases and pathogens found in California and treatment chemicals typically used at DFG hatcheries to treat said diseases and pathogens as identified by DFG's Fish Pathology Lab. DFG's Water Pollution Lab performs routine testing of hatchery discharge samples and conducts independent analyses of potential treatment chemicals, to ensure that the chemical application practices are considered safe for stocked fish and in compliance with NPDES permits.

Table 3-6. Common Treatment Chemicals Potentially Used at the Hatcheries

Drug or Chemical	Purpose of Application	Expected Method of Application or Treatment
Acetic acid	Control of external parasites	(1) Continuous flow bath: 1.5 to 2.2 gallons of glacial acetic acid added as a bolus to top of raceway. Gives a treatment level of approximately 335 to 500 mg/L. (2) Bath: used at a rate of 500 to 2,000 mg/L for 1 to 10 minutes.
Amoxicillin trihydrate	Control and prevention of external and systemic bacteria infections	Injected intraperitoneally: into broodstock twice a week, prior to spawning, at a rate of 40 mg/kg of fish.
Carbon dioxide	Anesthetic	Bath: bubbled in water. Usually used in small volumes of water.
Chloramine-T (N-sodium-N-chloro-p-toluenesulphonamide)	Control of external gill bacteria	(1) Continuous flow bath: used at a concentration of 10 mg/L for 1 hour. (2) Bath: used at a concentration of 10 mg/L for 1 hour.
Copper sulfate	Control of external parasites and bacteria	Continuous flow bath: used at a rate of up to 0.5 pounds per cfs of raceway flow.
Erythromycin	Control and prevention of external and systemic bacteria infections	(1) Injected intraperitoneally: at a rate of 40 mg/kg of fish, at 30-day intervals. (2) Feed: used in medicated feed or fish pills at a rate of 100 mg/kg of fish.
Florfenicol (Nuflor)	Control and prevention of external and systemic bacteria infections	Feed: Purchased medicated feed is administered to fish at a rate of 10 mg/kg of fish per day, split into morning and afternoon feedings.
Formalin (37% formaldehyde solution)	(1) Control of external parasites (2) Fungus control on fish eggs	(1) Continuous flow bath: Low dose used at a concentration of 25 mg/L for 8 hours. High dose used at a concentration of 167 to 250 mg/L for 1 hour. (2) Bath: used at a concentration of 2,000 mg/L, or less, for 15 minutes.

Drug or Chemical	Purpose of Application	Expected Method of Application or Treatment
Hydrogen peroxide[1]	Control of external parasites and fungus	Continuous flow bath: (a) used on fish at a rate of 100 mg/L, or less, for 45 minutes to 1 hour (b) used on fish eggs at a concentration of 500 to 1,000 mg/L for 15 minutes
MS-222/tricane methane sulfonate (Finquel, Tricaine-S)	Anesthetic	Bath: used at a rate of 50 to 250 mg/L, usually in a small volume of water.
Oxytetracycline HCL (Terramycin)	Control and prevention of external and systemic bacteria infections	(1) Bath: used in tanks for 6 to 8 hours at a concentration of 100 mg/L or less. (2) Feed: fed at a rate of 3.75 grams of oxytetracycline per 100 pounds of fish per day.
Penicillin G potassium	Control and prevention of external and systemic bacteria infections	Bath: used in tanks for 6 to 8 hours at a concentration of 150 IU/ml (500,000,000 IU/311.8 g packet).
Potassium permanganate	Control of external parasites and bacteria	(1) Flush: used at a rate of 2 ounces per cfs of raceway flow, poured in all at once, for a total of three treatments, spaced 10 to 15 minutes apart (2.32 mg/L for a 45-minute treatment, 3.48 mg/L for a 30-minute treatment). (2) Bath: used at a rate of 2 mg/L, or less, for 1 hour.
PVP iodine	Disinfect and control diseases on fish eggs	Bath: used at a concentration of 100 mg/L for 10 to 30 minutes.
Sodium bicarbonate	Anesthetic	Bath: used at a rate of 142 to 642 mg/L, usually in a small volume of water.
Sodium chloride (salt)	Fish cleansing, diseease control, and stress reduction	Continuous flow bath: used at a rate of 150 to 700 pounds of salt per cfs of raceway flow.
Sulfadimethoxine-ormetoprim (Romet-30)	Control and prevention of external and systemic bacteria infections	Feed: used at a rate of 50 mg/kg of fish per day.

Notes:
cfs = cubic feet per second.
g = gram.
IU/ml = international units per milliliter.
mg/L = milligrams per liter.
mg/kg = milligrams per kilogram.

[1] Not used at CDFG fish hatcheries during or prior to the 2004–2008 baseline period.

Measured or estimated concentrations of potential constituents of concern were identified from historical DMRs prepared by hatchery staff for compliance with its NPDES permit. No data were available for those hatcheries that are not operated under NPDES permits (i.e., Kern River Planting Base, Fillmore Hatchery, and Silverado Fisheries Base). Additionally, no DMRs were available for the Mount Whitney Hatchery, and several other hatcheries had limited data available. Supplemental data collected by DFG, or reported in the available NPDES permits, also were reviewed to characterize the quality of hatchery discharges. Because the Program does not involve any change in hatchery operations, the future quality of hatchery discharges is generally considered to be the same as currently produced for the purposes of this analysis. Where specific changes in Program operations have occurred, such as the discontinued use of copper sulfate at most of the hatcheries, changes are considered in the analysis.

The first step in the water quality assessment was to conduct a constituent "screening" analysis of available discharge water quality data, which included comparing hatchery discharge quality to applicable water quality standards. The screening analysis consisted of determining: (1) if the constituent had been detected, and (2) the maximum detected concentration. Concentrations were compared with applicable federal water quality criteria (e.g., the CTR) and state water quality objectives contained in basin plans. For pollutants of concern with no federal or state adopted criteria, the NPDES permits, EPA 304(a) recommended water quality criteria, and scientific literature were reviewed to identify appropriate water quality thresholds. Constituents that have never been detected at or above the laboratory reporting limit, and constituents detected but always at levels below applicable water quality standards or other relevant guidance values, were not evaluated further. This includes constituents that were detected but are not regulated and that do not have any other relevant guidance value that would facilitate an impact assessment. Examples of such constituents include inorganic ions (calcium, potassium, and magnesium). This screening analysis determined that numerous constituents are not of concern and, therefore, do not require detailed assessment in this EIR/EIS. Constituents detected above an applicable water quality standard or other relevant guidance values where no standard exists (e.g., EPA-recommended criteria), at least once, were evaluated further in this EIR. Appendix D provides tables summarizing the maximum concentrations of detected constituents, along with applicable water quality criteria.

The potential water quality effects of the hatchery discharges to either surface receiving water bodies or underlying aquifers were evaluated based on the frequency and relative magnitude of the increase in constituent concentration/parameter level in the receiving water and resultant water quality compared with the standard. The increase in the receiving water concentration was determined based on stream flow and hatchery discharge rates, and ambient receiving water and hatchery discharge water concentrations. Potential water quality effects on groundwater were assessed qualitatively based on hatchery discharge water concentrations and known groundwater conditions in various aquifers.

Temperature

The temperature of hatchery waters may become elevated prior to being discharged to surface waters as a result of increased solar exposure, or the receiving water in reaches where stream flow has been diverted to the hatchery may increase as a result of slower flow velocities, which allows additional warming to occur over time. Aquatic life uses are the most sensitive beneficial uses that would be affected by the thermal effects of the hatchery discharges. The assessment of potential thermal effects of hatchery operations on fisheries and aquatic resources is provided in Chapter 4, "Biological Resources." The assessment of thermal effects herein evaluated the potential for hatchery discharges to cause exceedances of the applicable basin plan temperature objectives in the receiving water by frequency and magnitude that would adversely affect other non-aquatic life beneficial uses.

Significance Criteria

For the purposes of this analysis, a Program impact pertaining to hydrology or water quality was considered significant if it would result in any of the following, which are based on professional judgment and Appendix G of the State CEQA Guidelines (14 CCR 15000 et seq.):

- substantial reduction in surface water or groundwater quantity that would adversely affect the water supply beneficial use of the water body or groundwater aquifer;
- substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on site or off site;
- substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in increased frequency and magnitude of flooding that would pose significant risks to human life or property;
- degrade one or more water quality parameter by frequency and magnitude that would adversely affect beneficial uses of a water body or groundwater aquifer; or
- cause violation of applicable water quality criteria/objectives, outside the zone of initial discharge mixing, that would result in adverse effects on receiving water beneficial uses.

Impacts and Mitigation Measures

Effects of Hatchery Operations on Hydrology and Water Supply

Impact HYD-1: Effects of Hatchery Operations on Channel Erosion (Less than Significant)

Hatchery water discharges can potentially change stream flow rates (i.e., flow, depth, and velocity), which in turn can cause or contribute to channel erosion and sedimentation downstream of the hatcheries. Additionally, hatcheries served by groundwater contribute water to surface stream flows that otherwise might not exist, which can affect channel erosion rates. Based on the hatchery operation information shown in Table 3-3, each hatchery's discharge location and water source were characterized as follows: The majority of hatcheries are located downstream of dams and reservoirs where water is supplied directly to the hatchery and hatchery discharges return water back to the source stream; five (i.e., Mount Shasta Hatchery, Darrah Springs Hatchery, Kern River Planting Base, Hot Creek Hatchery, and Mount Whitney Hatchery) divert directly from natural streams or springs; and seven hatcheries use groundwater (Table 3-3).

The discharge locations of certain hatcheries would exclude them from affecting natural channel erosion processes. Hatcheries that directly divert water from an upstream reservoir or river location, and discharge hatchery water to the same channel, do not measurably affect total channel flow rates downstream of the hatchery and thus would not affect base flow-related erosion rates, compared with existing conditions. The quantity of water diverted into the hatchery and the hatchery discharge flows are similar because the hatcheries are largely constructed concrete facilities (i.e., consumptive use or loss of water via leakage to groundwater or evaporation is low . The discharge water from these hatcheries (i.e., from fish ladders, raceways, pond systems, and discharge settling ponds), is from constructed permanent outfall structures, pipelines, or channels that do not change over time. The discharge-related operations would not change under the Program, so the potential discharge-related effects on localized erosion and sediment transport where the outfalls are located in natural channels would not be expected to change measurably.

The hatchery discharges (or portions of the discharges) for several hatcheries (i.e., Feather River Hatchery Thermalito Annex, Black Rock Rearing Ponds, Darrah Springs Hatchery, and Crystal Lake Hatchery) are to artificial channels or lakes or are used entirely for agricultural irrigation (i.e., Fillmore Hatchery) and would not substantially affect erosion. The Nimbus, American River, Feather River, and Mad River Hatcheries discharge primarily to percolation ponds, and any direct discharges to receiving waters are limited to infrequent overflows and are unlikely to affect erosion substantially. Additionally, the Mad River Hatchery discharge is restricted to less than 1% of the background Mad River streamflow, which further limits its potential effect on erosion.

The remaining hatcheries, consisting of the Mount Shasta Hatchery facility and the hatcheries that use groundwater, increase the flows to receiving waters and thus have the potential to increase the net rates of channel erosion downstream of the hatchery. The Mount Shasta Hatchery diverts the flow of Big Springs Creek through the hatchery, with an average of 10.7 million gallons per day (mgd) (16.6 cfs) discharged to nearby Cold Creek. Cold Creek is a small channel that flows about 2 miles until it enters Lake Siskiyou, and the hatchery discharge produces the majority of flow in the channel. Because the flows to Cold Creek are controlled and relatively constant year-round, and have been occurring since the Mount Shasta Hatchery was constructed in 1888, the flow would not substantially affect channel erosion rates such that adverse effects on beneficial uses of Cold Creek or downstream waters would occur.

The Mojave River and Fish Springs Hatcheries use groundwater as the water supply and discharge hatchery water to natural channels. The design discharge rate of the Mojave River Hatchery is 16.7 mgd (equivalent to 25.9 cfs), which is about 36% of the average monthly stream flow in the Mojave River but only about 1.1% of the average maximum daily flows of 2,334 cfs, which occur in February each year (U.S. Geological Survey 2005). The relatively small hatchery discharge flow would not be expected to substantially affect erosion in the much larger and wider (i.e., over 1,100 feet), low-gradient Mojave River channel where the hatchery discharge enters.

The design discharge rate of the Fish Springs Hatchery is 18.1 mgd (equivalent to 28.0 cfs) to Fish Springs Creek and is the primary water source for the channel. Fish Springs Creek is a low-gradient channel located on the relatively level Owens River valley floor and flows about 1.4 miles to its confluence with the Owens River. A review of aerial photography indicates that the hatchery discharges have not resulted in sediment deposition at the confluence with the Owens River, thus indicating that the historical hatchery flows have not caused substantial erosion or sediment deposition.

