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# 4.9 AQUATIC BIOLOGICAL RESOURCES

This section discusses Project impacts on aquatic biological resources within the areas of direct impact, which are the construction zones of the Project components, as well as on a broader, regional scale. The potential for loss of special status (endangered, threatened, rare or protected) species associated with aquatic habitats is evaluated, as is the potential for loss of sensitive aquatic habitat, such as freshwater or brackish marsh, vernal pools, streams, or ponds. The potential for change in aquatic habitat in the Gulf of the Farallones National Marines Sanctuary and ecological risk to aquatic resources from toxicity or bioaccumulation are discussed. To provide a basis for this evaluation, aquatic biological resources are described in terms of aquatic communities, including estuaries, rivers, and streams, and other freshwater communities such as marshes, ponds, and vernal pools. Special status aquatic species which potentially occur in the Project area are identified, along with their status and typical habitat.

## IMPACTS EVALUATED IN OTHER SECTIONS

The following impacts associated with Aquatic Biological Resources are not evaluated in this section but are cross-referenced here to direct the reader to the sections where the impacts are addressed.

- Alteration of Surface Water Quality. Construction and operation of irrigation systems, storage reservoirs, and discharge into the Russian River may affect existing water quality in streams, ponds, and other bodies of water. The potential ecological risk to organisms due to Project implementation is discussed in this section. Other water quality issues are discussed in Section 4.6, Surface Water Quality.

- Submerged and Emergent Aquatic Plants. Impacts on these aquatic plants, for example algae and water primrose are evaluated as part of Section 4.6, Surface Water Quality.

- Jurisdictional Wetlands. Impacts caused by the discharge of dredge and fill material into jurisdictional wetlands are discussed in Section 4.10, Jurisdictional Wetlands Resources.

- Soil Erosion. Impacts due to erosion and sedimentation are discussed in Section 4.3, Geology, Soils, and Seismicity for construction impacts and Section 4.2, Agriculture for impacts of irrigation.

- Upland Plant and Wildlife Communities. Impacts to upland plant and wildlife communities are discussed in Section 4.8, Terrestrial Biological Resources.

## AFFECTED ENVIRONMENT (SETTING)

The Project alternatives are located in a region that supports an abundance of diverse aquatic ecosystems. The aquatic ecosystems within the Area of Direct Impacts (for definition and map, see Affected Environment of Terrestrial Biological Resources, Section 4.8) could be directly affected by the construction and operation of the Project components. These same actions could indirectly affect aquatic biological resources on a broader, regional scale (i.e., within the Area of Indirect Impacts).

Various public and private natural resource planning efforts are underway that provide for the conservation and regulation of aquatic biological resources, both within the Area of Indirect Impacts and Area of Direct Impacts. Existing and future plans for these resources could be affected by the Project alternatives.

### Regional Aquatic Biological Resources

#### *Southern Region*

The Area of Indirect Impacts within Sonoma and northern Marin counties encompasses a variety of aquatic ecosystems. In the southern region, representative aquatic ecosystems include San Pablo Bay (a northern extension of San Francisco Bay) and several small estuaries and drainages that enter San Pablo Bay, including Petaluma River, Tolay Creek, Sonoma Creek, and Napa Slough. In addition, the tidal wetlands associated with San Pablo Bay, in combination with the large salt marsh surrounding the Petaluma River, form the second largest contiguous wetland in the San Francisco Bay Area (after Suisun Marsh).

#### *Western Region*

In the western region of Sonoma and Marin counties, coastal aquatic ecosystems include Lagunitas Creek and Walker Creek (entering Tomales Bay); the Estero de San Antonio and its associated Stemple Creek drainage; the Estero Americano and its associated Americano Creek drainage; Bodega Bay; Salmon Creek; and the Russian River and its associated estuary. The Russian River is the largest drainage in the region.

A variety of factors including historical and current development have reduced the abundance and diversity of the aquatic resources associated with the major aquatic ecosystems in the region, leading to the protection or the proposed protection of several species (i.e., special-status species). Lists of special-status species potentially occurring in the region were provided by California Department and Fish and Game, National Marine Fisheries Sanctuary, and United States Fish and Wildlife Service. Additional information regarding special-status species was obtained from the California Native Plant Society and Madrone Audubon Society. The comprehensive special-status plant and wildlife lists generated by this process include 182 plant species and 102 wildlife species. Professional judgment of HBA Project team biologists and coordination with resource experts resulted in a reduced number of special-status species, those deemed most likely to occur within the Project area. An explanation of the screening process and consolidated lists of special-status plant and wildlife are provided in the *Biological Resources*, *Volume 2* (Harland Bartholomew & Associates, Inc. 1996b).

Approximately 50 special-status aquatic plant and wildlife species have been identified as potentially occurring in the Area of Indirect Impacts and consequently are evaluated in this EIR/EIS (Table 4.9-1).

The aquatic biological resources of Sonoma and Marin counties within the Area of Indirect Impacts are described below and are identified in association with the dominant plant communities and wildlife habitats. The acreages of each aquatic plant community and associated aquatic wildlife habitat identified within the Area of Indirect Impacts are presented in the Environmental Consequences (Impacts) and Recommended Mitigation section.

### Aquatic Communities

The following section provides a brief discussion of the structure and function of various aquatic plant and wildlife resources within the Area of Indirect Impacts. Aquatic plant communities and their corresponding California Statewide Wildlife Habitat Relationship System (CWHR) wildlife habitat types in parentheses are described below and in Table 4.9-2.

# Table 4.9-1

## Special-Status Species Associated with Aquatic Habitats

| | Status | | | | Management Concerns | |
|---|---|---|---|---|---|---|
| Species | State[1] | Federal[1] | CNPS[1] | Source | Habitat | Potential Threats |
| **Plants** | | | | | | |
| *Alopecurus aequalis* var. *sonomensis*<br>Sonoma alopecurus | -- | FPE | 1B | 2,3,5,10 | Freshwater marsh, riparian scrub, and wet meadow. | Grazing and wetland habitat loss. |
| *Astragalus tener* var. *tener*<br>Alkali milk-vetch | -- | -- | 4 | 6 | Valley grasslands (adobe clay), alkali flats, and vernally moist meadows. | Grazing, agriculture, and urbanization. |
| *Blennosperma bakeri*<br>Sonoma sunshine | SE | FE | 1B | 2,3,5 | Found in association with vernal pools, wet grasslands, and drainage swells. | Urbanization, grazing, and agriculture. |
| *Calamagrostis bolanderi*<br>Bolander's reed grass | -- | -- | 4 | 6 | Freshwater marsh, coastal scrub, bogs, moist meadows, and open woodlands. | Unknown. |
| *Calamagrostis crassiglumis*<br>Thurber's reed grass | -- | -- | 2 | 2,5 | Coastal scrub (mesic) and freshwater marsh. | Grazing. |
| *Campanula californica*<br>Swamp harebell | -- | -- | 1B | 2,3,5 | Bog/fen, freshwater marsh, north coast coniferous forest, closed-cone coniferous forest, and coastal marshy areas. | Grazing, development, and marsh habitat loss. |
| *Carex albida*<br>White sedge | SE | FPE | 1B | 2,3,5,10 | Freshwater marsh. Believed to be limited to a single population at Pitkin Marsh. | Wetland drainage and spraying of chemical effluents. |
| *Carex californica*<br>California sedge | -- | -- | 2 | 8 | Meadows drier areas of swamps. | Unknown. |
| *Carex comosa*<br>Bristly sedge | -- | -- | 2 | 6 | Lake margins and wet places. | Marsh drainage. |

Notes at end of table.

# Table 4.9-1

## Special-Status Species Associated with Aquatic Habitats

| | Status | | | | Management Concerns | |
|---|---|---|---|---|---|---|
| **Species** | **State[1]** | **Federal[1]** | **CNPS[1]** | **Source** | **Habitat** | **Potential Threats** |
| *Castilleja uliginosa*<br>Pitkin Marsh Indian paintbrush | SE | -- | 1A | 2,3,5,7 | Freshwater marsh and moist places. | Grazing, development, and marsh habitat loss. |
| *Cordylanthus maritimus* ssp. *palustris*<br>Point Reyes bird's-beak | -- | -- | 1B | 2,3,5 | Coastal salt marsh. | Development, foot traffic, non-native plants, and altered hydrology. |
| *Cordylanthus mollis* ssp. *mollis*<br>Soft bird's-beak | SR | FPE | 1B | 2,3,5,7 | Coastal salt marsh | Development, foot traffic, non-native plants, and altered hydrology. |
| *Dichanthelium lanuginosum* var. *thermale* *[Panicum acuminatum* var. *acuminatum]*<br>Geysers dichanthelium [panicum] | SCE | -- | 1B | 8 | Meadows and seeps in the vicinity of hot springs, marshes, and streambanks. | Energy development. |
| *Downingia pusilla*<br>Dwarf downingia | -- | -- | 2 | 3 | Valley-foothill grasslands (mesic), vernal pools, and roadside ditches. | Urbanization, agriculture, grazing, and off-road vehicles. |
| *Eleocharis parvula*<br>Small spikerush | -- | -- | 4 | 6 | Coastal salt marsh. | Unknown. |
| *Grindelia stricta* var. *angustifolia*<br>Marsh gumplant | -- | -- | 4 | 8 | Coastal salt marsh and tidal areas. | Unknown. |
| *Helianthus exilis*<br>Serpentine sunflower | -- | -- | 4 | 8 | Seeps in cismontane woodland and chaparral with serpentine soils. | Unknown. |
| *Lasthenia burkei*<br>Burke's goldfields | SE | FE | 1B | 2,3,5 | Vernal pools and wet meadows. | Agriculture, urbanization and grazing. |

Notes at end of table.