This assessment indicates that hatcheries that are located below dams; that divert from and discharge flow to the same water body; or that discharge to land, lakes, or constructed channels would not substantially alter the existing drainage patterns in a manner that would result in substantial erosion or siltation on or off site. Additionally, surface water diversion and contribution of groundwater to receiving waters at the other hatcheries are not of sufficient quantity to cause substantial erosion and scour downstream of the discharge location. Therefore, hatchery discharges would not cause substantial erosion or siltation on or off site, and, therefore, this impact is considered less than significant.

Impact HYD-2: Effects of Hatchery Operations on Flooding and Flood Hazards (Less than Significant)

Hatchery water discharges to natural channels have the potential to contribute incrementally to the potential for flooding hazards when background rivers are flowing at or above flood stage. Return flows from hatcheries that are served by groundwater create new surface flows that otherwise might not exist and thus can contribute to the total flow volumes. Of a lesser concern, direct diversions from natural channels have the potential to reduce flows in the diverted reach, thereby potentially allowing riparian vegetation growth to encroach further into the channel than would occur otherwise. Vegetation in the channel can reduce the flow conveyance capacity, which can increase the potential for overbank flooding in the vicinity of the excess vegetation growth when high flows occur in the channel.

Based on the water sources and receiving water categories described above (see Impact HYD-1 and Table 3-3, above), hatcheries where the water supply is provided directly from upstream reservoirs, and hatcheries that directly divert from and discharge to the same receiving water, would not substantially cause or contribute to flooding because background stream flows would be nearly identical with or without the hatcheries. Land application of discharge water at the Fillmore Hatchery for irrigation would not exacerbate flooding. Hatcheries that discharge to constructed channels and reservoirs (i.e., Feather River Hatchery Thermalito Annex, Black Rock Rearing Ponds, Darrah Springs Hatchery, and Crystal Lake Hatchery) would not be expected to contribute substantially to flooding because the flow and storage conditions in these receiving water bodies are managed and controlled.

The Mad River, Mojave River, Fillmore, and Fish Springs Hatcheries rely on groundwater, and the hatchery discharges could potentially contribute to flooding or flood hazards in the water bodies that receive the hatchery discharges. However, as described above for Impact HYD-1, the contribution of flow from the Mojave River Hatchery compared with winter peak flows in the Mojave River is small, and the Fish Springs Hatchery would not contribute substantially to potential peak runoff rates in the Owens River compared with the much larger Owens River watershed (i.e., approximately 1,900 square miles). The design discharge rate of the Mad River Hatchery is 7.5 mgd (equivalent to 11.6 cfs), which is negligible (0.1%) compared with the average maximum daily flows of 10,400 cfs, which typically occur in December (U.S. Geological Survey 2005). At the Mount Shasta Hatchery, the diversion of water through the hatchery to Cold Creek is controlled, and overflows during peak runoff events are discharged to an in-line percolation pond and then to Wagon Creek (downstream of its confluence with Big Springs Creek). Because the Mount Shasta Hatchery discharge produces the majority of flow in Cold Creek, and peak flows are conveyed to Big Springs Creek/Wagon Creek, the additional flow to Cold Creek would not substantially increase peak flow events.

The potential for direct stream diversions to result in increased vegetation growth within the receiving waters exists at the Mount Shasta, Kern River, Darrah Springs, Hot Creek, and Mount Whitney Hatcheries. These hatcheries divert water from a surface stream (or springs) that would otherwise flow in natural channels between the diversion and discharge locations. The length of stream reaches between the diversion and discharge locations at all of the hatcheries are less than 0.5 mile. While channel encroachment of vegetation could affect flooding hazards, anecdotal information indicates that the potential for flooding is low in these areas. Hot Creek is not subject to substantial high water runoff rates because the geothermal source springs flow at a uniform rate through the year and produce the majority of flow that would otherwise flow in the diverted reach. The diversions at Kern River are only a small portion of the natural flow in the channels; therefore, substantial vegetation encroachment is not expected to occur where natural flows exist to maintain the current riparian vegetation conditions. Although some hatcheries are located within floodplains and have been subject to occasional flooding, there are no changes proposed for the discharge-related operations of the hatcheries and the potential for increased vegetation growth in the relatively short diverted reaches would not be expected to substantially restrict channel flows or increase flood hazards compared with existing conditions.

This assessment indicates that hatcheries that divert from and discharge flow to the same water body; or discharge to land, lakes, or constructed channels would not substantially alter the existing drainage patterns of the area and thus would not substantially increase the frequency or magnitude of flooding in the area. Any minor effects of hatchery facilities on area drainage would not pose significant risks to human life or property. Additionally, the contribution of flows by the Mount Shasta, Mojave River, and Fish Springs Hatcheries, and potential effects of vegetation encroachment in channels where the water has been reduced as a result of diversions, are not of sufficient quantity to substantially increase the frequency or magnitude of flooding in the area. Therefore, this impact is considered to be less than significant.

Impact HYD-3: Effects of Hatchery Operations on Surface Water Supply (Less than Significant)

Surface water diversions to support hatchery operations could potentially reduce the availability of surface water supplies to downstream water users. The effects of reduced stream flow would be limited to any existing water users between the stream diversion and hatchery discharges. Hatcheries that rely on groundwater as their water source would not be expected to adversely affect available surface water supplies, and there would be no change from existing conditions.

For hatcheries where the water supplies are provided directly from upstream reservoirs, or are directly diverted from and discharged to the same receiving waters, there would be a limited potential to affect surface water supplies because the water would be available downstream with or without the hatchery being present. Only stream flow in the short reach between the diversion and discharge locations would be reduced and potentially limit available water supply within the reach. Because the hatcheries are largely constructed concrete facilities, the consumptive use of water via leakage to groundwater or evaporation is low. Discharges at the Nimbus and American River, Feather River, and Mad River Hatcheries are to percolation ponds located in the permeable floodplain gravels of the receiving stream and, thus, the discharges also do not substantially reduce in-river flows downstream of the hatcheries.

The Mount Shasta, Kern River, Darrah Springs, Hot Creek, and Mount Whitney Hatcheries, and the Black Rock Rearing Ponds, divert water directly from streams or springs that would otherwise flow in natural channels to locations downstream of the hatcheries, as described above. The Mount Shasta Hatchery reduces water in Big Springs Creek through direct diversion and discharge to the adjacent Cold Creek. However, DFG's diversion to the Mount Shasta Hatchery has existed since 1888, and thus the diversion is an existing condition with respect to any residents adjacent to the Big Springs Creek. At the Black Rock Rearing Ponds hatchery, a portion of the water in a small creek is diverted; however, the hatchery discharges all water to the Los Angeles Aqueduct. Therefore, the diversion reduces the streamflow on a permanent basis. At the remaining five hatcheries, the distance between the diversion and discharge locations is less than 0.5 mile, and no other water diverters are located within the reaches having reduced flow. Because the diverted water at these five hatcheries ultimately flows to the receiving water that would exist if the hatcheries were not present, the hatcheries would not affect water users farther downstream.

Water use for the Program would not change; therefore, the potential discharge-related effects on water supply would not be expected to change measurably. This assessment indicates that hatcheries with diversions and discharges to the same water body, or that use groundwater, would not substantially reduce availability of surface water supplies and thus would not adversely affect the water supply beneficial use of the water body associated with the hatchery. Additionally, hatcheries that directly divert and use surface water for hatchery operations would not substantially reduce surface water supplies for any other water users and would not result in a substantial consumptive use. Therefore, this impact is considered to be less than significant.

Impact HYD-4: Effects on Groundwater Quantity from Hatchery Operations (Less than Significant)

Groundwater extractions to support hatchery operations could potentially deplete groundwater aquifers and reduce the availability of groundwater supplies to water users within the respective groundwater basin. Effects of groundwater aquifer depletion would be limited to those users within the basin. Hatcheries that rely solely on surface water as their water source would not adversely affect available groundwater supplies and are not discussed further in this section.

Nine hatcheries rely on groundwater as a primary or supplemental water source to supply the water demands of the hatchery operations. Of these, the Darrah Springs, Crystal Lake, and Hot Creek Hatcheries use spring-fed groundwater. The use of the spring-fed waters for hatchery operations has no effect on groundwater quantity because the water would be discharged from the aquifer regardless of whether or not it was used by hatcheries. The Black Rock Rearing Ponds and the Mad River Hatchery, Feather River Hatchery Thermalito Annex, Fish Springs Hatchery, Fillmore Hatchery, and Mojave River Hatchery pump groundwater to varying degrees.

Most of the hatcheries that pump groundwater discharge to local surface waters; however, the Fillmore and Mojave River Hatcheries discharge, at least in part, to land. While actual recharge rates have not been quantified, it is expected that hatchery discharges to land will recharge the underlying aquifers to some degree. Fillmore Hatchery discharges, used as irrigation water, are conveyed through an irrigation ditch to an agricultural field. Mojave River Hatchery discharges up to 7.7 mgd to land and up to 9 mgd to the Mojave River.

Maximum permitted extraction rates for hatcheries that pump groundwater are listed in Table 3-7 and are compared with the storage capacities of the basins. It is important to note that the extraction rates listed are the maximum permitted rates, and it is rare that groundwater is actually pumped at the maximum rate. For the purposes of this analysis, it is conservatively assumed that the hatcheries pump at the maximum permitted rate. When compared with the storage capacity of the applicable groundwater basins, the amount of water extracted during 1 year is generally less than 0.5%. This assessment indicates that groundwater extractions for the operation of the Mad River Hatchery, Feather River Hatchery Thermalito Annex, Fillmore Hatchery, and Mojave River Hatchery would not substantially reduce the availability of groundwater supplies and thus would not adversely affect the water supply beneficial use of the water body associated with those hatcheries.

The Black Rock Rearing Ponds are situated in the Thibaut-Sawmill Wellfield which has historically undergone large pumping-induced fluctuations (Owens Valley Monitor 2008). Groundwater pumping from wells that supply the Black Rock Rearing Ponds, combined with pumping from other wells in the area, has caused the elimination of spring flow from Big and Little Black Rock Springs. At Big Black Rock Springs, much of the area of the former riparian vegetation that was supplied by the spring is now occupied by the Black Rock Rearing Ponds facility and a large pond. Prior to 1970 Little Black Rock Spring supported marsh vegetation which occupied a small area at the edges of a spring-fed ditch. In 1971–1972, flow from the spring ceased with the start of pumping from a nearby well for supply to the hatchery. These occurrences took place well before the 2004–2008 baseline period and there is no evidence that continued pumping at current levels is likely to have any incremental adverse impacts to the water supply beneficial uses of groundwater on a regional level. In addition, nearly all pumped groundwater used at the Black Rock Springs facility is discharged to the Los Angeles Aqueduct and consumptive use of the water is negligible with respect to water supply availability beneficial uses.

Aerial photos of the area around the Fish Springs Hatchery indicate that a small pond and associated wetland were present prior to the onset of groundwater pumping to supply the facility. By 1981 the pond and wetland dried up and disappeared. Though no documentation is known to exist it is likely that the pond was spring fed as no discernible source of a surface water supply is visible in the aerial photos. However, this occurred well before the 2004–2008 baseline period and there is no evidence that continued pumping at current levels is likely to have any incremental adverse impacts to the water supply beneficial uses of groundwater. Therefore, this impact is considered less than significant.

Table 3-7. Permitted Hatchery Extractions Compared with Groundwater Basin Storage

Hatchery	Groundwater Subbasin (California Department of Water Resources Subbasin Number)	Maximum Permitted Extraction (mgd/acre-feet per day)	Converted Maximum Allowable Extraction (acre-feet/year)	Estimated Storage Capacity of Subbasin (acre-feet)	Maximum Annual Extraction Percentage of Storage Capacity
Black Rock Rearing Ponds	Owens Valley (6-12)	18.7/57.4	20,951	30,000,000	0.14
Fish Springs Hatchery		17.1/52.5	20,272		
Fillmore Hatchery	Fillmore (4-4.05)	11.4/35.0	12,992	7,330,000	0.17
Feather River Hatchery Thermalito Annex	East Butte (5-21.59)	7.8/23.9	8,736	3,128,959	0.28
Mad River Hatchery	N/A	7.5/23	8,400	N/A	N/A
Mojave River Hatchery	Upper Mojave River Basin (6-42)	5.1/15.7	18,704	13,000,000	0.04

Notes:
Refer to Appendix D for full tables showing available data used for the screening process, and identifying hatcheries with and without data.
N/A = not applicable.
mgd = million gallons per day.

Effects of Hatchery Operations on Surface Water and Groundwater Quality

Available data for a total of 36 constituents were evaluated in the data screening process (see Appendix D). Constituents determined to occasionally be at concentrations that would exceed water quality standards or guidance values were carried forward for further assessment. Constituents determined to rarely, if ever, exceed a water quality standard or other relevant guidance value in the undiluted hatchery discharge water were considered to have negligible, if any, potential for adverse water quality impacts and, therefore, were not carried forward for further assessment.