# Table 4.9-1

## Special-Status Species Associated with Aquatic Habitats

| Species | Status | | | | Management Concerns | |
|---|---|---|---|---|---|---|
| | State[1] | Federal[1] | CNPS[1] | Source | Habitat | Potential Threats |
| *Lathyrus jepsonii* var. *jepsonii*<br>Delta tule pea | -- | -- | 1B | 9 | Brackish and freshwater marsh, coastal and estuarine marshes. | Agriculture and water diversions. |
| *Legenere limosa*<br>Legenere | -- | -- | 1B | 2,3,5,7 | Vernal pools and sloughs. Occurs in pools with *Downingia pusilla*. | Grazing and development. |
| *Lilaeopsis masonii*<br>Mason's lilaeopsis | SR | -- | 1B | 9 | Brackish or freshwater marsh, riparian scrub, and intertidal streambanks. | Development, flood control, recreation, erosion, and agriculture. |
| *Lilium maritimum*<br>Coast lily | -- | -- | 1B | 2,5,6 | Coastal scrub, coastal prairie, bogs, broad-leaved upland forest, and gaps in coniferous forest. | Road maintenance, urbanization, and horticultural collecting. |
| *Lilium pardalinum* ssp. *pitkinense [L. pitkinense]*<br>Pitkin Marsh lily | SE | FPE | 1B | 2,3,5,10 | Freshwater marsh and valley-oak scrub. Endemic to Vine Hill area. | Marsh habitat loss, horticultural collection, and grazing. |
| *Limnanthes douglasii* ssp. *sulphurea*<br>Point Reyes meadowfoam | SE | -- | 1B | 2,5 | Vernal pools, freshwater marsh, and wet meadows of coastal prairies. | Grazing, trampling, and non-native plants. |
| *Limnanthes vinculans*<br>Sebastopol meadowfoam | SE | FE | 1B | 2,3,5 | Vernal pools and wet meadows. Endemic to Sonoma County. | Urbanization, agriculture, and grazing. |
| *Navarretia leucocephala* ssp. *bakeri*<br>Baker's navarretia | -- | -- | 1B | 3 | Vernal pools, valley-foothill grasslands, cismontane woodland, and mesic meadows. | Unknown. |

Notes at end of table.

# Table 4.9-1

## Special-Status Species Associated with Aquatic Habitats

| | Status | | | | Management Concerns | |
|---|---|---|---|---|---|---|
| **Species** | **State[1]** | **Federal[1]** | **CNPS[1]** | **Source** | **Habitat** | **Potential Threats** |
| *Navarretia leucocephala* ssp. *plieantha [N. plieantha]*<br>Many-flowered navarretia | SE | FPE | 1B | 2,3,5 | Vernal pools. | Grazing, development, and off-road vehicles. |
| *Plagiobothrys glaber*<br>Hairless popcorn-flower | -- | -- | 1A | 2 | Wet alkaline soils in valleys and coastal salt marshes. | Grazing and development. |
| *Plagiobothrys mollis* var. *vestitus*<br>Petaluma popcorn-flower | -- | -- | 1A | 2,3,5,7 | Wet sites in valley-foothill grassland. | Draining and development of marshes. |
| *Pleuropogon hooverianus*<br>North Coast semaphore grass | SR | -- | 1B | 2,3,5 | Broad-leaved, upland forests and meadows; vernal pools; marshes; and redwood forests. | Unknown. |
| *Pogogyne douglasii* ssp. *parviflora [P. douglasii]*<br>Douglas pogogyne | -- | -- | 3 | 8 | Chaparral with serpentine soils, valley-foothill grasslands, vernal freshwater marshes, and vernal pools. | Urbanization and agriculture. |
| *Polygonum marinense*<br>Marin knotweed | -- | -- | 3 | 2,3,5 | Coastal saltmarsh. | Coastal development. |
| *Potentilla hickmanii*<br>Hickman's cinquefoil | SE | FPE | 1B | 2,3,5,7 | Vernally wet meadows and open pine forests. | Urbanization and recreational activities. |
| *Ranunculus lobbii*<br>Lobb's aquatic buttercup | -- | -- | 4 | 6 | Shallow water, vernal pools, valley and foothill grassland, oak woodland, and mixed forest. | Urbanization and agriculture. |

Notes at end of table.

## Table 4.9-1

### Special-Status Species Associated with Aquatic Habitats

| Species | Status: State[1] | Status: Federal[1] | Status: CNPS[1] | Status: Source | Management Concerns: Habitat | Management Concerns: Potential Threats |
|---|---|---|---|---|---|---|
| *Rhynchospora alba*<br>White beaked-rush | -- | -- | 4 | 6 | Freshwater marsh. | Unknown. |
| *Rhynchospora californica*<br>California beaked-rush | -- | -- | 1B | 2,3,5 | Meadows, freshwater marshes, seeps, and bogs. | Marsh habitat loss. |
| *Rhynchospora globularis* var. *globularis*<br>Round-headed beaked-rush | -- | -- | 2 | | Freshwater marsh. | Marsh habitat loss. |
| *Sidalcea calycosa* ssp. *rhizomata*<br>Point Reyes checkerbloom | -- | -- | 1B | 8 | Marshes near coast. | Unknown. |
| *Sidalcea oregana* ssp. *valida*<br>Kenwood Marsh checkerbloom | SE | FPE | 1B | 2,3,5,10 | Freshwater marsh. | Grazing and habitat alteration. |
| *Suaeda californica*<br>California seablite | -- | FPE | 1B | 2,5 | Coastal salt marsh | Recreation, erosion, and alteration of marsh habitat. Development, foot traffic, non-native plants, and altered hydrology. |
| **INVERTEBRATES** | | | | | | |
| *Branchinecta conservatio*<br>Conservancy fairy shrimp | -- | FE | -- | 1 | Valley-foothill grasslands in vernal pools. | Habitat destruction due to agricultural and urban development. |
| *Branchinecta longiantennae*<br>Longhorn fairy shrimp | -- | FE | -- | 1 | Valley-foothill grasslands in vernal pools. | Habitat destruction due to agricultural and urban development. |

Notes at end of table.

# Table 4.9-1

## Special-Status Species Associated with Aquatic Habitats

| | Status | | | | Management Concerns | |
|---|---|---|---|---|---|---|
| Species | State[1] | Federal[1] | CNPS[1] | Source | Habitat | Potential Threats |
| *Branchinecta lynchi*<br>Vernal pool fairy shrimp | -- | FT | -- | 1 | Valley-foothill grasslands in vernal pools. | Habitat destruction due to agricultural and urban development. |
| *Lepidurus packardi*<br>Vernal pool tadpole shrimp | -- | FE | -- | 1 | Valley-foothill grasslands in vernal pools. | Habitat loss and degradation. |
| *Syncaris pacifica*<br>California freshwater shrimp | SE | FE | -- | 2,3,5 | Suitable habitat in streams with riparian tree cover and submerged roots and branches along undercut banks. | Degradation of water quality, loss of annual stream flow, and introduction of exotic predatory fish. |
| **FISH** | | | | | | |
| *Eucyclogobius newberryi*<br>Tidewater goby | SSC | FE | -- | 2,3,5 | Brackish water habitats. Still, but not stagnant, water. | Degradation of habitat and water quality, and changes in flow and salinity. |
| *Hypomesus transpacificus*<br>Delta smelt | ST | FT | -- | 7 | Confined to the upper Sacramento-San Joaquin River estuary in shallow waters near the entrapment zone. | Degradation of water quality, and changes in flow and salinity. |
| *Hysterocarpus traskii pomo*<br>Russian River tule perch | SSC | -- | -- | 3,5 | Confined to the Russian River and its tributaries. | Degradation of water quality and habitat. |
| *Lampetra ayresi*<br>River lamprey | SSC | -- | -- | 7 | Coastal streams and rivers from San Francisco north. | Degradation of habitat and water quality and changes in flow regimes. |

Notes at end of table.

## Table 4.9-1

### Special-Status Species Associated with Aquatic Habitats

| Species | Status | | | | Management Concerns | |
|---|---|---|---|---|---|---|
| | State[1] | Federal[1] | CNPS[1] | Source | Habitat | Potential Threats |
| *Lavinia symmetricus navarroensis* Navarro roach | SSC | -- | -- | 2,5 | Slower, warmer reaches of streams in the Russian and Navarro River drainages. | Degradation of water quality, changes in flow regimes, and competition from introduced species. |
| *Mylopharodon conocephalus* Hardhead | SSC | -- | -- | 1 | Large pools with little silt in the Sacramento-San Joaquin and Russian River systems. | Competition from introduced centrarchids and habitat loss. |
| *Oncorhynchus kisutch* Coho salmon | SSC | FPT | -- | 7 | Most coastal streams and rivers from San Lorenzo Creek in Santa Cruz County north. | Damming, agricultural development, logging, overfishing, and improper watershed management. |
| *Pogonichthys macrolepidotus* Splittail | SE | FPT | -- | 2,5 | Backwater slough areas in the lower Delta, San Pablo Bay, and Petaluma River. | Habitat loss, degradation of water quality, and changes in flow regimes. |
| *Spirinchus thaleichthys* Longfin smelt | SSC | -- | -- | 2,5 | Prefers moderately saline waters in major bays and estuaries from San Francisco Bay northward. | Degradation of water quality and changes in flow regimes. |
| **AMPHIBIANS** | | | | | | |
| *Ambystoma californiense* California tiger salamander | SSC | FC | -- | 2,4,5 | Oak savannah, valley-foothill grasslands, and vernal pools. | Habitat destruction due to agricultural and urban development. |

Notes at end of table.

## Table 4.9-1

### Special-Status Species Associated with Aquatic Habitats

| Species | Status | | | | Management Concerns | |
|---|---|---|---|---|---|---|
| | State[1] | Federal[1] | CNPS[1] | Source | Habitat | Potential Threats |
| *Rana aurora draytoni* California red-legged frog[8] | SSC | FT | -- | 2,3,4,5, 7 | Marshes, streams, lakes, reservoirs, and ponds in foothills and grasslands. | Habitat destruction due to agricultural and urban development, introduction of exotic predators, degradation of water quality, and changes in flow regimes. |
| *Rana boylii* Foothill yellow-legged frog | SSC | -- | -- | 2,4,5 | Fast-moving streams and rivers in chaparral, forests, and woodlands. | Habitat destruction due to agricultural and urban development, introduction of exotic predators, degradation of water quality, and changes in flow regimes. |
| **REPTILES** | | | | | | |
| *Clemmys marmorata marmorata* Northwestern pond turtle | SSC | -- | -- | 2,3,4 | Lakes, ponds, reservoirs, and slow-moving streams and rivers, primarily in foothills and lowlands. | Habitat destruction, degradation of water quality, and changes in flow regimes. |

Source: Harland Bartholomew and Associates, Inc., 1996

Notes:

1. State status data taken from California Department of Fish and Game documents, Endangered and Threatened Animals of California and Listing Dates (Revised January 1995) and Special Animals (Revised August 1994)

   SE = State-listed Endangered

   ST = State-listed Threatened

   SSC = Species of Special Concern

Federal status and probable distribution in Marin and Sonoma counties determined by correspondence with Laurie Simons-United States Fish and Wildlife Service, 9 February 1994.

FE = Endangered

FT = Threatened

FPE = Proposed Endangered

FPT = Proposed Threatened

FC = Candidate for listing under the Endangered Species Act

CNPS 2 = California Native Plant Society List 2

CNPS3 = California Native Plant Society List 3

CNPS4 = California Native Plant Society List 4

2. CNDDB = Natural Diversity Data Base, California Department of Fish and Game, 15 March 1995.
3. Distribution of State listed species and Species of Special Concern confirmed with California Statewide Wildlife Habitat Relationships System, California Department of Fish and Game, April 1990.
4. United States Fish and Wildlife Service letter from Cay Goude, 16 February 1995.
5. Species requested to be included by Caitlin Bean, California Department of Fish and Game Biologist, Region 3.
6. United States Fish and Wildlife Service letter from Joel Medlin, 22 June 1995.
7. Federal Register, 61 (101) 25813-25833.

Habitat Sources:

California Department of Fish and Game Natural Heritage Program, Natural Diversity Data Base, 23 December 1993.

EIP Associates. December 1990. Santa Rosa Sub-Regional Water Reclamation System "Long-Term Wastewater System Draft Environmental Impact Report/Statement."

Note: In a series of federal register notices (50 CFR Part 17, Volume 61, Number 40, 7457-74563 and 7595-7613, February 28, 1996), the United States Fish and Wildlife Service reclassified 96 candidate taxa of plants and animals. The United States Fish and Wildlife Service no longer recognizes a federal candidate category 2 status. There are now 182 plant and 89 animal taxa on a single candidate species list. These taxa are considered by the United States Fish and Wildlife Service as candidates for possible addition to the List of Endangered and Threatened Plants and Animals. As a consequence, the status of many taxa originally included in the analysis has changed, requiring that many taxa be removed from the list of species being considered in this EIR/EIS analysis. See Biological Resources, Volume 2 for further information (Harland Bartholomew & Associates 1996b).

8 Note: There are two closely related subspecies of red-legged frog in the Project area: California and northern. The identity of the species within any one alternative is unclear. Northern red-legged frogs are a California Department of Fish and Game species of special concern. The California red-legged frog is federally-threatened.

The recent federal ruling establishing the final status of California red-legged frog as federally-threatened provided the geographic range of the species. Red-legged frogs in the Walker Creek, Sonoma Creek, Petaluma River, and Tolay Creek watersheds are identified as the California subspecies and are considered federally-threatened (personal communication, Karen Miller, USFWS, July 11, 1996.) All other red-legged frogs in the Project area appear to be the northern subspecies, although final confirmation as not been received.

In the current analysis, all red-legged frogs in the Project area are considered to be the California subspecies though the status will be confirmed prior to the Final EIR/EIS. All red-legged frogs not determined to be the California subspecies will be evaluated as a species of special concern. Findings of significance and proposed mitigation are not expected to change.

## Table 4.9-2

Relationship of Aquatic Plant Community and Wildlife Habitat Relationship System Habitat Type

| Aquatic Plant Community | Corresponding CWHR Habitat |
|---|---|
| N/A | Estuarine |
| Coastal Brackish Marsh | Saline Emergent Wetland |
| Coastal Salt Marsh | Saline Emergent Wetland |
| Freshwater Marsh | Fresh Emergent Wetland |
| Freshwater Pond | Lacustrine (Palustrine[1]) |
| Freshwater Seep | Habitat element within various Wildlife Habitat Types |
| N/A | Riverine |
| Drainage | Habitat element of Annual Grassland |
| Seasonally Wet Vegetation | Habitat element of Annual Grassland |
| Vernal Pool | Habitat Element of Annual Grassland |

Source: Grentell, W. E., Jr., 1988. A Guide to Wildlife Habitats of California

Notes:
N/A Not Applicable
CWHR California Wildlife Habitat Relationship System
1. Freshwater ponds are conventionally considered palustrine habitat and will be referenced throughout this section as palustrine, though the CWHR System groups lacustrine and palustrine together under lacustrine.

Titles used below refer to aquatic plant community. Corresponding CWHR habitat is in parentheses.

### ***Estuaries***

#### *Estuarine*

Estuaries develop in the mouths of partially closed rivers or bays where inflowing fresh water mixes with marine water. Estuaries are dynamic systems influenced by many randomly occurring elements of the physical environment. The water chemistry (e.g., salinity) and hydrology of estuaries are influenced daily and seasonally by tributary stream hydrology and tidal rhythms.

The marine influence of small estuaries of the Sonoma and Marin counties coastal region is interrupted, on a seasonal basis, by sand bar formation at the mouth of the estuaries. During these times, water movement between the marine and estuarine environments is greatly reduced. The resultant ecosystem is largely defined by the hydrology of the inflowing streams. If the incoming stream flows are perennial and of sufficient volume to overcome evaporative losses, the resultant system will be hyposaline (lower concentration of salt ) and a brackish (salt concentration greater than freshwater and less than saltwater) marsh may be formed. If the inflowing streams are intermittent, the resultant ecosystem from evaporative losses may become hypersaline (higher concentration of salt) and support a unique assemblage of salt-tolerant species.

Estuaries provide important habitat for a variety of organisms. Many aquatic organisms complete their entire life cycle within the estuary (e.g., tidewater goby [*Eucyclogobius newberryi*] and staghorn sculpin [*Leptocottus armatus*]). Estuaries are important migration corridors for anadromous salmonids, lampreys, and other fishes. These migratory species must undergo dramatic physiological changes in order to survive the transition between fresh water and saltwater environments. Estuaries provide a location where this transition can occur.

Estuaries in the Area of Indirect Impacts provide habitat elements for cover, resting, reproduction, and foraging for many birds and mammals, including a variety of waterfowl species and special-status birds including California clapper rail (*Rallus longirostris obsoletus*) and California black rail (*Laterallus jamaicensis coturniculus)*. Plant cover associated with estuaries provides shelter for shorebirds during severe winter storms. Eelgrass beds are a characteristic element of estuaries. Eelgrass provides a critical food source for migratory brant (*Branta bernicla*) and other water birds. Eelgrass beds are discussed in more detail in the West County regional description.

### *Coastal Brackish Marsh (Saline Emergent Wetland)*

Coastal brackish marsh is a plant community that contains elements from both salt marsh and freshwater marsh plant communities. The plants in this community have evolved in response to a unique set of ecological conditions including seasonal variations in inundation areas, variable salinity, changing hydrology due to seasonal flooding, and periodic desiccation. Salinity may vary considerably, and may increase at high tide or during seasons of low freshwater runoff. Coastal brackish marsh gradually intergrades with coastal salt marsh toward the ocean and along the interior edges of coastal bays, estuaries, and coastal lagoons. Occasionally, coastal brackish marsh intergrades with freshwater marsh at the mouths of rivers (Madrone Associates 1977). Within the Area of Indirect Impacts, coastal brackish marsh is found on the upper reaches of the Estero Americano and the Estero de San Antonio.

Coastal brackish marsh has been classified by the California Department of Fish and Game as a sensitive natural community (California Department of Fish and Game 1995). Plant species found within the coastal brackish marsh community are normally dominated by perennial, emergent, herbaceous monocots that grow to around six feet in height (Holland 1986). Resident bird species that forage in coastal brackish marshes include the black-crowned night-heron (*Nycticorax nycticorax*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), and snowy egret (*Egretta thula*) (Harvey et al. 1992). Typical nesting birds in coastal brackish marshes include American bittern (*Botaurus lentiginosus*), cinnamon teal (*Anas cyanoptera*), common yellowthroat (*Geothlypis trichas*), mallard (*Anas platyrhynchos*), marsh wren (*Cistothorus palustris*), sora (*Porzana carolina*), and Virginia rail (*Rallus limicola*) (Harvey et al. 1992). Coastal brackish marshes provide vegetation that is consumed by beavers (*Castor canadensis*) and muskrats (*Ondatra zibethica*). Predators that utilize coastal brackish marshes as foraging habitat include mink (*Mustela vison*), river otter (*Lutra canadensis*), red fox (*Vulpes vulpes*), and northern harrier (*Circus cyaneus*) (Harvey et al. 1992). Special-status animal species that are found in coastal brackish marshes include salt marsh harvest mouse (*Reithrodontomys raviventris*) and California black rail.