Impact HYD-5: Water Quality Effects of Hatchery Discharges to Suspended Solids and Turbidity (Less than Significant)

Hatchery operations result in the accumulation of organic solids in fish rearing ponds, raceways, and settling ponds primarily from uneaten feed and feces from the cultured fish. Settled solids can be disturbed and re-suspended into the water column by high water flows, fish activity, and facility cleaning operations. The potential release of suspended solids to surface receiving water bodies is a concern to aquatic life if concentrations rise to a level that affects an organism's ability to sight-feed and obtain oxygen, or causes abrasion to tissues such as the gills of fish. Recreation and general aesthetic appeal of water bodies can be impaired by reduced water clarity, particularly those waters where background concentrations of TSS and turbidity are low, resulting in high water visibility. Suspended mineral-based sediment, if present at sufficient levels, may increase the rate of stream sedimentation allowing particles to deposit. Sedimentation can adversely affect fish spawning gravels and can block or clog agricultural/municipal water intake pipes.

TSS and turbidity are parameters that reflect the effects of particulate matter in the aquatic environment. Basin plan objectives for turbidity and TSS are not specific for the protection of any single beneficial use. In general, the most sensitive beneficial uses are the support of aquatic life and recreation. This assessment considered measured concentrations of turbidity and TSS in hatchery discharge water with respect to the basin plan objectives as follows.

- **TSS:** The applicable basin plans where the DFG hatcheries are located all contain a narrative water quality objective prescribing that suspended sediment load and suspended sediment discharge rate of surface waters not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. The NPDES permits for the hatcheries contain average monthly effluent limitations (AMELs) for net TSS (i.e., the incremental increases between the hatchery's source water and the discharge water) that range from 5 to 8 milligrams/liter (mg/L) (depending on the hatchery), and maximum daily effluent limitations (MDELs) for net TSS of 15 mg/L.
    - Hatchery discharge data for TSS were evaluated for exceedances of the NPDES permit effluent limitations, which reflect the RWQCB's interpretation of appropriate numerical concentrations that would achieve the applicable narrative TSS objectives in the basin plans.
    - For three hatcheries, where there is no influent TSS data, undiluted discharge water concentrations exceeding 5 mg/L were used as a trigger to include the hatchery in the water quality assessment for TSS.
- **Turbidity:** Hatchery discharge data for turbidity were evaluated for exceedances of the applicable basin plan turbidity objectives, which are based on an allowable increase in the receiving water turbidity level. The allowable increase is 20% in the North Coast basin plan and 10% in the Lahontan basin plan. The Central Valley basin plan has a three-tiered objective where the magnitude of the allowable increase changes with ambient background concentrations, with the lowest objective of <1 nephelometric turbidity unit (NTU) for background turbidity between 1 and 5 NTUs. However, the new amendment of the Central Valley basin plan was considered; it will allow receiving water to increase up to 2 NTUs when the receiving water is less than 1 NTU. The allowable increase is 1 NTU when the receiving water is between 1 and 5 NTUs. The basin plan amendment is undergoing final approvals by the EPA at this time.
    - Hatchery DMR data for the upstream receiving water site (R1) and downstream site (R2) were compared with the applicable objectives. In cases where R1/R2 data did not exist, hatcheries with discharge water data exceeding 2 NTUs were included in the assessment.

Table 3-8 summarizes the available hatchery DMR data for TSS and turbidity and identifies the magnitude and frequency of exceedances of the applicable objectives used for this assessment. Based on the available data from 19 hatcheries, there were twelve hatcheries with at least one exceedance of the net TSS AMEL permit limit, and a single exceedance of the MDEL at one hatchery. The datasets reviewed indicate that the rate of exceedance at ten of the twelve hatcheries is less than once per year, approximately once per year at the Mokelumne River Hatchery, and approximately twice per year at the Hot Creek Hatchery. The highest net TSS concentration was observed at the Mokelumne River hatchery. The hatchery discharge water at the Nimbus and American River Hatcheries is conveyed to a settling and percolation pond located on permeable floodplain cobbles and gravel adjacent to the American River channel, and the majority of flow infiltrates directly to the groundwater and rarely overflows with direct discharge to the river. Therefore, the direct discharge of TSS and turbidity from the Nimbus and American River Hatcheries is considered unlikely because the solids would be filtered from the discharge water as it percolates through the underlying floodplain sediments.

Table 3-8. Assessment of Total Suspended Solids and Turbidity Concentrations in Hatchery Discharges with Exceedances

Hatchery	Total Suspended Solids (TSS) Exceedances (net>5 mg/L)			Turbidity Exceedances (R2-R1>objective)	
	Maximum Net TSS (mg/L)[a]	Frequency[b]		Maximum Turbidity (NTU)[c]	Frequency[b]
Iron Gate Hatchery	5.0	1/57		1.6	1/10
Mokelumne River Hatchery	25.6	2/51		0.81	0/25
Nimbus Hatchery	17.2	2/77		1.85	2/44
Warm Springs Hatchery	8.6	2/75		1.8[d]	1/75[d]
Feather River Hatchery Thermalito Annex	5.1	1/54		0.5	0/54
Merced River Hatchery	10.7	1/39		3.2	2/39
American River Hatchery	**Same as Nimbus Hatchery**				
Darrah Springs Hatchery	5.4	1/55		0.8	0/15
Hot Creek Hatchery	10.4	13/120		-0.3	0/13
Black Rock Rearing Ponds	14.0	2/56		-	-
Mojave River Hatchery	6.2 [e]	6/72		-	-
Mount Shasta Hatchery	20.0	1/45		0.3	0/45

Notes:

Refer to Appendix D for full tables showing available data used for the screening process, and identifying hatcheries with and without data.

[a] Maximum observed net TSS value; screening value of 5 mg/L corresponds to typical average monthly effluent limitation in NPDES permits issued to the hatcheries.

[b] Frequency stated as (number of exceedances/total number of observations).

[c] Maximum observed difference (R2 minus R1).

[d] R2/R1 data not available; exceedance calculated based on: discharge water minus influent.

[e] Value shown measured in discharge only. TSS was not measured in source water.

mg/L = milligrams per liter.

NTU = nephelometric turbidity unit

- = no available data.

Based on hatchery DMR data for turbidity, there are three hatcheries with at least one set of R1/R2 samples exceeding a turbidity receiving water limitation, indicating a rate of exceedance of less than once per year. The turbidity exceedances occurred at hatcheries that also had exceedances of the net TSS objective; however, the exceedances did not necessarily occur on the same sample date as the TSS exceedances.

The NPDES permits, in some cases, require the hatchery to record visual observations such as discoloration, bottom deposits, visible films/sheens, or objectionable growth (i.e., fungi/slimes). Based on a review of the hatchery DMRs, 10 of the 19 hatcheries record the visual observations. While the specificity of the operator's notes vary substantially, the observations indicate that nuisance conditions and objectionable bottom deposits do not occur downstream of these hatcheries.

Undiluted hatchery discharges of TSS and turbidity would be expected to result in a zone of initial mixing in the receiving water where concentrations could be elevated compared with lower background stream-flow conditions. As the hatchery discharge water mixes with receiving water, the discharge TSS/turbidity becomes diluted. With respect to the R2 turbidity observations, it is uncertain whether the data reflect the fully mixed receiving water conditions. Downstream R2 sampling locations for NPDES permit compliance are typically located 50 to 300 feet downstream from the hatchery. The zone of complete mixing, particularly in large, wide rivers may be farther downstream than the R2 sampling location. Therefore, the turbidity exceedances may reflect mixing zone concentrations rather than the fully mixed receiving water concentration and additional dilution would occur as the hatchery discharge fully mixes with the receiving water. The hatcheries with observed turbidity exceedances all discharge to relatively large receiving water bodies that would be expected to provide dilution and assimilative capacity for the hatchery discharges. Therefore, in such cases where receiving water dilution flow is available, this assessment of R2/R1 values would be conservative.

For hatcheries on streams with substantial year-round water supplies, available receiving water flow and dilution in the receiving water is likely to provide sufficient assimilative capacity to further reduce in-stream TSS and turbidity concentrations upon full mixing. As shown in Table 3-8, the net increase in water TSS levels rarely exceeds 5 mg/L. Upon the hatchery water being discharged into and mixing with the receiving water, the maximum observed increase in turbidity at the R2 monitoring site, relative to the upstream R1 site was 1.9 NTUs, based on data available for this assessment. Consequently, exceedances of basin plan turbidity objectives due to hatchery discharges are rare.

DFG has conducted studies at the Hot Creek hatchery for the RWQCB to investigate benthic macroinvertebrate (BMI) conditions in the receiving water (Hot Creek) downstream of hatchery discharges. The most recent study (Jellison et al. 2007) found that BMI community indices are of lower quality downstream of the hatchery and may be secondarily related to the increased TSS concentrations in hatchery discharges from settling ponds (see discussion of nutrients below). DFG is coordinating with RWQCB staff to implement facility improvements and changes in hatchery settling pond operations (settling pond flow routing in series versus parallel), and to remove solids from the settling ponds in an effort to reduce the observed in-stream effects.

Based on the assessment of available data, there is a relatively low frequency of potential exceedances of TSS and turbidity objectives in the hatchery discharges and receiving water bodies. Because the hatchery facilities are largely concrete (rather than earthen), and settling ponds remove any heavy mineral sediment, the solids discharged from the hatchery settling ponds are expected to be largely composed of degradable organic matter (i.e., fish wastes, uneaten/undigested feed, and feces). The hatchery settling ponds are specifically for the purpose of removing suspended particulate matter, and thus complying with the NPDES permits, which in part are based on the EPA's effluent guidelines for TSS discharges from hatcheries. The EPA found that feed is the only major source of solids in flow-through hatchery systems and that optimization of feed management through the use of high-quality feeds to minimize feed waste can reduce the solids generated and released to the environment (U.S. Environmental Protection Agency 2004).

The magnitude of typical increases in TSS and turbidity concentrations in hatchery discharges, and related effects on receiving waters upon complete mixing downstream of the discharges, would be small and would typically comply with applicable permit limits and water quality standards. The turbidity exceedances are only slightly higher than the lowest objective of >1 NTU change. In the Central Valley RWQCB's staff report for the turbidity basin plan amendment, it was concluded that at low turbidities, the visual and aesthetic quality of water differs negligibly and turbidity discharges need not be limited to <1 NTU for the protection of recreation beneficial uses (Central Valley Regional Water Quality Control Board 2007). The association of TSS levels with degraded BMI habitat conditions downstream of the Hot Creek Hatchery discharges appears to be an isolated condition and not apparent at other hatcheries. Based on the NPDES compliance data, there is no demonstrated pattern of frequent exceedances of the turbidity objectives or excessive discharges of TSS. Additionally, pursuant to the NPDES permits, the hatchery operators are required to make visual observations of in-stream nuisance conditions such as scum formation and bottom deposits. Based on the operator logs of visual observations, the data do not indicate the presence of nuisance conditions. It appears that the sedimentation in Hot Creek is localized to a zone of initial mixing downstream from the hatchery (Jellison et al. 2007) and does not cause sedimentation that would adversely affect beneficial uses such as agriculture or municipal supply.

Because the frequency and magnitude of exceedances of turbidity and TSS objectives at all hatcheries are low, because the TSS discharges are organic and degradable in the aquatic environment; and because the effects of the discharges are largely localized to initial mixing zones within the receiving waters, this assessment indicates that hatchery discharges do not cause violation of applicable water quality objectives (outside the zone of initial mixing) or degrade water quality regarding these parameters by frequency or magnitude that would adversely affect sensitive beneficial uses such as recreation or water supply. Therefore, there also would be no substantial adverse effects on any other designated beneficial uses that are less sensitive, or insensitive, to turbidity and TSS concentrations. Therefore, the potential effects of TSS and turbidity in the hatchery discharges on receiving water quality and beneficial uses (other than the aquatic life beneficial use) are less than significant.

Refer to Chapter 4, "Biological Resources," for the impact determination for the effects of turbidity and TSS on fisheries and aquatic resources (i.e., impacts on aquatic life beneficial uses.)

Impact HYD-6: Water Quality Effects of Hatchery Discharges to pH, Dissolved Oxygen, and Salinity (Less than Significant)

The parameters pH, DO, and salinity represent physical and chemical properties of water. Fish hatchery operations can affect pH, DO, and salinity through the use of chemicals, changes in flow velocity and temperature, introduction of fish wastes, and metabolic processes, and as a result of biological growth (e.g., algae and bacteria) in the hatchery and settling ponds. In natural waters, photosynthesis by algae and aquatic plants, and the respiration of plants, animals, and bacteria influence pH levels throughout a given day. The pH of surface waters is important to aquatic life because pH affects the ability of fish and other aquatic organisms to regulate basic life-sustaining processes, primarily the exchanges of respiratory gases and salts within the water in which they live. Hatchery feed and fish wastes contribute biochemical oxygen demand (BOD) to the hatchery water, which can reduce DO in the water column. Respiration of the fish in the hatchery also depletes oxygen, and hatcheries closely manage DO levels for the fish via flow control, passive aeration devices, or mechanical aeration. The organic solids residing in settling ponds also may exert oxygen demand.

Salinity is an important constituent for drinking water supplies, with higher salinity adversely affecting consumer acceptance by imparting undesirable tastes. Salinity also is a concern for agricultural irrigation if concentrations are elevated relative to the tolerance thresholds for plant growth and harvest yields in salt-sensitive crops. Salinity refers to the combined total concentrations of numerous inorganic constituents, with the majority of salinity typically provided by anions (sulfate, chloride, fluoride, and nitrate), cations (calcium, magnesium, sodium, and potassium), and bicarbonate/carbonate.

This assessment considered measured concentrations of pH, DO, and EC in hatchery discharge water with respect to the basin plan objectives, and other available guidance values, as follows.

- **pH:** Support of aquatic life is the most sensitive beneficial use with respect to pH and changes in pH (McKee and Wolf 1963; National Academy of Sciences 1972). The basin plans contain specific numeric water quality objectives for the protection of the most sensitive uses. Hatchery discharge pH data were evaluated for exceedances of the applicable basin plan objectives, which state that discharges shall not cause the receiving water pH to be reduced to less than pH 6.5 or increased above pH 8.5. The new Central Valley basin plan amendment for pH was considered; it eliminates the provision that restricts the allowable pH change to 0.5 unit if the receiving water pH is between 6.5 and 8.5 for the protection of aquatic life. The elimination of this latter provision (i.e., the 0.5-unit change provision) makes the pH objectives more consistent with the U.S. EPA *National Recommended Water Quality Criteria* (U.S. Environmental Protection Agency 2006).
    - Hatchery DMR data for R1 and R2 locations were compared with the applicable pH objectives. In cases where R1/R2 data did not exist, hatcheries with discharge water data <6.5 or >8.5 were included in the assessment.
- **DO:** Support of aquatic life is the most sensitive beneficial use with respect to DO concentrations (McKee and Wolf 1963; National Academy of Sciences 1972). Hatchery discharge DO data were evaluated for exceedances of the most stringent basin plan objective, which state that discharges shall not cause the receiving water DO to fall below 7.0 mg/L.
    - R1 and R2 receiving water data were compared to the applicable objectives. In cases where R1/R2 data did not exist, hatcheries with discharge water DO concentrations <7.0 mg/L were included in the assessment.
- **Salinity:** Agricultural irrigation water supply is the most sensitive beneficial use to changes in salinity. TDS and EC are measures of salinity that are regulated under the basin plans through narrative and specific numerical objectives. The state's secondary drinking water maximum contaminant level (MCL) for consumer acceptance for EC is a range of values with a lower goal of 900 microsiemens per centimeter (μS/cm) EC, corresponding to a TDS value of 500 mg/L, and

an upper value, 1,600 µS/cm EC (1,000 mg/L TDS). The upper value is considered acceptable for municipal supplies when it is neither reasonable nor feasible to provide more suitable waters. The long-term agricultural water quality goal of 700 micromhos per centimeter (µmhos/cm) EC (450 mg/L TDS) developed by the World Health Organization (Ayers and Westcot 1985) is often used by the Central Valley RWQCB to implement the basin plan's narrative chemical constituent objective, which is designed to prevent discharges from adversely affecting agricultural beneficial uses.

- Undiluted hatchery discharge EC/TDS data were evaluated for exceedances of the lowest agricultural EC goal of 700 µmhos/cm, and the secondary drinking water MCL of 900 µS/cm. Additionally, lower site-specific basin plan EC/TDS objectives identified in the NPDES permits of hatcheries also were considered in the assessment of salinity (i.e., Feather River, Nimbus, American River, San Joaquin River, and Hot Creek Hatcheries).
- Undiluted hatchery discharge data for chloride were evaluated for exceedances of the agricultural goal of 106 mg/L used by the Central Valley RWQCB to interpret the narrative chemical water quality objective for protection of agricultural beneficial uses.

Table 3-9 summarizes the maximum hatchery discharge concentrations and exceedances of regulatory objectives and guidance values used for this assessment. Based on hatchery DMR data, there are four hatcheries with one occurrence each of pH levels at the downstream R2 monitoring site that exceed the <6.5 or >8.5 objective for incremental change. The increment of change was less than 0.5 in all cases where downstream R2 monitoring data was available.

Based on the hatchery DMR data, there are eight hatcheries with at least one occurrence of DO that decreased between the R1 and R2 monitoring sites, which resulted in R2 concentrations below the most stringent basin plan objective of 7.0 mg/L. Four exceedances of the DO objective occurred at the San Joaquin River Hatchery over the course of 28 months, indicating a frequency of about two events per year. DO levels in the Mojave River Hatchery discharge were consistently below 7.0 mg/L. Additionally, the DO was less than the minimum instantaneous Lahontan basin plan specific objective of 4.0 mg/L for a designated Cold Freshwater Habitat (COLD) beneficial use stream on two dates in the 27 monthly sample values. Information in the NPDES permit for the Mojave River Hatchery indicates that the groundwater supply used at the facility naturally has low DO and must be aerated.

Table 3-9. Assessment of pH and Dissolved Oxygen Concentrations in Hatchery Discharges with Exceedances

Hatchery	pH Exceedances (<6.5 or >8.5)			Dissolved Oxygen (DO) Exceedances (<7.0 mg/L)	
	Maximum pH (std.)[a]	Frequency[b]		Minimum DO (mg/L)[a]	Frequency[b]
Salmon/Steelhead Hatcheries					
Feather River Hatchery Thermalito Annex	8.7 (+0.1)	2/28		–	–
Iron Gate Hatchery	–	–		6.3 (-1.3)	2/9
Mokelumne River Hatchery	–	–		6.7 (-2.7)[c]	1/50
Merced River Hatchery	6.5 (+0.1)	2/39		-	-
Nimbus Hatchery	–	–		5.2 (-1.2)	1/43
Trout Hatcheries					
American River Hatchery	**Same as Nimbus Hatchery**				
Black Rock Rearing Ponds	–	–		4.2 (-0.5)[d]	1/20
Crystal Lake Hatchery	–	–		5.9 (-0.3)	2/55
Darrah Springs Hatchery	–	–		7.0[e]	1/55
Moccasin Creek Hatchery	6.3 (-0.2)	1/60		–	–
Mojave River Hatchery	9.0	1/72		3.3[c]	10/27[c]
San Joaquin Hatchery	–	–		6.4 (-2.1)	4/28

Notes:

Refer to Appendix D for full tables showing available data used for the screening process, and identifying hatcheries with and without data.

pH (std) = standard pH units.

[a] Maximum observed difference (R2 minus R1).

[b] Frequency stated as (number of exceedances/total number of observations)

[c] R1 and influent data not available; potential exceedance based on discharge water concentration.

[d] Discharge water DO was higher than the R2 values on the date of exceedance.

[e] Data collected at only one receiving water locationmg/L = milligrams per liter.

– = No exceedances observed.

Based on available DMR data for undiluted hatchery discharges, EC and TDS concentrations do not exceed the applicable agricultural EC goal or secondary drinking water MCLs. However, information in the NPDES permits for the Feather River Hatchery and the Feather River Hatchery Thermalito Annex indicate that chloride in the undiluted hatchery discharges may exceed the 106 mg/L chloride agricultural goal. The stated maximum hatchery discharge concentration is 373 mg/L for both hatcheries, and a review of the DMR data for the Thermalito Annex hatchery identified 11 of 21 monthly samples exceeding the 106 mg/L objective (concentrations at the Feather River Hatchery were all less than 106 mg/L in the 2004–2008 DMR data that were reviewed).

Elevated chloride levels are associated with the use of salt for hatchery water treatment. Hatchery discharges would be expected to result in a zone of initial mixing in the receiving water where chloride concentrations could be elevated compared with lower background stream-flow conditions but would further decrease as the discharge became increasingly mixed and diluted with receiving water. The worst-case incremental chloride increase caused by the hatchery discharges can be represented by the combined design hatchery discharge flow rates of the two hatcheries, maximum hatchery chloride concentration, and minimum receiving water flow with assumed non-detectable chloride levels. Based on U.S. Geological Survey (USGS) gauge data, the 90% exceedance flow of the Feather River is 988 cfs downstream of the two hatcheries, which includes the hatchery discharges (U.S. Geological Survey 2005). Based on the design maximum hatchery discharge of 55.1 mgd (about 85 cfs), the minimum dilution available in the Feather River is about 11:1. This worst-case scenario would result in a maximum incremental increase in receiving water chloride of 32 mg/L. Water quality data collected for the Oroville Facilities Relicensing program (California Department of Water Resources 2004) support this analysis of chloride. The DWR's data indicated maximum chloride concentrations in the Feather River upstream of the hatchery of 1 mg/L in a total of 29 samples collected during the period of September 2002–January 2004, 132 mg/L in the hatchery settling pond, 22 mg/L immediately downstream of the hatchery, and 2 mg/L about 2 miles downstream of the hatchery.

The assessment indicates that the frequency of potential pH, DO, and salinity (i.e., only chloride) exceedances is low among the 19 hatcheries with available data and also relatively low within the hatcheries having exceedances. Based on the available dilution in the receiving water where the hatchery discharges occur, there is sufficient assimilative capacity for these parameters such that the magnitude of potential exceedances in downstream receiving water concentration, upon full mixing, are expected to be minimal, if any such exceedances occur at all. With respect to DO and pH, aeration and natural equilibration processes as the hatchery discharges mix with receiving water downstream would attenuate the DO and pH changes, and receiving water would not be expected to exceed objectives in the fully mixed stream flow. A possible exception may be the Mojave River Hatchery. The assessment indicates that the Mojave River Hatchery discharges could result in DO concentrations below the lowest applicable objectives for aquatic life protection. However, other beneficial uses, such as water supply, groundwater recharge, recreation, and wildlife, are not identified as being sensitive to DO concentrations (McKee and Wolf 1963).

With respect to chloride contributed from the use of salt at hatcheries, the data indicate that salt use does not substantially increase salinity in the discharge water for the majority of the hatcheries. There is sufficient dilution and assimilative capacity for the Feather River Hatchery discharges such that receiving water concentrations would only exceed the agricultural goal in a small zone of immediate mixing in the receiving water. Beyond the zone of initial mixing, the hatchery discharge would not cause the receiving water to exceed the agricultural goal of 700 µS/cm or the 106 mg/L chloride goal.

Because the frequency and magnitude of exceedances of pH and DO objectives are low, and because receiving water degradation with regard to pH and DO is small, particularly beyond the zone of initial mixing, the minor pH and DO effects of hatchery discharges would not adversely affect any non-aquatic life beneficial uses. Furthermore, the hatchery discharges are low in salinity parameters and would not cause substantial adverse effects to any beneficial uses due to changes in salinity. Therefore, the effects of hatchery discharges on receiving water pH, DO, and salinity would not adversely affect any non-aquatic life beneficial uses of the receiving water. Therefore, this impact is considered less than significant.

Refer to Chapter 4, "Biological Resources," for the impact determination for the effects of pH, DO, and salinity on fisheries and aquatic resources (i.e., on aquatic life beneficial uses).

Impact HYD-7: Water Quality Effects of Hatchery Discharges on Nutrient Biostimulation in Receiving Waters (Less than Significant)

Nutrients refer to the group of constituents primarily responsible for organic enrichment, or eutrophication, of the aquatic ecosystem through growth and production in the lowest trophic levels of the food chain, in particular through biostimulation of the primary producers (i.e., algae and aquatic vascular plants). Nitrogen (N) and phosphorus (P) are key nutrients that control aquatic plant and algae growth; however micronutrients, including silicon and potassium, are also important to primary production. Eutrophication of surface waters can cause nuisance algae blooms and aquatic plant growth, and related DO depletion, plant decay odors, and reduced water clarity. These undesirable conditions can affect aquatic life, recreational and aesthetic beneficial uses, and water supply uses. In addition to biostimulation, nitrate levels in water exceeding 10 mg/L N can adversely affect drinking water by potentially causing methemoglobinemia (i.e., "blue baby" syndrome) in infants. Additionally, the unionized form of dissolved ammonia nitrogen (NH_3) is extremely toxic to aquatic organisms at low concentrations.