### *Coastal Salt Marsh (Saline Emergent Wetland)*

Coastal salt marsh communities are tidally influenced emergent wetland habitats dominated by salt tolerant plants (Lewis 1982). Salt marshes are usually found in sheltered inland margins of bays, lagoons, and estuaries (Holland 1986) and are characterized by the presence of perennial emergent grasses, succulent herbs, and suffrutescent (herbaceous above, with a woody base) shrubs (Springer 1988).

Salinity levels in salt marshes vary temporally and spatially, increasing in dry summer months or at high tide and decreasing during periods of freshwater inflow. Species composition and densities are influenced by the salinity of the supporting water matrix. The very salt-tolerant cord grass (*Spartina* sp.) may dominate communities near open waters while pickleweed often dominates in the mid-littoral (near shore) zones.

Northern coastal salt marsh has been identified by the California Department of Fish and Game as a sensitive natural community.

Salt marsh communities occur at several locations within the Area of Indirect Impacts. The most extensive of these salt marsh communities are associated with the mouths of the Estero Americano and Estero de San Antonio. Salt marsh habitat also occurs along the lower reaches of Walker Creek where it flows into Tomales Bay, along the lower Petaluma River where it enters San Pablo Bay in Marin County, and along the shoreline of Bodega Harbor.

Salt marshes are used by a wide diversity of wildlife species. Waterfowl and shorebird species utilize this habitat for foraging and nesting. Common salt marsh bird species include great blue heron, great egret, American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus mexicanus*), mallard, ruddy duck (*Oxyura jamaicensis*), and cinnamon teal. Songbirds such as song sparrow (*Melospiza melodia*), common yellowthroat, red-winged blackbird (*Agelaius phoeniceus*), and marsh wren also nest in this habitat. In addition, raptors such as northern harrier, red-shouldered hawk (*Buteo lineatus*), white-tailed kite (*Elanus leucurus*), and short-eared owl (*Asio flammeus*) forage in salt marshes. Salt marshes also serve as an important winter foraging area for the endangered peregrine falcon (*Falco peregrinus*). Mammal species that are common in this habitat include raccoon (*Procyon lotor*), mink, river otter, a variety of shrews (*Sorex* spp.), voles (*Phenacomys* spp.), and mice. While local reptiles and amphibians do not normally inhabit salt marshes, Pacific gopher snake (*Pituophis melanoleucus catenifer*), garter snakes (*Thamnophis* spp.), Pacific chorus frog (*Pseudacris regilla*), and western toad (*Bufo boreas*) may sometimes be found on the periphery of this habitat.

A variety of special-status plants occur in coastal salt marsh. These species include Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris*), small spikerush (*Eleocharis parvula*), and marsh gumplant (*Grindelia stricta* var. *angustifolia*). Special-status animal species potentially found in salt marshes include salt marsh harvest mouse, California clapper rail, California black rail, San Pablo vole, San Pablo song sparrow, and saltmarsh yellowthroat.

### *Static Freshwater Communities*

#### *Palustrine (Lacustrine)*

Palustrine habitat includes all nontidal wetlands dominated by emergent mosses, lichens, persistent emergents, shrubs, or trees, and tidal wetlands with similar characteristics and salinity levels less than 0.5 percent (Cowardin et al. 1979). Wetlands exhibiting the four following characteristics may also be identified as palustrine (despite the absence of the vegetation described above) (Cowardin et al. 1979):

- Absence of bedrock or active wave-formed shoreline features;
- Water depth less than 6.6 feet at the deepest point of the basin;
- Less than 20 acres in area; and
- Less than 0.5 percent salinity.

Bogs, fens, marshes, prairies, and swamps are vegetated wetlands that are characterized as palustrine habitats. Small ponds (i.e., shallow, intermittent, or permanent water bodies) are also included as palustrine habitat. Palustrine wetlands may be located above the shoreline of estuaries, lakes, river channels, or on river floodplains, on slopes or in isolated catchments. Lakes or rivers may also contain islands of palustrine wetland habitat.

The separation of palustrine and lacustrine habitats is frequently unclear and is primarily determined by the type of water mixing and vegetation present in the water body (Goldman and Horne 1983). When convective mixing (mixing due to thermal gradients) predominates, a water body may be considered a pond. Conversely, a water body may be considered a lake when wind plays the dominant role in mixing. The frequent thermal stratification of pond waters, and abundant growths of floating and rooted aquatic macrophytes are characteristics which also help to define palustrine habitats (Goldman and Horne 1983).

### *Freshwater Marsh (Fresh Emergent Wetland)*

Freshwater marsh vegetation is characterized by herbaceous plants adapted to perennially wet aquatic habitats (hydrophytes) and occurs near the edges of rivers and lakes or in basins or depressions that flood periodically. In the Area of Indirect Impacts, freshwater marsh habitat may be found in association with perennial streams, around farm ponds, or adjacent to the margins of estuaries.

Coastal and valley freshwater marsh is a type of plant community that has been identified by the California Department of Fish and Game as a sensitive natural community.

The roots of marsh plants are adapted for anaerobic conditions during periods of inundation. Perennial monocots such as Baltic rush and nutsedge (*Cyperus esculentus*) often dominate the upper fringes of marsh habitats, whereas cattails and tules (*Scirpus acutus* var. *occidentalis*) occur in deeper waters.

Freshwater marsh supports a high diversity of wildlife species. Many species of fish, amphibians, reptiles, birds, and mammals depend upon marshes for food, cover, and water. The entire life cycle of many species is completed within this wetland habitat. Birds are particularly suited to exploit this habitat. Typical species found in freshwater marsh include belted kingfisher (*Ceryle alcyon*), great blue heron, green heron (*Butorides virescens*), great egret, American coot, marsh wren, and red-winged blackbird. Freshwater marshes also provide important feeding and resting habitat for resident waterfowl including mallards and migratory waterfowl such as ring-necked ducks (*Aythya collaris*). Other common vertebrate species found in the freshwater marsh community include bullfrog (*Rana catesbeiana*), Pacific chorus frog, western aquatic garter snake (*Thamnophis couchi*), common garter snake (*Thamnophis sirtalis*), muskrat, raccoon, shrews and cottontails (*Sylvilagus* spp.) Carp (*Cyprinus carpio*), mosquito fish (*Gambusia affinis*), bullhead, and sunfish (*Lepomis* spp.) are common fish species found in marshes. Many of these fish species provide an important food source for predators which hunt in the marsh environment.

Many special-status plant species, including Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*), Bolander's reed grass (*Calamagrostis bolanderi*), Thurber's reed grass (*Calamagrostis crassiglumis*), swamp harebell (*Campanula californica*), white sedge (*Carex albida*), and Pitkin Marsh lily (*Lilium pardalinum* ssp. *pitkinense*) are found in freshwater marsh habitats. Special-status animal species associated with freshwater marsh habitats include tricolored blackbird (*Agelaius tricolor*), great blue heron, short-eared owl, and northern harrier (Table 4.8-1).

Portions of the bay lands, including areas potentially containing freshwater marshes, were not accessible for on-site surveys. Therefore, color aerial photographs (3x3 inch color slides; April 1994) were used to map and evaluate the vegetative communities. Although wetland areas were discernible on the photographs, it was not possible to determine the type of wetland habitat present, for example, freshwater marsh, seasonal wetland, vernal pool, or brackish marsh. Therefore, these areas were mapped as "undetermined wetland type."

### *Freshwater Pond (Lacustrine)*

Palustrine habitats within the Area of Indirect Impacts include man-made impoundments created by the damming of natural drainage channels. These impoundments (freshwater ponds) primarily collect water for agricultural uses including irrigation and livestock watering. Phytoplankton such as algae and diatoms comprise the greatest biomass of plant species in freshwater ponds (Grenfell 1988). Shoreline vegetation often consists of floating rooted aquatic plants such as water lily (*Nuphar* spp.) and knotweed (*Polygonum* spp.). California bulrush (*Scirpus californicus*) and common cattail (*Typha* spp.) are typical freshwater marsh plants that frequently occur along the shorelines of freshwater ponds (Grenfell 1988). Vegetation is commonly harvested from stock ponds in the fall to provide greater storage capacity for the following spring.

Freshwater ponds provide important nesting habitat for resident birds including mallard, pied-billed grebe (*Podilymbus podiceps*), American coot (*Fulica americana*), song sparrow, and red-winged blackbird. In winter, migratory waterfowl utilize this habitat type for feeding and resting (e.g., lesser scaup [*Aythya affinis*]). Garter snakes and bullfrogs also frequently occur in this aquatic habitat type. Many species of sunfish and catfish (*Ictalurus* spp.) are often stocked in man-made freshwater ponds.

There are no special-status plant species specifically associated with man-made freshwater ponds. Special-status animal species found in freshwater ponds include northwestern pond turtle (*Clemmys marmorata marmorata*).

Although considered as palustrine under the Cowardin classification system, man-made freshwater ponds are included under the CWHR lacustrine habitat type (see Table 4.9-2).

### *Freshwater Seep (Element of Many Wildlife Habitat Types)*

Seeps occur where the groundwater table is high or where underground springs seep water out of the ground. Seeps are common at many locations throughout the Area of Indirect Impacts, and may form permanently or temporarily wet conditions. Seepage from underground springs produces an environment conducive to the growth of hydrophytic grasses, rushes, sedges, and herbaceous vegetation.

Freshwater seeps are included as a habitat element within various Wildlife Habitat Relationship System habitat types (Table 4.9-2). Many species of mammals and small birds utilize freshwater seeps as a source of water and cover. Reptiles and amphibians that occasionally use freshwater seeps include garter snakes and Pacific chorus frog.