Natural sources of nutrients include eroded soil particles, aerial deposition (i.e., dust and ash), wild animal feces, and detrital plant matter. Human sources include wastewater, fertilizers, urban stormwater runoff, domestic animal wastes, and soil erosion. Nutrients are contributed to hatchery water primarily from uneaten commercial pelletized feed distributed to the cultured fish and from fish feces that are deposited in the hatchery channels. Dissolved and total nutrients may then be discharged to hatchery settling ponds or directly discharged to the receiving water. The EPA found that feed is the only major source of nutrients, such as nitrogen and phosphorus, in flow-through hatchery systems (U.S. Environmental Protection Agency 2004). The EPA found that the use of high quality feeds and minimizing feed waste can reduce the nutrients generated and released to the environment.

This assessment considered measured nutrient concentrations in hatchery discharge water, and visual observations for biostimulation, with respect to available basin plan objectives and guidance values. Aquatic organisms are the most sensitive beneficial uses to changes in nutrient concentrations (McKee and Wolf 1963; National Academy of Sciences 1972) and levels causing problem eutrophication vary greatly across water bodies. All basin plans contain a narrative objective for biostimulation that specifies receiving waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect the water for beneficial uses. No applicable numeric criteria for nitrogen or phosphorus compounds have been adopted by any RWQCB for region-wide application for the specific purpose of controlling biostimulatory effects. However, an exception for one hatchery location is the Lahontan RWQCB basin plan which contains specific receiving water quality objectives for nutrients in Hot Creek, as follows:

- Hot Creek below the Hot Creek Hatchery: annual average/90th percentile objectives specified as 0.2/0.4 mg/L N (nitrate); 0.3/1.5 mg/L N total nitrogen; and, 0.65/1.22 mg/L P (orthophosphate).

The California primary drinking water MCL for nitrate is 10 mg/L N, and the Lahontan basin plan contains a specific nitrate objective of 5 mg/L N for the West Fork Mojave River, which is applicable for the Mojave River Hatchery. Ammonia is a nutrient; however, the lowest applicable guidance concentrations are the pH- and temperature-dependent EPA *National Recommended Water Quality Criteria* for aquatic life protection from the toxic effects of unionized ammonia.

Undiluted hatchery discharge data were evaluated for exceedances of the drinking water MCL, or site-specific nutrient objectives, as appropriate for each hatchery. Available hatchery DMR data also were reviewed for visual observations of the receiving water that demonstrate the level of biostimulatory responses resulting from the hatchery water discharges. Table 3-10 summarizes the nutrient concentrations for the six hatcheries where there were available nitrogen and phosphorus data.

Table 3-10. Nutrient Concentrations in Hatchery Discharges

	Iron Gate	Feather River[a]	Hot Creek[b]	Fish Springs[b]	Black Rock Rearing Ponds[b]	Mojave River[b]	Mt. Whitney
Nitrate (mg/L)							
n	–	29	54	28	34	15	34
Maximum hatchery discharge	–	0.3	0.81 (0.69)	0.85 (0.91)	0.34 (0.41)	5.2 (4.4)	0.89
Minimum hatchery discharge	–	0.02	0.14	0.01	0.015	3.6	0.008
Maximum source water	–	0.2	1.2	0.90	–	–	–
Minimum source water	–	0.01	0.21	<0.01	–	–	–
Maximum receiving water (R2)	–	–	0.25	1.4	–	–	–
Total Nitrogen (mg/L)							
n	19	2	27	28	22	15	20
Maximum hatchery discharge	2.06	0.53	1.19 (1.76)	1.21 (1.47)	0.81 (0.93)	5.6 (3.5)	0.78
Minimum hatchery discharge	–	–	<0.25	0.28	0.07	<1.7	<0.25
Maximum source water	–	0.16	0.46	0.29	–	–	–
Minimum source water	–	–	<0.24	–	–	–	–
Maximum receiving water (R2)	–	1.41	0.53	0.66	–	–	–
Orthophosphate (mg/L)							
n	–	25	51	28	32	12	34
Maximum hatchery discharge	–	0.12	0.28 (0.32)	0.21 (0.21)	0.098 (0.086)	0.59 (0.35)	0.067
Minimum hatchery discharge	–	<0.01	0.15	0.09	0.014	0.21	<0.01

	Iron Gate	Feather River[a]	Hot Creek[b]	Fish Springs[b]	Black Rock Rearing Ponds[b]	Mojave River[b]	Mt. Whitney
Maximum source water	–	0.11	0.27	0.19	–	–	–
Minimum source water	–	<0.01	0.14	0.078	–	–	–
Maximum receiving water (R2)	–	–	0.23	0.213	–	–	–
Total Phosphorus (mg/L)							
n	19	28	–	–	–	–	–
Maximum hatchery discharge	0.25	0.18	–	–	–	–	–
Minimum hatchery discharge	–	0.02	–	–	–	–	–
Maximum source water	–	0.11	–	–	–	–	–
Minimum source water	–	<0.01	–	–	–	–	–

Notes:
Refer to Appendix D for full tables showing available data used for the screening process, and identifying hatcheries with and without data.
n = number of sample values.
R2 = receiving water downstream of hatchery discharge location.
– = no available data.
ND = Not Detected
[a] Data include one (1) DMR sample value and monthly data collected for the DWR's Oroville Relicensing for December 2002 through January 2004 (California Department of Water Resources 2004).
[b] Maximum hatchery values and "n" sample numbers based on DMR data; values in parentheses are historical maximum concentrations reported in the NPDES permit for February 2000 through June 2004.

Based on available DMR data reviewed for the Hot Creek Hatchery, the maximum nitrate (0.81 mg/L N) and total nitrogen (1.76 mg/L N) concentrations in undiluted hatchery discharges from settling ponds have the potential to exceed the basin plan–specific annual average nitrate (0.2 mg/L N) and total nitrogen (0.3 mg/L N) water quality objectives applicable to Hot Creek. However, the geothermal springs that are the source water supply for the hatchery and Hot Creek are also high and often represent the majority of the concentrations present in the hatchery discharges. Nitrate is often higher in the springs than in hatchery discharges, and the incremental increases in nitrogen associated with the hatchery are primarily in the form of total nitrogen. Therefore, a majority of the nutrients would flow downstream of the hatchery via Hot Creek whether the hatchery was present or not. The hatchery discharges have exceeded the instantaneous maximum nitrate (0.4 mg/L N) and total nitrogen (1.5 mg/L N) objectives infrequently. A single hatchery discharge sample from the Mojave River Hatchery exceeded the basin plan site-specific nitrate objective of 5.0 mg/L N, indicating a low potential to exceed this objective. Based on the maximum nitrate concentrations in hatchery discharges, which have ranged from 0.3 to 5.2 mg/L N, there is no potential for the discharges to cause exceedance of the primary drinking water nitrate MCL of 10 mg/L N in the receiving waters.

Limited DMR data for ammonia in four hatchery water samples from the San Joaquin Hatchery indicate concentrations ranging from 0.1 to 0.4 mg/L N. The DWR's monitoring of the Feather River Hatchery during December 2002–January 2004 indicated ammonia ranging from <0.08 to 0.11 mg/L N in the hatchery influent and <0.02 to 0.4 mg/L N in the hatchery settling pond water. Based on the maximum temperature and pH values recorded for these hatcheries' discharges at any time in the year, the ammonia values would not exceed the lowest EPA-recommended chronic aquatic life criteria.

Available phosphorus data (i.e., orthophosphate and total phosphorus) are more limited than nitrogen data. Comparison of nitrogen and phosphorus concentrations in hatchery discharge water to source water concentrations for the Feather River and Hot Creek Hatcheries indicates that orthophosphate concentrations increase to a lesser degree than nitrate and total nitrogen. Maximum orthophosphate and nitrate concentrations are similar in the source water and hatchery water, whereas the maximum hatchery total nitrogen concentrations are up to 2.6 times higher than source water concentrations. The orthophosphate concentrations in both the hatchery discharges and source water are lower than the basin plan objectives applicable to Hot Creek. Moreover, phosphate in Hot Creek spring water is present at sufficient concentrations such that aquatic algae growth is not limited by changes in phosphate concentrations (Jellison et al. 2007). Additionally, the DMR data for the Hot Creek hatchery indicates that the majority of orthophosphate in hatchery discharge water (i.e., greater than 75%) is contributed by the naturally elevated phosphate concentrations in the Hot Creek spring source water supply.

Based on a review of the DMR data for the 10 hatcheries that record visual observations of potential nuisance growth conditions in the receiving water, the hatcheries typically do not appear to cause nuisance biostimulatory responses such as discoloration, bottom deposits, visible films/sheens, or objectionable growth (i.e., fungi/slimes). DFG has documented the effects of the Hot Creek Hatchery discharges on receiving water indicating that benthic algae growth is greater downstream of the hatchery compared to upstream conditions. The biological productivity is believed to be primarily related to the increased nutrient concentrations in hatchery discharges from settling ponds (Jellison et al. 2007). The DMR data suggest that the nutrients contained in the geothermal springs that form Hot Creek (which are the source water for the hatchery) often are at higher concentrations than the hatchery discharge, and thus are a natural source contributing to the receiving water nutrient concentrations. As noted above (see Impact HYD-5), DFG is coordinating with RWQCB staff to implement facility improvements in an effort to reduce the observed in-stream effects.

The assessment of nutrients indicates that hatchery discharges do not have the potential to exceed the nitrate drinking water MCL. With respect to the potential for hatchery discharges to cause biostimulatory conditions in the receiving waters, the available DMR data reviewed indicate that undiluted hatchery discharges could result in increased nutrient concentrations within a zone of initial mixing in the receiving waters. However, the DMR data also indicate that nutrient conditions of hatchery water often differs little from that of the hatchery source water. Based on the available dilution in the receiving water where the hatchery discharges occur, the potential increases in downstream receiving water nutrient concentrations upon full mixing are expected to be small. Moreover, the hatchery records of visual observations of receiving water conditions indicate a low potential for biostimulation to occur to a level that would cause substantial adverse effects on beneficial uses.

This assessment indicates that elevated nutrient concentrations are not always present in hatchery discharges or are typically only moderately elevated. Because nutrients would be diluted within the initial zone of mixing and farther downstream, and because nutrients are assimilated and degraded by biota in the receiving waters, the hatchery discharges are not expected to cause substantial adverse biostimulation effects in the receiving water. Visual observations by hatchery managers indicate that nuisance effects of biostimulation do not occur in the receiving waters as a result of the hatchery discharges. Additionally, the Lahontan RWQCB and DFG are aware of the biostimulation conditions in Hot Creek downstream of the Hot Creek Hatchery and are conducting studies and developing response actions to address the potential contributions of nutrients from the hatchery discharges. Because numeric water quality criteria/objectives do not exist for nutrients, and the narrative objective with regard to excessive biostimulation is not exceeded due to hatchery discharges beyond the zone of initial mixing, and because degradation of water quality with regard to nutrients would not be of a frequency or magnitude that it would cause adverse effects on non-aquatic life beneficial uses of the receiving waters, this impact is considered less than significant.

Refer to Chapter 3, "Biological Resources," for the impact determination for the effects of nutrients on fisheries and aquatic resources (i.e., to aquatic life beneficial uses.)

Impact HYD-8: Water Quality Effects of Hatchery Discharges Containing Aquaculture Treatment Chemicals and Drugs (Less than Significant)

As described above (see "Environmental Setting" and Table 3-6), DFG hatchery managers periodically use water treatment chemicals, drugs, and vaccines to treat specific parasite or disease conditions of the cultured fish or prevent the formation of detrimental fungal or bacterial conditions. The use of treatment chemicals and drugs at hatcheries has the potential to adversely affect the quality of receiving waters and beneficial uses if the concentrations exceed drinking water standards or otherwise degrade the quality of drinking water supplies, or adversely affect aquatic biota such that indirect effects occur on aesthetic appeal or recreational opportunities. This assessment addresses two categories of chemical use and potential exposure to hatchery chemicals and drugs in the aquatic environment.

- The first category of chemical use consists of treatments via immersion bath, or flushing the entire volume of water through one or more components of hatchery facilities, with the following compounds: acetic acid, copper sulfate (pentahydrate), formalin (formaldehyde), PVP iodine, potassium permanganate($KMnO_4$), hydrogen peroxide, and Chloramine-T. The duration of water treatments for this class of chemicals may be up to several hours as chemicals and water fully circulate through the hatchery.
- The second category of chemical use consists of aquaculture drugs, anesthetics, or vaccines that are used infrequently compared with the water treatment chemicals identified above and are typically applied in small water volumes or in fish feed. Compounds used most frequently include oxytetracycline, florfenicol, penicillin G, Romet-30, and anesthetics (MS-222). The durations of drug and anesthetic treatments dispensed into hatchery water are much shorter than treatment chemicals described above and typically on the order of minutes, or up to 1 hour long.

With the exception of the trace metal copper in copper sulfate products, there are no numerical regulatory criteria (i.e., CTR criteria or basin plan objectives) or EPA-recommended criteria for the treatment chemicals that are periodically used at the hatcheries. However, all of the basin plans for California contain a narrative objective for toxicity that specifies that all waters will be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life. This assessment relies on guidance aquatic toxicity values developed by DFG's Pesticide Unit, referenced in the Lahontan and Central Valley RWQCB NPDES permits (Lahontan Regional Water Quality Control Board 2006, Central Valley Regional Water Quality Control Board 2008), and a recent toxicity assessment prepared by DFG's Pesticide Investigations Unit (California Department of Fish and Game 2007). DFG developed the toxicity concentrations using short-term acute test methods (i.e., lethality end point) and chronic test methods (i.e., growth and reproduction end points), which then were used by the RWQCB for derivation of the NPDES permit effluent limitations as the appropriate numerical concentrations considered protective of the applicable narrative toxicity objective. Drinking water criteria, including the California Department of Public Health (DPH) MCL and action levels, also are considered in this analysis. Table 3-11 shows the guidance concentration values and drinking water criteria relied upon for this assessment.

For the majority of the treatment chemicals and drugs used at the hatcheries, the lowest guidance concentration values identified by the RWQCBs in the NPDES permits are for the protection of aquatic life. Thus, aquatic life is considered the most sensitive environmental resource to discharges of these compounds in the aquatic environment.

Table 3-11. Treatment Doses, Guidance Concentration Values, and Measured Hatchery Discharge Concentrations of Treatment Chemicals and Drugs

Chemical	Treatment Dose [a]	Guidance Concentrations		Hatchery Discharge Concentrations
		Aquatic Toxicity	Drinking Water	
Acetic acid	335–2,000 mg/L	–	97 µg/L [2]	–
Chloramine-T	10 mg/L	1.8 mg/L [3] 2.8 mg/L [4] 86.3 mg/L [5]	–	–
Copper sulfate	240 µg/L Cu	7.9 µg/L [6]	1,000 µg/L [7] 1,300 µg/L [8]	1–122 µg/L Cu (n=36) [a]
Formalin (37% formaldehyde solution)	25–2,000 mg/L	1.3 mg/L [9]	0.1 mg/L [10] 1.4 mg/L [11]	<0.005 mg/L (n=1) [b] ND (n=3) [c] 1.4/0.55 (n=1) [d]
Hydrogen peroxide	100 mg/L	1.3 mg/L [5]	–	0.3–37 mg/L (n=5) [a] 2.6-3.6 mg/L (n=2) [e] 0.2–0.8 mg/L (n=5) [f] 0.0 mg/L (n=1) [g] 3 mg/L (n=2) [h]
MS-222/tricane methane sulfonate	50–250 mg/L	70 mg/L [12]	–	0.01 – 0.29 mg/L (n=3) [b]
Oxytetracycline HCL (Terramycin)	100 mg/L	40.4 mg/L [5]	–	–
Potassium permanganate	2–3.48 mg/L	0.038 mg/L [13] 0.20 mg/L [12] 0.25 mg/L [5]	–	0.1 – 5.0 mg/L (n=6) [a] 0.03 – 0.06 mg/L (n=25) [e] 0.06 – 3.6 mg/L (n=7) [f] 0.004 – 0.084 mg/L (n=7) [g]

PVP iodine	100 mg/L	0.86 mg/L [5]	–	0.00 mg/L (n=8) [g] ND (n=5) [c] ND (n=4) [i]

Notes:

– = No data available.

[1] Refer to Table 3-6 for typical doses of treatment chemicals.

[2] Taste and odor threshold (Central Valley Regional Water Quality Control Board 2008).

[3] 48-hour acute toxicity No Adverse Effect Level (NOEL) for *Daphnia magna* (Lahontan Regional Water Quality Control Board 2006).

[4] 96-hour median lethal concentration (LC50; concentration where over 50% of the test organisms die) for rainbow trout (Lahontan Regional Water Quality Control Board 2006).

[5] 96-hour acute NOEL for *Ceriodaphnia dubia* (Lahontan Regional Water Quality Control Board 2006).

[6] Hardness-dependent chronic California Toxics Rule (CTR) dissolved copper criteria used for derivation of the NPDES permit limitations; based on hardness of 75 mg/L as calcium carbonate ($CaCO_3$).

[7] California Department of Public Health (DPH) secondary drinking water maximum contaminant level (MCL).

[8] CTR human health criterion for consumption of water and organisms.

[9] 7-day chronic toxicity No Adverse Effect Concentration (NOEC) for *Ceriodaphnia dubia* (Lahontan Regional Water Quality Control Board 2006).

[10] California DPH Drinking Water Action Level.

[11] EPA Integrated Risk Information System (IRIS) dose as a drinking water level.

[12] 96-hour acute NOEC for *Ceriodaphnia dubia* (California Department of Fish and Game 2007).

[13] 96-hour acute NOEL for *Ceriodaphnia dubia* (Central Valley Regional Water Quality Control Board 2008).

[a] Discharger monitoring report (DMR) data specified as range of concentrations (number of data values).

[b] DMR data for Hot Creek Hatchery specified as range of concentrations (number of data values).

[c] DMR data for Mount Shasta Hatchery specified non-detect (ND) (reporting limit not provided) (number of data records).

[d] NPDES permit fact sheet for Nimbus and American River Hatcheries specified as "discharge water/receiving water 100 feet dowstream of settling pond" (number of data values).

[e] DMR data for Crystal Lake Hatchery specified as range of concentrations (number of data values).

[f] DMR data for Nimbus and American River Hatcheries specified as range of concentrations (number of data values).

[g] DMR data for Mokelumne River Hatchery specified as range of concentrations (number of data values).

[h] DMR data for Moccasin Creek Hatchery specified as range of concentrations (number of data values).

[i] DMR data for Iron Gate Hatchery specified ND (reporting limit not provided) (number of data records).

Based on a review of the NPDES DMR monitoring data, quantitative information regarding the concentrations of treatment chemicals and drugs in undiluted hatchery discharge water is limited. Moreover, these compounds have not generally been monitored in the receiving water. Table 3-11 summarizes measured hatchery discharge concentration data for eight hatcheries where there were available data. The target treatment doses for the majority of the treatment chemicals and drugs have the potential to result in concentrations in undiluted hatchery discharges that would exceed DFG's aquatic toxicity guidance values, and target doses of acetic acid and formaldehyde also exceed guidance values for drinking water protection. An exception is copper sulfate, where the target treatment dose does not exceed the regulatory objectives for drinking water.

Within the available DMR data, concentrations of copper, hydrogen peroxide, and potassium permanganate have been monitored with the greatest frequency. Sample concentrations have exceeded the lowest DFG guidance toxicity values at least once at the majority of the hatcheries that collect data for these constituents.

Based on the frequency and duration of treatment applications at the hatcheries, expected rate of dilution and degradation in the environment, and reported hatchery discharge concentrations, a number of chemical compounds are considered to pose a low risk of adversely affecting water quality and beneficial uses. The following information supports further assessment of these compounds.

- The use of copper sulfate products has been discontinued at all DFG hatcheries. Based on the maximum measured copper concentrations in undiluted hatchery discharge water, the use of copper sulfate has the potential to exceed the lowest regulatory CTR criteria for the protection of aquatic life. However, measured hatchery water concentrations are well below the applicable drinking water objectives.
- Acetic acid, carbon dioxide and sodium bicarbonate, and PVP iodine are Food and Drug Administration (FDA) LRP compounds. As such, they are considered to pose a low risk to the environment when used according to the product label instructions. Anesthetics (i.e., carbon dioxide and sodium bicarbonate) are used for short periods at hatcheries and thus do not have the potential to be discharged to receiving water bodies over a long exposure period. Acetic acid and PVP iodine can be used in immersion bath and whole raceway treatments and thus may result in measureable concentrations in undiluted hatchery water discharged to receiving waters. Of the available data for PVP iodine from three hatcheries, the compound was not detected in any samples. Acetic acid is used for very brief periods and is an organic acid that readily degrades in the aquatic environment with a half-life of 1 to 10 days (J. T. Baker 2009).
- Available hatchery discharge data for the anesthetic MS-222, which is FDA-approved, is limited to one hatchery, where all values were very low compared with the DFG toxicity guidance value. However, as noted above, anesthetics are used for short periods (i.e., minutes) and do not have the potential to be discharged to receiving water bodies over a long exposure period.
- There are no available measured hatchery discharge data for the drugs oxytetracycline, Florfenicol, Penicillin G, or Romet-30 in the DMR data for the DFG hatcheries. These compounds are typically used for short periods (i.e., hours) in the water or as additives to the fish feed and thus have a low potential to be discharged directly to receiving waters. Additionally, as a result of the typical application for disease control, the potential exposure period to receiving waters is intermittent over the year. Uneaten food tends to be removed through the solids collection process, which further limits the potential exposure to receiving waters. The USGS conducted a study of 13 fish hatcheries across the United States to evaluate the discharge of three classes of antibiotics (i.e., sulfonamides, tetracyclines, and quinolines) in undiluted hatchery water. The USGS study found that oxytetracycline, tetracycline, and sulfadimethoxine were detected in 4%, 1%, and 12% of the samples, respectively (Thurman et al. 2003). The maximum concentration of oxytetracycline (0.01 mg/L) was well below DFG's guidance value for aquatic toxicity of 40.4 mg/L. Additionally, the RWQCBs have determined for the NDPES permitting process that oxytetracycline, Romet-30, and florfenicol (when used in feed formulations); erythromycin (when injected or used in feed formulations); and amoxycillin (when injected) are unlikely to be directly discharged to receiving waters at concentrations that would cause or contribute to an excursion of the basin plan narrative water quality objectives for toxicity.
- Given the assumption that the FDA-approved anesthetics, LRP compounds, and antibiotics are used according to the label instructions, or as prescribed by DFG hatchery veterinarians, the

potentially elevated concentrations of these compounds in undiluted hatchery discharge water would be infrequent, would be expected to degrade over time in the aquatic environment, or would be diluted within the zone of complete mixing of the receiving waters. The available data suggest a relatively low potential for hatchery discharge water to exceed DFG guidance values, which are considered protective of aquatic life, the most sensitive of the beneficial uses to these compounds. Consequently, the potential for adverse affects on the other less sensitive designated beneficial uses is very low.

The available data suggest that four of the treatment chemicals used at the hatcheries in constant flow immersion bath or flushing treatment applications (i.e., Chloramine-T, formaldehyde, hydrogen peroxide, and potassium permanganate) may exceed guidance concentration values in undiluted hatchery water and are thus assessed further below for the potential to exceed guidance values in the receiving water bodies.

- Measured hatchery discharge concentrations for Chloramine-T do not exist. Chloramine-T is a chemical used for control of bacterial gill disease and, unlike other chlorine-based disinfectants, does not form harmful chlorinated compounds. The use of Chloramine-T is subject to an INAD exemption by the FDA and has not been used routinely in California hatcheries. Chloramine-T degrades in the aquatic environment to para-toluenesulfonamide (p-TSA), which is slightly toxic to algae at sufficiently high concentrations but is generally nontoxic to fish and daphnids (Haeneke 2002). Formaldehyde monitoring at the hatcheries is limited to three DFG hatcheries with laboratory sample values reported as "not detected" at two of the hatcheries. The NPDES permit for the Nimbus and American River Hatcheries indicated that formaldehyde was measured in the hatchery discharge settling pond at a concentration of 1.4 mg/L and in the receiving water downstream from the pond at 0.55 mg/L. Based on the current practices at DFG's hatcheries, formaldehyde is used very infrequently. Formaldehyde is used for external parasite and fungus control in immersion bath and the flushing of raceways. In the aquatic environment, formaldehyde oxidizes to formic acid, which then can be metabolically degraded by bacteria to carbon dioxide and water, resulting in a relatively short half-life in water of 36 hours (Food and Drug Administration 1995).
- Hydrogen peroxide has been measured in undiluted hatchery discharge water at three of the hatcheries at concentrations exceeding the lowest applicable DFG toxicity guidance values. Hydrogen peroxide is typically used for flush treatment of raceways to control fungi on fish at all life stages, including eggs. Hydrogen peroxide may also be used under an INAD exemption to control external bacterial infections. Hydrogen peroxide is a strong oxidizer that is rapidly degraded in the aquatic environment to water and oxygen with a half-life typically between 2 to 8 hours (U.S. Geological Survey 2006).
- Potassium permanganate has been measured in undiluted hatchery discharge water at four hatcheries at concentrations exceeding the DFG toxicity guidance values at least once. Potassium permanganate is a strong oxidizing agent that is used to control external disease and parasites in hatcheries. It degrades rapidly in the aquatic environment as it is readily converted to insoluble manganese dioxide (MnO_2) as it reacts with reduced substances. In non-reducing and non-acidic environments, MnO_2 is insoluble and has a very low bioaccumulative potential. Treatment applications are typically of short duration (i.e., 1 hour), and thus the potential exposure period to receiving water is intermittent over the year and of short duration. Mad River Hatchery conducts acute aquatic whole effluent toxicity (WET) tests with *Ceriodaphnia dubia* for settling pond water samples when potassium permanganate treatments occur. Three available WET test results from 2007–2008 monitoring data indicated no observable toxicity.