Freshwater seep communities have the potential to support several special-status plant species including Mount Tamalpais thistle (*Cirsium hydrophilum* var. *vaseyi*), California lady's-slipper (*Cypripedium californicum*), Geyser's dichanthelium (*Dichanthelium lanuginosum* var. *thermale*), and California beaked-rush.

### *Seasonally Wet Vegetation (Element of Annual Grassland)*

Seasonal wet vegetation wetland is a common plant community or habitat in the Area of Indirect Impacts. This plant community or habitat occurs in shallow depressions, swales, and drainages that fill with precipitation and runoff, and remain saturated or inundated during winter and spring months. These habitats support species adapted to temporarily wet conditions followed by long periods of desiccation. Seasonal wetlands support many of the same types of species found in vernal pools and freshwater seeps.

Seasonal wetlands provide important foraging habitat for migratory waterfowl and shorebirds, and nesting habitat for mallard and cinnamon teal. Wildlife species observed utilizing seasonal wetlands also include black-tailed deer (*Odocoileus hemionus*), black-tailed jackrabbit (*Lepus californicus*), California ground squirrel (*Spermophilus beecheyi*), gopher snake, gray fox (*Urocyon cinereoargenteus*), and muskrat (Harvey et al. 1992). This wetland habitat type also often supports a high diversity of small aquatic invertebrates, (i.e., zooplankton, mollusks, crustaceans, and aquatic insect larvae). In addition, vertebrates such as Pacific tree frog use seasonal wetlands as breeding habitat.

Special-status plant species that occur in habitats which support seasonally wet vegetation include Sonoma sunshine, Sebastopol meadowfoam (*Limnanthes douglasii* ssp. *sulphurea*), Baker's navarretia (*Navarretia leucocephala* ssp. *bakeri*), Burke's goldfields (*Lasthenia burkei*), and Douglas's pogogyne

(*Pogogyne douglasii* ssp. *parviflora*). Special-status animal species that use seasonal wetlands as breeding habitat include California tiger salamander (*Ambystoma californiense*).

### *Vernal Pool (Element of Annual Grassland)*

Vernal pools, a subclass of seasonal wetlands, occur in formed depressions in grasslands and other habitats that are underlain with an impervious layer. These depressions fill with water in the winter and slowly dry in the spring and summer. Vernal pools are characterized by four different stages. These stages include a filling stage in the fall, a holding stage in the winter, a drying stage in the spring, and a dry stage through the summer (Zedler 1987). Vernal pools are classified according to the substrate on which they occur. These substrates include terrace soils, volcanic mudflows, and hardpan.

Northern vernal pool and northern hardpan vernal pool are two types of vernal pools that occur in the Area of Indirect Impacts and have been identified by the California Department of Fish and Game as sensitive natural communities.

Spectacular spring wildflower displays develop in vernal pools. As water in the vernal pools recedes during the spring, vernal pool annual plants begin to germinate and grow. A concentric display (i.e., rings) of small but brightly-colored annual plants develops in the vernal pool basin as different plant species respond to the different and changing temperatures and hydrology of the drying pool. These concentric rings are not exhibited by all vernal pools, but are unique to vernal pools in California. This ecosystem is therefore relatively easy to identify during the spring and summer months, when surrounding vegetation is often dry and brown.

Vernal pools are included as a habitat element of the CWHR annual grassland habitat type (Table 4.9-2). Vernal pools are characterized by a high diversity of aquatic insect larvae and other macroinvertebrates including several species of endangered or threatened species of vernal pool shrimp. Pacific chorus frog and the special-status California tiger salamander use vernal pools as breeding habitat. In addition, many other wildlife species including cinnamon teal, common snipe (*Gallinago gallinago*), great egret, greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), mallard, and snowy egret, have been observed utilizing vernal pools as foraging or nesting habitat (Harvey et al. 1992). Migratory shorebirds and waterfowl make extensive use of vernal pools as foraging habitat during the winter months. Mammals that generally occur in the surrounding grassland habitat and occasionally use vernal pools include black-tailed jackrabbit, California vole *(Microtus californicus)*, deer mouse (*Peromyscus maniculatus*), and western harvest mouse (*Reithrodontomys megalotis*) (Harvey et al. 1992).

Vernal pools support a unique ecosystem. Introduced species make up less than seven percent of the total number of species found in vernal pools (Holland and Jain 1977). Of the 32 special-status plant species addressed in this section of the EIR/EIS, 10 species are associated with vernal pools or other seasonal wetlands. Representative special-status plant species that may be found in vernal pools of the Area of Indirect Impacts include dwarf downingia (*Downingia pusilla*), Sonoma sunshine (*Blennosperma bakeri*), Sebastopol meadowfoam, many-flowered navarretia (*Navarretia leucocephala* ssp. *plieantha*), and Burke's goldfields.

### *Rivers and Streams (Riverine)*

Riverine habitats are channeled wetlands, such as rivers and streams, that are created naturally or artificially. Riverine habitats can be characterized as perennial (permanent flow) or intermittent (periodic flow) depending on flow regime. Streams and rivers originate from higher elevation sources (springs and lakes) and flow downward at a rate relative to slope and water volume. Water velocity will normally decline as the stream approaches progressively lower elevations, while water volume will continue to increase until the flow becomes slow-moving. During this transition from fast-moving to slow-moving water, temperature and turbidity tends to increase, while dissolved oxygen decreases or becomes more variable (Grenfell 1988).

Open waters of rivers and streams provide suitable foraging habitat for gulls (*Larus* sp.), osprey (*Pandion haliaetus*), and bald eagle (*Haliaeetus leucocephalus*). Waters near shore provide foraging habitat for waterfowl, herons, shorebirds, and belted kingfisher (*Ceryle alcyon*). Insect-eating birds include swallows, flycatchers, and swifts that forage above the open waters. Common mammals found in riverine habitats include striped skunk (*Mephitis mephitis*), raccoon, mink, river otter, and muskrat (Grenfell 1988).

Aquatic riverine habitats are often classified according to their ability to support different faunal (i.e., animal) assemblages (Merritt Smith Consulting 1996b). Assessment of aquatic riverine habitat quality is based on a combination of factors including water temperature, water quality, extent of riparian canopy, substrate type, stream gradient (i.e., slope), presence of riffles (i.e., areas of shallow turbulent water passing through or over stones on gravel of a fairly uniform size), amount of instream shelter, presence and quality of gravel spawning beds, bank stabilization, abundance of insects, and permanence (i.e., perennial or intermittent).

#### *Ephemeral/Drainage (Riverine)*

Ephemeral riverine habitats (including drainages) contain flowing water for only part of the year. Flow may cease anytime from late spring to early autumn depending on the water source and climate. Standing water may or may not remain as isolated pools within the streambed. Substrate types of intermittent riverine habitats range from fine sediments to mud to bedrock. Vegetation along intermittent streams (if present) includes spike rush, toad rush, spreading rush, prickle-fruited buttercup, and water sedge. The wildlife species that commonly utilize intermittent streams include garter snakes and bullfrog.

Special-status animal species occasionally found inhabiting intermittent streams (with at least some permanent pools) include California freshwater shrimp (*Syncaris pacifica*) and Tomales isopod (*Caecidotea tomalensis*). Special-status plant species that may occur in intermittent streams include Rattan's milk-vetch, streamside daisy, and Lobb's aquatic buttercup.

### *Perennial (Riverine)*

Perennial streams flow year-round. Perennial riverine habitats can be grouped into two separate categories; lower perennial and upper perennial.

Upper perennial riverine habitats have steeper gradients and higher current velocities than lower perennial habitats. The substrate of upper perennial streams generally consists of rock, cobble, or gravel, with occasional patches of sand. Shallow, fast-flowing reaches have gravel or boulder substrates and are called "riffles." Deep, slow-flowing reaches have sand or mud substrates and are called "pools." The characteristic species assemblages of upper perennial riverine habitats are primarily associated with the rocky substrates of riffles and include diatoms, mayflies, stoneflies, and black flies. Fish species associated with upper perennial riverine habitats include steelhead trout, Coho salmon, sculpin (*Cottus* sp.), splittail, hard head *(Mylopoharodon canocephalus)* and California roach *(Hesperoleucus symmetricus)*. Protected pools may support species similar to those found in lower perennial riverine habitats due to the similarities in substrate size and stream flow velocity, but more often harbor only salmonids or sculpin (Jones & Stokes Associates 1981).

Special-status species found in perennial streams include Tomales isopod, California freshwater shrimp, Coho salmon, steelhead, California red-legged frog, foothill yellow-legged frog, northwestern pond turtle, splittail, and hardhead.

Lower perennial riverine habitats are characterized by a gentle gradient and are associated with the lower reaches of streams that approach ocean outfall (Jones & Stokes Associates 1981). These streams reach relatively low current velocities. The stream bottom is typically composed of mud or sand.

Characteristic species assemblages found in lower perennial habitats consist of planktonic organisms such as diatoms, copepods, and green algae, as well as sand or mud bottom-dwellers including amphipods, midge fly larvae, and freshwater clams. Native fish species found in lower perennial habits include Sacramento sucker (*Catostomus occidentalis*), California roach, Sacramento blackfish (*Orthodon microlepidotus*), and Sacramento squawfish (*Ptychocheilus grandis*). Introduced species found in lower perennial habitats include several species of centrarchids (i.e., black bass, smallmouth bass, bluegill, green sunfish, and black crappie).