The concentration of potassium permanganate treatments exceeded 2 mg/L when the WET tests were conducted, indicating that hatchery discharge water is unlikely to cause aquatic toxicity at the prescribed treatment dose.

- Under the direction of DFG veterinarians/pathologists, the FDA-approved treatment chemicals and drugs are used according to the label instructions, or as prescribed by DFG hatchery veterinarians, the potentially elevated concentrations of Chloramine-T, formaldehyde, hydrogen peroxide, and potassium permanganate in undiluted hatchery discharge water would be expected to rapidly degrade in the aquatic environment, or would be diluted within the zone of complete mixing of the receiving waters.

The available data suggest a relatively low potential for hatchery discharge water to exceed DFG guidance values for treatment chemicals and drugs that are considered protective of aquatic life, the most sensitive of the beneficial uses to these compounds. Consequently, the potential for adverse effects on aquatic life beneficial uses and the other less sensitive designated beneficial uses is very low. Hatchery discharges are not expected to substantially degrade water quality with regard to the aquaculture treatment chemicals and drugs discussed herein and, therefore, would not be expected to adversely affect any receiving water beneficial uses. Therefore, the potential impact of treatment chemicals and drugs in the hatchery discharges to receiving water quality and beneficial uses is less than significant.

Impact HYD-9: Effects of Hatchery Operations on Discharge Water Temperature (Less than Significant)

The diversion and use of surface water or groundwater by hatcheries can alter water temperature by increasing the exposure to direct sunlight (e.g., in settling ponds) and ambient air temperatures. If the increase in hatchery discharge water temperatures and the volume discharged to the receiving water are of sufficient magnitude, temperatures of the fully mixed receiving water also may be affected. Substantial temperature alterations may adversely affect beneficial uses of the receiving water and may violate regulatory standards and objectives.

In order to assess the thermal effects of DFG's hatchery program, a multistep data review and compilation process was performed to determine the extent that the hatchery operations could affect receiving water temperatures. The data review outlined below resulted in 11 hatcheries with sufficient concurrent upstream and downstream temperature data to conduct an assessment.

- Available temperature data were reviewed to determine which of the hatcheries had sufficient temperature data with which to conduct an assessment of hatchery operations on receiving water temperatures.
- The effect of each hatchery's operations was determined by comparing receiving water temperatures upstream (R1) and downstream (R2) of each hatchery for which sufficient temperature data were available.
- For those hatcheries that not did have concurrent upstream and downstream receiving water temperature, the available data were examined for hatcheries with sufficient upstream and effluent flow and upstream temperature data to facilitate a mass-balance analysis of temperature effects. However, insufficient data were available for the remaining facilities to facilitate such an assessment.

The results of this assessment were compared with applicable water quality standards and objectives to determine if, and to what extent, each of the hatcheries was degrading receiving water thermal conditions and whether thermal effects were adversely affecting any beneficial uses. This assessment relies on the basin plan temperature objectives applicable to each hatchery's location. The basin plans contains temperature objectives for the protection of beneficial uses. The relevant temperature objectives from the basin plan for the North Coast RWQCB are as follows.

- Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions thereto.
- In addition, the following temperature objectives apply to surface waters:
- The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.
- At no time or place shall the temperature of any COLD water be increased by more than 5°F above natural receiving water temperature.
- At no time or place shall the temperature of WARM intrastate waters be increased more than 5°F above natural receiving water temperature.

The relevant temperature objectives from the basin plan for the Central Valley RWQCB are as follows.

- The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.
- Temperature objectives for COLD interstate waters, WARM interstate waters, and Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions. There are also temperature objectives for the Delta in the State Water Board's May 1991 "Water Quality Control Plan for Salinity."
- At no time or place shall the temperature of COLD or WARM intrastate waters be increased by more than 5°F above natural receiving water temperature.
- In determining compliance with the water quality objectives for temperature, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

The relevant temperature objectives from the basin plan for Lahontan RWQCB are as follows.

- The natural receiving water temperature of all waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect the water for beneficial uses.
- For waters designated WARM, water temperatures shall not be altered by more than five degrees Fahrenheit (5°F) above or below the natural temperature. For waters designated COLD, the temperature shall not be altered.

- Temperature objectives for COLD interstate waters and WARM interstate waters are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions.

The most sensitive of the designated beneficial uses to water temperature are associated with aquatic life, including Commercial and Sport Fishing (COMM); Aquaculture (AQUA); Warm Freshwater Habitat (WARM); Cold Freshwater Habitat (COLD); Estuarine Habitat (EST); Wildlife Habitat (WILD); Preservation of Biological Habitats of Special Significance (BIOL); Rare, Threatened, or Endangered Species (RARE); Migration of Aquatic Organisms (MIGR); and Spawning, Reproductive, and/or Early Development (SPWN) (McKee and Wolf 1963). Of these beneficial uses, COLD is the most sensitive to temperature increases. This assessment characterizes the effects of hatchery operations on receiving water temperatures and addresses the potential to adversely affect those beneficial uses not associated with aquatic life. An assessment of potential water temperature effects on aquatic life beneficial uses is provided in Chapter 4, "Biological Resources."

Of the remaining non-aquatic life beneficial uses, Industrial Process Supply (PRO), Ground Water Recharge (GWR), Freshwater Replenishment (FRSH), Navigation (NAV), Hydropower Generation (POW), Shellfish Harvesting (SHELL), and Non-contact Water Recreation (REC-2) are unaffected, or minimally affected, by water temperature. The relative magnitude of hatchery operation effects on receiving water and temperatures would not adversely affect these beneficial uses; therefore, no further assessment for these uses is warranted. Municipal and Domestic Supply (MUN), Agricultural Supply (AGR; e.g., for rice seed germination), Industrial Service Supply (IND; e.g., for cooling water) and Water Contact Recreation (REC-1; e.g., for swimming, etc.) are more readily affected by water temperature (McKee and Wolf 1963). Moreover, the sensitivity of these beneficial uses are dependent on the absolute water temperatures and not identified as being sensitive to the degree of change in background conditions (McKee and Wolf 1963). Finally, in determining compliance with the basin plan temperature objectives, the Central Valley RWQCB allows appropriate averaging periods to be applied, provided that beneficial uses are protected.

For the purposes of this assessment, hatchery data were assessed by determining if any changes in receiving water temperature would be of sufficient magnitude and duration to adversely affect the MUN, AGR, IND, and REC-1 beneficial uses.

Table 3-12 provides a summary of the calculated R2-R1 temperature differences for each hatchery and receiving water body. Absolute receiving water and effluent temperature data from each of the 11 hatcheries also are summarized by minimum, maximum, and average. The data (for the 11 hatcheries that have sufficient temperature data to assess) indicate that receiving water temperatures are only minimally affected as a result of the hatchery water discharges. The comparison of concurrent upstream and downstream temperature differences (R2-R1) indicates that average temperature differences ranged from -0.5°F (i.e., average temperatures downstream of the facility were lower than those upstream) to 2.2°F. In more than half of the facilities, average temperature differentials were 0.1°F or less, thereby indicating that most hatcheries are having a negligible effect on receiving water temperatures.

Table 3-12. Measured Hatchery Discharge and Receiving Water Temperatures (°F)

Hatchery	Upstream		Hatchery Discharge		Downstream		Change (Downstream - Upstream)			
	Average	Maximum	Average	Maximum	Average	Maximum	n	Minimum	Average	Maximum
Salmon/Steelhead Hatcheries										
Feather River Hatchery	54.6	63.0	--	--	54.7	63.0	10	-1.1	0.1	1.0
Feather River Hatchery Thermalito Annex	57.3	68.7	--	--	57.2	67.8	12	-1.0	0.0	1.0
Iron Gate Hatchery	56.3[a]	71.2	47.0[a]	55.6	56.2	69.4	10	-2.7	-0.1	8.0
Mokelumne River Hatchery	54.9	60.1	55.4	6.1	55.4	62.0	15	-0.7	0.6	2.0
Nimbus Hatchery/ American River Hatchery	57.1	68.4	56.3	69.1	57.2	68.0	18	-0.9	0.1	1.8
Trout Hatcheries										
Black Rock	60.2[b]	70.0	55.6[b]	62.0	59.8	68.0	5	-2.0	0.4	2.0
Crystal Lake	49.8	58.8	--	--	52.0	57.7	17	-1.1	2.2	4.0
Darrah Springs	56.4	60.6	--	--	55.9	58.8	30	-3.4	-0.5	1.8
Moccasin Creek	51.6	56.0	--	--	51.2	57.0	60	-5.0	0.4	2.0
San Joaquin Hatchery	51.5	64.4	52.3	64.4	52.1	62.6	86	-5.4	0.4	6.1

Notes:
Refer to Appendix D for full tables showing available data used for the screening process, and identifying hatcheries with and without data.
n = number of samples.
[a] Iron Gate Hatchery discharge cooler than upstream Klamath River water as a result of its source water supply of colder water from Iron Gate Reservoir.
[b] Black Rock Hatchery discharge cooler than upstream Los Angeles Aqueduct water as a result of its source water supply from colder groundwater.

There were a combined total of three instances (i.e., 1% of all available data) at two hatcheries in which the 5°F basin plan objectives were exceeded, as shown in Table 3-13 and described below:

- The Iron Gate Hatchery exceeded the North Coast's 5°F objective once, where the downstream temperature was 8.0°F higher than the upstream temperature.
- The San Joaquin Hatchery had two exceedances of the Central Valley's 5°F objective, where downstream temperatures were 5.4°F and 6.1°F higher than upstream temperatures.

These data suggest that there is a low probability of exceedances of the 5°F objective in the receiving water bodies. Additionally, it is important to note that in all three instances, the temperature of the concurrently measured hatchery discharge water was higher than those measured upstream but lower than those measured downstream. This indicates that the temperature increase in the receiving water (and exceedance of the 5°F objective) may not have been caused solely by the hatchery discharge, and heat input from other factors apparently affected the measured temperatures. Moreover, in determining compliance with the temperature objectives, the basin plan allows appropriate averaging periods to be considered, provided that beneficial uses will be fully protected. Based on the indicated low frequency of potential elevated temperatures downstream of the hatcheries, the potential effect of hatchery discharges is likely to be minimal when averaged over the time period that sensitive beneficial uses could be affected (e.g., days, weeks, or months).

Table 3-13. Water Temperatures Exceeding the Basin Plan 5°F Temperature Objective

Hatchery	Date	Temperature (°F)			Downstream - Upstream (°F)
		Upstream	Downstream	Hatchery Discharge	
Iron Gate Hatchery	06/03/2008	51.7	59.7	54.0	8.0
San Joaquin Hatchery	06/26/2008	51.8	57.2	56.8	5.4
	07/24/2008	51.1	57.2	56.5	6.1

As stated above, the basin plan for the Lahontan RWQCB does not provide a 5°F objective for bodies designated COLD. Of the four hatcheries located within the Lahontan RWQCB region (see Table 3-1), all of which discharge to water bodies designated COLD, only the Black Rock Rearing Ponds had usable upstream and downstream temperature data available for this assessment. Available data for this facility indicate that average downstream temperatures are only 0.4°F higher than upstream temperatures. Furthermore, average and maximum discharge water temperatures at this facility were lower than average, and maximum temperatures upstream or downstream of the discharge. Consequently, it is unlikely that this facility, which uses groundwater as its source water, would have any measurable long-term effect on water temperatures in the Los Angeles Aqueduct, which empties into Haiwee Reservoir.

The assessment of the hatcheries with available concurrent upstream and downstream temperature data indicate that hatchery water discharges have only minimal effects on receiving water temperature. Because the frequency of potential exceedances of the basin plan 5°F objective is low and because the temperatures downstream of each facility are similar to, and often lower than, measured upstream temperatures, with no hatchery showing substantial temperature increases in its receiving water on a chronic time frame, hatchery operations do not substantially degrade the thermal conditions of the receiving water downstream of their discharge. As such, the typically minor thermal effects that hatchery operations impart on their receiving waters would not be expected to cause adverse effects on MUN, AGR, IND, REC-1, or other non-aquatic life beneficial uses. Therefore, this impact is considered less than significant.

Refer to Chapter 4, "Biological Resources," for the impact determination for thermal effects on fisheries and aquatic resources (i.e., to aquatic life beneficial uses).

Impact HYD-10: Effects on Groundwater Quality from Hatchery Operations (Less than Significant)

The potential for individual hatchery operations to affect local groundwater quality is based on several factors: the method of wastewater storage, treatment, and disposal; the volume and duration of wastewater storage; the underlying soil types and geophysical properties; and the volume and quality of discharged effluent that is available for recharge relative to the volume of stored groundwater in the basin.

Storage and treatment of wastewater generally includes the use of detention basins and settling ponds. Unlined basins and ponds can allow for percolation of wastewater to the aquifer below. However, most of the DFG hatcheries use a flow-through system, which limits percolation of effluent due to a short residence time in the basins and ponds.

Nearly all DFG hatcheries discharge treated effluent directly to nearby surface waters, with some exceptions. Fish Springs Hatchery discharges some of its wastewater to nearby Fish Springs Creek but also discharges indirectly to the Owens Valley Groundwater Basin via infiltration of water discharged to nearby land surfaces. Fillmore Hatchery discharges to watercress fields, where the crop uses the nitrogen waste and suspended solids are allowed to settle. Water not taken up by crops is presumably either lost to evaporation or infiltrated into the Fillmore Subbasin. The Mad River, Feather River, Nimbus, and American River Hatcheries discharge to settling ponds that are constructed on top of permeable floodplain gravel and cobble beds. The settling ponds at the Feather River, Nimbus, and American River Hatcheries were constructed in highly permeable gravels that allow the entire flows to discharge indirectly to the Feather and American Rivers, respectively, through seepage.

The potential for effects on groundwater is higher at these hatcheries compared with those that discharge solely to surface waters. Table 3-14 lists data on maximum allowable hatchery discharge flows, groundwater storage capacities, and groundwater level trends for basins underlying hatcheries that discharge to land. It is important to note that the discharge rates listed are the maximum permitted rates, and seldom, if ever, do hatcheries discharge at the maximum rate. For the purposes of this analysis, it is conservatively assumed that the hatcheries discharge at the maximum permitted rate.

Table 3-14. Maximum Hatchery Discharge Volumes and Groundwater Basin Areas and Volumes

Hatchery	Maximum Allowable Hatchery Discharge Flows (mgd/acre-feet per day)	Groundwater Subbasin (DWR Subbasin Number)	Groundwater Surface Area (acres)	Estimated Groundwater Storage Capacity (acre-feet)
Feather River	47.3/145	East Butte (5-21.59)	265,390	3,128,959
Fillmore	11.6/36	Fillmore However, this occurred well before the 2004-2008 baseline period and there is no evidence that continued pumping at current levels is likely to have any incremental adverse impacts to the water supply beneficial uses of groundwater. (4-4.05)	20,800	7,330,000
Fish Springs	18.1/56	Owens Valley (6-12)	661,000	30,000,000
Mad River	7.5/23	N/A	N/A	N/A
Nimbus/American River	90/276	North American (5-21.64)	351,000	4,900,000

Note:
N/A = not applicable.

Table 3-15 contains groundwater quality impairments as stated in DWR Bulletin 118. The table also contains effluent limitations prescribed in the individual NPDES permits that the hatcheries must meet in order to protect beneficial uses of the groundwater. Note that the Fillmore Hatchery does not currently have an NPDES permit; however, basin plan standards for the protection of beneficial uses of groundwater still apply to the Fillmore Hatchery. Because of the small volumes of discharged effluent (relative to the sizes of the groundwater basins) and the NPDES permit effluent limitations assigned to the hatcheries to protect the beneficial uses of the groundwater, it is not expected that these discharges would have significant adverse impacts on groundwater quality. Therefore, impacts on groundwater associated with the DFG's Program are considered less than significant.

Table 3-15. Effluent Limitations Compared with Existing Groundwater Impairments

Hatchery	Effluent Limitations[a]	Groundwater Subbasin (DWR Subbasin Number)	Existing Groundwater Impairments
Feather River	The discharger shall not cause the groundwater to be degraded, to exceed water quality objectives, unreasonably affect beneficial uses, or cause a condition of pollution or nuisance. The discharge shall not cause the groundwater to contain taste or odor producing substances in concentrations that cause a nuisance or adversely affect beneficial uses. The discharge shall not cause toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with beneficial uses. This limitation applies regardless of whether the toxicity is caused by a single substance or the synergistic effects of multiple substances.	East Butte (5-21.59)	Manganese, iron, magnesium, total dissolved solids, conductivity, and calcium, primary inorganics, nitrates
Fillmore	Fillmore does not have an NPDES permit. However, there is no discharge to surface water, but rather only discharge to land. As a result the same groundwater effluent limitations for the Feather River Hatchery would apply to the Fillmore Hatchery to protect groundwater beneficial uses.	Fillmore (4-4.05)	Radiological, nitrates, salts, volatile organic compounds, semi-volatile organic compounds, and secondary inorganics
Fish Springs	The median concentration of coliform organisms over any seven day period shall be less than 1.1/100 milliliters. Ground Waters shall not contain chemical constituents in excess of maximum contaminant levels (MCLs) or secondary MCLs based upon drinking water standards of Title 22 in the Code of Regulations. Groundwaters shall not contain concentrations of radionuclides in excess of the concentrations specified in Title 22 The discharge shall not cause the groundwater to contain taste or odor producing substances in concentrations above Title 22 standards.	Owens Valley (6-12)	Boron, fluoride, primary and secondary inorganics
Mad River	N/A	N/A	N/A
Nimbus/ American River	Effluent limitations have been set for electrical conductivity (EC), total dissolved solids (TDS), copper, pH, formaldehyde, dissolved oxygen (DO), turbidity, and total suspended solids (TSS). Continuation of monitoring for hydrogen	North American (5-21.64)	Primary and secondary inorganics, volatile organic compounds, semi-volatile organic compounds, radiological; elevated levels of

Hatchery	Effluent Limitations[a]	Groundwater Subbasin (DWR Subbasin Number)	Existing Groundwater Impairments
	peroxide will occur for future potential effluent limitations. Since mercury is known surface water impairment, a mercury study is to be completed to determine if the hatchery is a contributor.		TDS/specific conductance, chloride, sodium, bicarbonate, boron, fluoride, nitrate, iron manganese, and arsenic in some locations

Notes:
N/A = not applicable.
[a] Effluent limitations for groundwater as identified in individual NPDES permits

Impact HYD-11: Water Quality Effects of Trout and Salmon Stocking Operations (Less than Significant)

DFG's trout stocking program transports fish to inland streams, lakes, and reservoirs primarily by tanker truck and, to a lesser extent, via air transport or other means. DFG's salmon and steelhead stocking operations are conducted with a combination of direct release from the hatcheries and trucking to downstream stocking locations. Stocking operations result in the discharge of the transport water to the receiving water when the fish are released. DFG prepares fish for transport by withholding feed for 1 or 2 days in advance of transport and then transports the fish in cold, clean water to reduce stress. Cessation of feeding is for the purpose of reducing fecal production and ammonia formation in the transport water that would harm the transported fish. The stocking operations have the potential to affect receiving water quality in the short-term as a result of the discharge of constituents in the water used to transport fish to the stocking locations.

Trout stocking operations have the potential to cause long-term water quality effects if the stocked fish populations result in changes to nutrient levels, nutrient cycling dynamics, and the aquatic ecology of the stocked water bodies. Investigations of fish stocking in inland lakes suggests that introduced trout (and other top predator fish species) can indirectly increase or decrease phytoplankton production (i.e., algae) via changes to trophic relationships between piscivorous and planktivorous fish species, which in turn can alter the cycling and concentrations of nutrients (Eby et al. 2006). Potential long-term water quality effects of DFG's salmon and steelhead stocking operations include the contribution of nutrients to rivers when adults return from the ocean and die, and the carcasses decay, which releases nutrients from fish tissues/bones. The return of nutrients from carcass decay also has been widely implicated as having an important beneficial effect in providing nutrients for the food chain (Bilby et al. 2003; Hatfield and Naiman 2001). The DWR's analysis of nutrient concentrations in the Feather River upstream and downstream of the Feather River Hatchery found occasionally elevated concentrations; however, the data did not indicate that spawned salmon were contributing to elevated concentrations or reducing water quality (California Department of Water Resources 2004). Additionally, the decay of adult salmon carcasses after spawning takes place potentially contributes anthropogenic (i.e., human-made) toxins such as polychlorinated biphenyl compounds (PCBs) to receiving waters that result from accumulation in fish tissues during the salmon's life cycle in the ocean (Krummel et al. 2003).

The NPDES permits do not require water quality monitoring of the stocking operations. Therefore, this water quality assessment assumed that constituents of concern in stocking discharges would be similar to the available DMR data for hatchery discharges assessed above for Impacts HYD-5 through HYD-8. Moreover, the quality of discharged water released during stocking operations would be expected to contain less TSS, turbidity, and nutrients because feed would be eliminated and related fecal content would be reduced. This assessment considered the stocking frequency, discharge quantity, and dilution and assimilative capacity of the receiving waters in determining whether substantial adverse water quality effects would occur.

The potential short-term water quality effects of DFG's stocking operations are considered to be minimal based on the relatively small quantities of water involved in the transport operations (i.e., minimal (0–2,000 gallons) compared with the volume and available dilution provided in the receiving waters. Based on the assessment of DMR water quality data for undiluted hatchery discharges discussed in Impacts HYD-5 through HYD-8, transport water that is discharged during stocking operations would contain relatively low concentrations of TSS, turbidity, and nutrients. Constituent concentrations in transport water would be expected to contain even lower concentrations of these constituents and not contain appreciable levels of treatment chemicals or drugs. Therefore, the discharge of transport water would not be expected to measurably increase constituent concentrations in receiving waters beyond a small nearshore zone of initial mixing, and any elevated nearshore concentrations would rapidly decrease as a result of dispersion and dilution into the receiving water.

Available scientific literature (Eby et al. 2006; Elser et al. 1995) indicates that long-term changes in trophic interactions of fish species, zooplankton, and primary productivity in inland lake stocking locations may occur as a result of trout stocking programs. The potential for increased phytoplankton production could reduce water clarity, which is a potential concern for water supply beneficial uses and is an aesthetic factor for recreational activities. However, a review of literature does not indicate that stocking-related water quality changes would be of sufficient magnitude to cause substantial adverse effects on any beneficial uses of stocked water bodies (Eby et al. 2006).

DFG's salmon and steelhead stocking operations result in the annual return of adult salmonids to fresh water, where they die, and carcasses decay within the river. It is possible that the decay of large numbers of adult salmon carcasses could contribute excess nutrients or anthropogenic toxicants (e.g., PCBs) to rivers via the release of constituents that have accumulated in fish tissues while growing in the ocean. Although the contributions of nutrients or chemicals from salmon carcasses may increase the total loading to the river, there is no available information that suggests the effects are causing substantial adverse effects on beneficial uses. Moreover, the return and death of steelhead and salmon to their natal streams is a natural phenomenon, regardless of whether a portion of the run is of hatchery origin. As such, the effects this phenomenon has on water quality are part of the natural base condition of the receiving waters.

Because stocking operations are intermittent, are infrequent (compared with hatchery water discharges), and release small quantities of water, the potential short-term water quality effects would be limited to initial nearshore mixing zones and would not cause substantial adverse effects on beneficial uses. Because salmonids naturally return to fresh water annually, the release of nutrients from carcass decay is a normal and natural aspect of the riverine system and is not expected to increase nutrient concentrations to problematic levels or adversely affect beneficial uses, as a result of the runs being supplemented by hatchery operations. Therefore, the frequency and magnitude of both potential short-term and long-term water quality effects of DFG's trout and salmon stocking program are considered to be a less-than-significant impact.

Other Programs

Private Stocking Permits

The California Fish and Game Commission has promulgated regulations giving DFG the authority, through Division 12 of the CFGC, to register and regulate private individuals, other than DFG, who wish to import, raise, sell, or stock live aquatic plants and animals within the state. The focus of the regulations is to prevent the import and release of organisms that might cause harm to native populations of wildlife and plants. The basic elements of the regulatory program are an aquaculturist registration process (which includes the identification of source water), a permit to import live plants and animals, and a permit to stock aquatic species in public or private waters within the state.

DFG does not sample or evaluate the quality of water used to raise various aquatic organisms, and does not require specific water quality tests for water used to transport fish. The water quality issue associated with the private stocking permit program would be the release of constituents of concern to waters of the state through placing fish in the various stocked water bodies. Based on regulation, the aquaculuturist providing the fish must identify the source of water used to raise the fish. It is assumed that individuals stocking fish use the same methods to release fish to water bodies as those typically used by DFG (described earlier in this chapter). Because the amounts of water used to transport fish are minimal (several orders of magnitude less than the waters being stocked), and assumed to be of adequate quality for safe transportation of fish, the effect the private stocking permit program would have on water quality at planting locations is considered less-than-significant.

Fishing in the City

DFG's Fishing in the City program does not involve the release of substantial quantities of waterto the environment. Therefore, the program does not have the potential to substantially affect water quality.

Salmon in the Classroom

DFG's Salmon in the Classroom program does not involve the release of substantial quantities of waterto the environment. Therefore, the program does not have the potential to substantially affect water quality.