## Regional Resource Planning Efforts

Many fish and other aquatic species are commercially and recreationally important. In addition, unique and sensitive aquatic resources exist throughout the Area of Indirect Impacts. Consequently, many private and public large-scale planning efforts have been undertaken throughout Sonoma and Marin counties in part to protect, restore, and conserve these resources. A summary of the major regional planning efforts and their guidelines for natural resources protection is presented in Table 4.8-4 in the Terrestrial Biological Section.

## Local Geographic Area Resource Description

The Project area in Sonoma and northern Marin counties can be divided into five relatively distinct geographic areas (i.e., Santa Rosa Plain/Russian River, West County, South County, Sebastopol, and geysers) based primarily on watersheds and their associated aquatic and terrestrial biological resources. A brief discussion of local watersheds, associated aquatic resources (including special-status species), and local resource planning efforts of each geographic region is provided below (see Figures 4.8-1a, 1b, and 1c in Section 4.8, Terrestrial Biological Resources).

### *Santa Rosa Plain/Russian River*

The major watersheds associated with the Santa Rosa Plain/Russian River geographic area are the Russian River and the Laguna de Santa Rosa. Mark West Creek is a major tributary draining into the Russian River from the northwest and the Laguna de Santa Rosa from the south. Santa Rosa Creek is the main tributary draining the Laguna de Santa Rosa from the east. However, other smaller perennial and intermittent creeks are also present within this geographic area.

#### *Russian River*

The Russian River, which drains approximately 1,485 square miles in Mendocino and Sonoma counties, originates in Mendocino County, meanders south through the Alexander Valley, and eventually cuts through the Mendocino Range to the ocean at Jenner. The Russian River is the largest river between San Francisco and Point Delgado on the northern California coast, measuring 110 miles in length (Goodwin et al. 1994). Large creek systems that flow from the surrounding steep, mountainous terrain comprise the watershed of the river.

These creeks drain to the flat, alluvial valleys of the upper and middle river, and to the lower canyon that begins at Wohler Bridge. The river reaches tidewater near Duncan Mills and enters the ocean at Jenner where an estuary has formed.

The Russian River has been impacted by agricultural and urban development, and flow is controlled by impoundments at Lake Mendocino and Lake Sonoma (EIP 1990). Flow releases from these reservoirs during the summer and winter months strongly influence river hydrology and temperature, which in turn influences the composition of the aquatic community in the river. Other impacts to the river include treated wastewater discharges from the cities of Healdsburg, Santa Rosa, and others (the winter discharge from the Santa Rosa Subregional System flows from the Laguna de Santa Rosa into the river at Mirabel); gravel mining; summer check dams; water diversions; septic system discharges; flooding; and urban and agricultural runoff. Vineyards, gravel skimming operations, and cattle grazing also occur at numerous points along the river.

The Russian River provides wildlife and fish habitat, many recreational use areas, and a drinking water supply. Several species of warmwater fish are resident in the river, while cold-water fish (i.e., steelhead trout and coho salmon) occur primarily as migrants between the ocean and the upriver spawning habitat. The Sonoma County Water Agency and the Windsor Water District, as well as numerous communities, divert drinking water from the river. Residents and vacationers swim, canoe, and fish along the river in many areas. Many vacation homes lie downstream of Wohler Bridge.

The Russian River is essentially a "warmwater" fish habitat for at least five months of each year, which means that water temperatures are too high in summer for salmonids (steelhead, coho salmon, chinook salmon) and other "coldwater" fishes (Merritt Smith Consulting 1995). Salmonids are not year-round residents of the river. Salmonid spawning and juvenile rearing take place in the upper reaches of smaller tributaries where suitable spawning gravels are present and cooler water persists throughout the summer months. The fish species resident in the mainstream throughout the year are native species such as Sacramento sucker, hardhead, Sacramento squawfish, and California roach, and introduced warmwater species such as carp, smallmouth bass, largemouth bass, bluegill, and catfish.

The Russian River estuary, which consists of the lower few miles of the river between Duncan Mills and Jenner, is subject to sand bar closure at the mouth during summer low flow periods. However, in recent years, the mouth has been kept open by artificial means to prevent flooding of homes located along the banks near Jenner. Artificial breaching of the sand bar in the summer of 1992 and spring of 1993 appeared to have minimal impacts on the estuarine community. However, historical biological data associated with the estuary are lacking (Goodwin 1994). The estuary supports fish species typical of other estuaries in the region including Pacific herring (*Clupea harengus*), topsmelt (*Atherinops affinis*), bay pipefish (*Syngnathus leptorhynchus*), shiner surfperch (*Cymatogaster aggregata*), starry flounder (*Platichthys stellatus*), staghorn sculpin (*Leptacottus armatus*), and threespine stickleback (*Gasterosteus aculeatus*) (California Department of Fish and Game 1984, M. Fawcett, pers. communication). Other fish species occasionally captured by fishermen in the Russian River estuary include striped bass and white sturgeon (*Acipenser transmontanus*). However, neither of the latter two species are residents or routine visitors to the Russian River estuary. The occasional captures probably represent straying or feeding forays by individuals during their movements along the coast.

Two species of pinnipeds (seals and sea lions) consistently use the area at the mouth of the Russian River. Harbor seals (*Phoca vitulina*), sometimes numbering in the hundreds, are found at this site all year and use the sandspits on either side of the river mouth as haul-out locations (areas where pinnipeds congregate to rest). Their preferred haul-outs on the sandspits are located inside the estuary near the river mouth rather than on the outside adjacent to the open ocean. California sea lions (*Zalophus californianus*) are also present in the area from December through June each year. In contrast to the large resident harbor seal population, sea lion numbers are low (rarely more than five individuals), as they normally do not come ashore at this site. Sea lions forage, as do a small number of harbor seals, in the area near the river mouth. Juvenile elephant seals were occasionally seen on the haul-out during 1992. Their appearance is unusual since they have not been previously reported using this site as a haul-out location (Sonoma County 1994). Other mammals that live in or are associated with the river include mink, river otter, and raccoon.

### *Laguna de Santa Rosa*

The Laguna de Santa Rosa (Laguna) is a major tributary of the lower Russian River. The Laguna is a wide, marshy area lying along the western edge of the Santa Rosa Plain that drains to the Russian River. The boundaries of the Laguna de Santa Rosa have lacked a clear definition in the past. The headwaters of the Laguna are located in the hills south and east of the City of Santa Rosa. The creek then enters the Santa Rosa Plain near Stony Point Road and meanders to the north. Immediately west and north of the City of Santa Rosa, the Laguna de Santa Rosa merges with Mark West Creek. Some have referred to the waterway as Mark West Creek from this point to the Russian River, and others have referred to the waterway as the Laguna de Santa Rosa. For the purposes of this report, the Laguna de Santa Rosa is defined as the waterway and its associated flood plain in the Santa Rosa Plain located below an elevation of 75 feet above mean sea level, between Stony Point Road to the south and the Russian River to the north.

The Laguna watershed covers approximately 250 square miles (160,000 acres) and is bounded by the Sonoma Mountains on the east and low foothills on the north, south, and west. Most of the streams feeding into the Laguna originate on the east side of the valley and include Santa Rosa Creek, Roseland Creek, and Matanzas Creek. Blucher Creek originates on the west side of the valley.

The Laguna area formerly supported a gently sloping complex of riparian forests, marshes, and lakes. However, due to commercial and residential development over the last several decades, very little of this complex remains. On higher ground, remnants of oak savanna and grasslands of the Santa Rosa Plain are present among the farmlands. Although many of the area's wetlands have been degraded or eliminated by development, the Santa Rosa Plain still supports many types of wetlands including vernal swales, vernal pools, other seasonal wetlands, permanent ponds, marshes, intermittent and perennial creeks, and the Laguna de Santa Rosa (CH2M Hill 1995).

The Laguna is a slow-moving stream of very slight gradient which overflows its banks regularly. The Laguna floodplain serves as an important flood storage area for the Russian River (De Mars et al. 1977), storing up to nearly 80,000 acre-feet of water during 100-year flood events. This retention capacity translates into a 14-foot reduction of the flood peak at Guerneville on the Russian River.

In addition to the flood control benefit of the Laguna, the area provides extensive lands that are suitable for farming and ranching. Agricultural uses of the Laguna area include dairy operations, vineyards, orchards, and small ranches. These diverse land uses provide a valuable open space greenbelt.

Marshes and seasonal wetlands in the area surrounding the Laguna provide wildlife (including waterfowl) and fish habitat, and opportunities for recreational and local educational uses such as hunting and birdwatching (CH2M Hill 1995). Several rare or endangered animal and plant species are found in the habitat provided by these wetlands. Nearly 300 animal species, including California roach, carp, Sacramento sucker, Pacific chorus frog, and northwestern pond turtle, are known to occur in the Laguna area (Smith and CH2M Hill 1990). The Laguna also serves as a migration corridor for fish. Steelhead trout and coho salmon migrate through the Laguna to their natal (original location where fish were hatched) streams to spawn.

The Laguna receives reclaimed water from the Santa Rosa Subregional System and Windsor Water District and is also influenced by urban and agricultural runoff. Stormwater runoff from four cities (Santa Rosa, Sebastopol, Cotati, and Rohnert Park) contributes metals, solids, and nutrients to the Laguna. Dairies, vineyards, orchards, and grazing lands also drain to the waterway and add to the nutrient and solid loads of the Laguna.

### *Mark West Creek*

Mark West Creek is one of the principal tributaries of the Laguna de Santa Rosa and the Russian River. Mark West Creek enters the Russian River at Mirabel Park and drains an area of approximately 254 square miles in the southeastern portion of the drainage basin (EIP 1990). Mark West Creek is a perennial stream that supports an annual run of steelhead trout and provides habitat for other resident special-status species including northwestern pond turtle and Russian River tule perch. Although Mark West Creek also provides suitable habitat for other special-status aquatic species such as foothill yellow-legged frog, California red-legged frog, and coho salmon, these species were rare or absent during recent surveys of the creek (Merritt Smith Consulting 1996b, 1996c, 1996d).

### *Santa Rosa Creek*

The Santa Rosa Creek watershed is located in central eastern Sonoma County and includes most of the City of Santa Rosa. Santa Rosa Creek drains an area of approximately 78.6 square miles, which includes a variety of agricultural, parks and open space, and urban land uses. The creek is approximately 22 miles long from the headwaters in Hood Mountain Regional Park to the confluence with the Laguna de Santa Rosa. Elevation along the creek ranges from about 1,500 feet above mean sea level (msl) at the uppermost headwaters to about 40 feet above msl at the confluence with the Laguna de Santa Rosa. Santa Rosa Creek once provided a local drinking water supply (through the late 1800s), but is currently impacted by dairy runoff and stormwater flows from the City of Santa Rosa (Ralph J. Alexander & Associates 1993).

Channelization of Santa Rosa Creek (after the 1955 flood) decreased the in-stream shelter, reduced riparian canopy and substrate, and eliminated cool temperatures required by native aquatic species in the lower reaches. Consequently, the lower reach of Santa Rosa Creek (Santa Rosa Flood Control Channel) is now a warmwater habitat which supports aquatic fauna very similar to the Russian River. The upper reaches of Santa Rosa Creek remain in a semi-natural condition (with cool water and a dense canopy) and support an annual spawning run of wild steelhead trout (Merritt Smith Consulting 1995).

## ***West County***

The major watersheds associated with the West County area are Americano Creek, Stemple Creek, Estero Americano, and Estero de San Antonio. However, other perennial and ephemeral creeks are also present within this geographic area. The Laguna de Santa Rosa and its major tributaries are described under the Santa Rosa Plain/Russian River geographic area.

### *Americano Creek and the Estero Americano*

Americano Creek is about 10 miles long and drains approximately 49 square miles in Sonoma and Marin counties. The main channel of Americano Creek has been heavily influenced by potato farming, livestock grazing, and dairy farming (Madrone Associates 1977, California Coastal Commission 1987, Buell and Associates 1988). Historically, the Americano Valley was cleared primarily for potato cultivation in the last quarter of the 1800s (John Cummings, personal communication, November, 1995). In addition, due to trampling by livestock, the Americano Creek streambed is buried in silt and the banks have slumped and eroded (Smith 1988). Heavy grazing pressures have left the riparian vegetation highly fragmented. Though Americano Creek becomes dry each summer, isolated freshwater pools remain within the streambed. Cattle often utilize these pools as a water source, strip the vegetation, and pollute the water with cattle waste. The few remaining unpolluted pools with intact upland vegetation, which are located in upper tributaries, provide suitable habitat for California red-legged frog and northwestern pond turtle. Spawning runs of steelhead trout and coho salmon have been eliminated, though three individual steelhead trout have been observed in a tributary of the Americano Creek (Harland Bartholomew & Associates 1996a). California freshwater shrimp also once occurred in the Americano Creek, but have apparently been extirpated (Serpa 1991).

Americano Creek discharges to Bodega Bay through the Estero Americano. This estuary is an eight-mile long tidal embayment that extends inland (Commins et al. 1990). The Estero Americano is narrow and relatively shallow (depth at mean high water varies from two to seven feet). Widths range from a few feet near the upper (landward) end to about 1,000 feet in some locations in the middle reaches of the estuary. The Estero encompasses approximately 300 acres, with adjacent wetland habitats extending over an additional 412 acres. The Estero is connected to Bodega Bay by a narrow inlet channel across the beach. Daily tidal and freshwater action along with southwesterly littoral currents results in sand bar formation at the bay mouth that somewhat restricts tidal exchange with the ocean (United States Fish and Wildlife Service 1981). The Estero Americano sand bar is breached on an almost annual basis in the spring. During the late summer and early fall of some years, when the bars are not opened naturally or artificially, the Estero functions as a hypersaline lagoon due to high evaporation and elimination of tidal influence (Madrone Associates 1977). A mudflat appears in the middle reach of the lower Estero during the winter months and provides important foraging habitat for shorebirds (Commins et al. 1990).

Marine fish species such as ling cod (*Ophiodon elongatus*) and cabezon (*Scorpaenichthys marmoratus*) may enter the Estero to forage during high tides but are excluded from the Estero during the months when the bars are closed. When the sand bars are open, species diversity increases due to an influx of marine fish species that are adapted to both estuarine and marine environments (e.g., starry flounder and English sole [*Parophrys vetulus*]) and those fish species that complete their life cycle within estuarine environments (e.g., shiner surfperch [*Cymatogaster aggregata*] and tidewater goby). Species that spawn in the Estero (e.g., Pacific herring [*Clupea harengus*] and topsmelt [*Atherinops affinis*]) or spend the early part of their life cycle in estuaries (plainfin midshipman [*Porichthys notatus*]) are also present in the Estero (Merritt Smith Consulting 1996a). The Estero Americano historically supported spawning runs of coho salmon and steelhead trout. Occasional steelhead adults still wander into this watershed (CSCC 1977, Buell and Associates 1988, Merritt Smith Consulting 1996a).

The composition of the fish species assemblage in the Estero at any given time is strongly influenced by the relative salinity of the water. Species diversity increases as salinity increases when the sand bars are open, particularly near the mouth of the Estero. Decreased species diversity occurs when the bars are closed, primarily because salinity in the lower reaches of the Estero is reduced and coastal recruitment of marine species is precluded.

In addition to the more than 45 fish species documented in the Estero Americano, over 110 benthic invertebrate species have also been identified (Merritt Smith Consulting 1996a). The most common invertebrates are mysids, including caridian shrimp (*Crangon* spp.) and crabs. Crab species inhabiting the Estero Americano include Dungeness crab (*Cancer magister*), rock crab (*Cancer antennarius*), yellow shore crab (*Hemigrapsis oregonensis*), and the introduced green crab. Tidewater goby, a federal/state endangered species, is the only special-status aquatic species known to occur in the Estero Americano (Merritt Smith Consulting 1996a).

### *Stemple Creek and Estero de San Antonio*

The Stemple Creek watershed is located immediately south of the Americano Creek watershed. This watershed begins east of Petaluma and empties into the Pacific Ocean through the Estero de San Antonio. The watershed encompasses approximately 50 square miles, almost all of which is in agricultural production. The drainage is cut almost exactly in half by the Sonoma-Marin county line. Though probably perennial in the past, Stemple Creek is now ephemeral (Prunuske Chatham 1994). The mainstem and tributaries of Stemple Creek have been heavily influenced by livestock ranching and other agricultural operations. On the eastern and western ends of the watershed, near Petaluma and Dillon Beach, rural residential development is encroaching on the watershed. The land draining into Stemple Creek is largely gently-sloping grassland (Prunuske Chatham 1994).

The Estero de San Antonio has become degraded through historic cattle utilization (Merritt Smith Consulting 1996a). Most of the mainstem flows through dairy and other livestock operations, resulting in fragmented riparian vegetation and eroded streambanks. The streambed consists primarily of silt and the pools that persist during the summer are typically trampled and polluted by cattle. The few remaining unpolluted pools with intact upland vegetation provide suitable habitat for California red-legged frog, northwestern pond turtle, and California freshwater shrimp (Serpa 1991). The stream formerly supported runs of steelhead trout and coho salmon, but these runs were extirpated by the 1970s (Madrone Associates 1977).

A sand bar often forms periodically in the inlet to the Estero de San Antonio. However, spring tidal flows are usually strong enough to erode the accumulated sand and breach the bar. During years when normal spring tidal flows do not occur, the sand bar may persist until sufficient rainfall runoff accumulates to cut through and overtop the bar (Merritt Smith Consulting 1996a).

Stemple Creek becomes an estero near the community of Fallon and flows about seven miles to the west, crossing under State Highway 1 on its way to the Pacific Ocean. Estero de San Antonio, an embayed river mouth, lies within the northern two miles of Marin County (United States Fish and Wildlife Service 1981). The 93 acres of open water of the Estero reach a depth of approximately 20 feet and may vary in width from 20 feet to almost 200 feet. The Estero de San Antonio has not been observed to develop hypersaline conditions, due in part to the restricted tidal exchange and the freshwater inflow from Stemple Creek. Much of the wetland habitat along the Estero de San Antonio is considered to be seasonal brackish marsh (Madrone Associates 1977). The wetlands of the Estero de San Antonio encompass approximately 191 acres of the watershed (Merritt Smith Consulting 1996a).

Research results indicate that the aquatic animal species diversity is lower in the Estero de San Antonio than in the Estero Americano. Thirteen species of fish and 20 species of benthic invertebrates have been identified in the Estero de San Antonio (Commins et al. 1990, Madrone Associates 1977, Merritt Smith Consulting 1996a). Common species identified for the Estero Americano are also common to the Estero de San Antonio. Tidewater goby is the only special-status aquatic species known to occur in the Estero de San Antonio (Merritt Smith Consulting 1996a).

Eelgrass beds are a special habitat feature of both the Estero Americano and Estero de San Antonio. While both esteros are composed primarily of open water habitat with relatively bare muddy or sandy bottom, there are several reaches that contain luxuriant beds of eelgrass. The Estero Americano contains roughly nine acres of eelgrass beds, while the Estero de San Antonio has approximately two acres of eelgrass beds. Eelgrass beds occur primarily in the subtidal zone because the plants are relatively intolerant to air exposure (Jones & Stokes Associates 1981). Eelgrass is a flowering plant that roots in the soft muddy bottom sediments and provides habitat for marine invertebrates and fish (Prunuske Chatham 1994). This plant species is tolerant of a wide range of salinities, from as high as 42 parts per thousand (ppt) to as low as 10 ppt (Prunuske Chatham 1994).

Shrimp and gastropods graze on algae that grow on eelgrass blades. Other invertebrates that occur in eelgrass beds include isopods, amphipods, decapods, and sea slugs (*Phyllaplysia taylori*). A variety of fish, including surfperches, sculpins, gobies, pipefish, gunnels, kelpfish, and herring, spawn in eelgrass (Prunuske Chatham 1994). These habitats are typically quite productive and provide a refuge from predation for a variety of invertebrates and fish. Loons, grebes, cormorants, ducks, and gulls are birds that forage in and around eelgrass beds because of the rich prey base associated with this plant community. Harbor seals have also been observed foraging in the vicinity of eelgrass beds.

Mudflats, which occur at the mouths of the Estero Americano and Estero de San Antonio, are an important habitat element of the West County region. Approximately 89 acres of mudflats have been mapped for the Estero Americano, and about five acres of mudflats have been mapped for the Estero de San Antonio (Harvey 1990).

The formation of mudflats occurs when stream sediments and ocean-born sediments are deposited in the shallow areas of an estuary. Within the esteros, mudflats are characterized by the presence of soft substrate invertebrates and algal populations (Madrone Associates 1977). Typical invertebrate fauna include bivalve species such as common softshell clam (*Mya arenaria*), sand clam (*Macoma secta*), and bent-nosed clam (*Macoma nasuta*), as well as limpets, sea slugs, polychaete worms (*Glycera capitata* and *Streblospia benedicti*), and various crustaceans including amphipods, yellow shore crab, ghost shrimp (*Callianassa* sp.), opossum shrimp, rock lice, and Dungeness crab (Madrone Associates 1977).

The invertebrates associated with mudflats provide a rich food source for a variety of shorebirds including western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), killdeer (*Charadrius vociferus*), willet (*Catoptrophorus semipalmatus*), marbled godwit (*Limosa fedoa*), greater yellowlegs, American avocet (*Recurvirostra americana*), and long-billed and short-billed dowitchers (Connors and Maron 1989). Most of the shorebirds found in the esteros are migratory and are most common during the fall and spring months. Shorebirds tend to move in and out of the esteros on a tidal schedule, maximizing the amount of time that they can forage during low tide (Prunuske Chatham 1994).

### *South County (Including Bay Lands)*

The three major watersheds in the South County geographic area are the southern portion of the Laguna de Santa Rosa, Petaluma River, and Tolay Creek. Crane Creek and Copeland Creek feed into the Laguna de Santa Rosa. The main tributaries draining into the Petaluma River in the South County area are Adobe Creek, Lichau Creek, and Willowbrook Creek. The Petaluma River, Tolay Creek, and Sonoma Creek in turn are major tributaries that drain into San Pablo Bay. The Laguna de Santa Rosa and its major tributaries are described under the Santa Rosa Plain/Russian River geographic area.

#### *Petaluma River*

The Petaluma River originates in the interior valleys of the Coast Range and flows south to San Pablo Bay. The watershed encompasses approximately 52 square miles. Stream flow data recorded from 1948 through 1963 by the U.S. Geologic Survey (USGS) indicate that no freshwater inflow occurred during the summer months of most years and that the maximum river flows during this period occurred in November through April from storm-related runoff. From October 21 through April 30, the City of Petaluma Utilities Department discharges treated effluent through a submerged outfall to the Petaluma River. The Petaluma River is characterized by mixed daily tides in which two high tides and two low tides occur each day.

The Petaluma River and associated marsh provide important habitat to anadromous and resident fish species. Anadromous (life history pattern in which a fish spawns in freshwater, then young fish migrate to sea to mature) fish species include chinook salmon, steelhead trout, striped bass, American shad (*Alosa sapidissima*), and white sturgeon. Resident fish of the Petaluma River and marsh include largemouth bass, black crappie, brown bullhead (*Ictalarus nebulosus*), and green sunfish. Salt-tolerant species include bay pipefish (*Syngnathus leptorhynchus*), splittail, Pacific herring, California roach, threespine stickleback, common carp, and inland silverside (*Menidia beryllina*) (Brown and Caldwell/Jones and Stokes Associates 1994).

Adobe Creek is a major tributary of the Petaluma River and formerly provided important migration, spawning, and rearing habitat for steelhead trout. Presently, some resident rainbow trout are believed to persist in parts of Adobe Creek, but regular runs of spawning steelhead no longer occur there (Bill Cox, California Department of Fish and Game fisheries biologist, Region 3 Yountville, personal communication, 1994). In addition, Adobe Creek probably supports other native and non-native fish species that are more tolerant of warm water and low dissolved oxygen conditions than are adult and juvenile steelhead trout (Brown & Caldwell/Jones & Stokes Associates 1994).

The Petaluma River and Sonoma Creek drain into San Pablo Bay. Because of its location, San Pablo Bay is a region of transition between the marine habitats of the ocean and the freshwater habitats of its tributaries. Water movements in San Pablo Bay result primarily from tidal currents as ocean waters enter and leave through the Golden Gate. These currents remain relatively constant throughout the year, although they are influenced by freshwater flood flows and winds. Currents are strongest in the deepwater channel that runs through the center of San Pablo Bay.

San Pablo Bay is part of the San Francisco Bay Delta System (Bay System), which is generally regarded as the most important aquatic ecosystem in California (EIP 1990). It is used extensively for both recreational and commercial purposes. About 40 percent of the land area of California drains into the Bay System. Since the turn of the century, freshwater inflow to the Bay System has diminished as large quantities of water are diverted and exported to the San Joaquin Valley and Southern California for urban and agricultural uses (EIP 1990).

The bay lands area, located north of San Pablo Bay, was formerly part of an interconnected system of seasonal wetlands and tidal marshes. The remaining seasonal wetlands, tidal marshes, and adjacent salt marshes provide essential habitat for migratory waterfowl and several special-status wildlife species. Many of these tidal areas are now surrounded by levees and have been drained for agriculture. Agricultural fields, channels, and levees support most of the remaining plant communities which contain native plant species or provide wildlife habitat (see bay lands description under South County Geographic Area, Section 4.8, Terrestrial Biological Resources for further information). Most of the seasonal wetlands in the bay lands area are located south of State Highway 37 in close proximity to San Pablo Bay and the Petaluma River. The seasonal wetlands north of State Highway 37 have been greatly reduced and degraded, but are used by migratory waterfowl, wading birds, and shorebirds during high rainfall years (e.g., 1983 and 1995) (Laurel Marcus, California Coastal Conservancy, personal communication, February 20, 1996).

### *Sebastopol*

There are two major watersheds within the Sebastopol geographic area. One of these watersheds is drained by Green Valley Creek and Atascadero Creek, while the other is drained by the Laguna de Santa Rosa. The Laguna de Santa Rosa and its major tributaries are described under the Santa Rosa Plain/Russian River geographic area.

Green Valley Creek is a small stream system that enters the Russian River about one mile downstream from the mouth of the Laguna de Santa Rosa. Recent habitat and fish surveys indicate that only a small portion of Green Valley Creek (near Green Valley Creek Road) still contains habitat adequate for salmonid spawning and rearing. Green Valley Creek supports small runs of steelhead trout and coho salmon and has a resident population of the federally endangered California freshwater shrimp (Merritt Smith Consulting 1996a).

Atascadero Creek, located at the western boundary of Sebastopol, is part of a larger watershed that includes Green Valley Creek and Atascadero Marsh (PAS & Associates 1992). Atascadero Creek is the main tributary feeding into Green Valley Creek. Recent California Department of Fish and Game fish surveys indicate that some steelhead trout and coho salmon spawning and rearing habitat occurs in Atascadero Creek and its tributary, Jonive Creek, at Ragle Regional Park (Bill Cox, California Department of Fish and Game fisheries biologist, Region 3 Yountville, personal communication, 1994).

### *Geysers*

The main drainage associated with the geysers geographic area is Big Sulphur Creek. However, several smaller tributaries, including Anna Belcher Creek, Little Sulphur Creek, Cobb Creek, Squaw Creek, Hurley Creek, Deer Creek, Sausal Creek, Hoot Owl Creek, Maacama Creek, Franz Creek, Brooks Creek, and Pool Creek, are also present within the geysers reserve and proposed pipeline route. The following habitat characterization of Big Sulphur Creek is based upon stream crossing assessments conducted by fisheries biologists along those areas of the streams that are proposed to be crossed by Project pipelines (Merritt Smith Consulting 1996c).

Big Sulphur Creek is a perennial stream that originates in the southern portion of the geysers reserve, flows in a northwesterly direction through northeastern Sonoma County and empties into the Russian River. Most of the watershed is steep and forested (Environmental Science Associates 1994). Big Sulphur Creek has suitable habitat for special-status aquatic animal species including foothill yellow-legged frog, Russian River tule perch, California red-legged frog, northwestern pond turtle, hardhead, coho salmon, and steelhead trout (Merritt Smith Consulting 1996b, Merritt Smith Consulting 1996c, Merritt Smith Consulting 1996d). The aquatic biological resources of the smaller tributaries (within surveyed sections) of the geysers area are summarized in the *Stream Crossings Assessment* Technical Memorandum (Merritt Smith Consulting 1996c).

## Regulatory Framework

The regulatory framework that provides the policies and regulations governing impacts to aquatic biological resources within the Area of Indirect Impacts is equivalent to that for Terrestrial Biological Resources presented in Section 4.8.

In addition, the National Oceanic and Atmospheric Administration (NOAA) has administrative authority over the Gulf of the Farallones National Marine Sanctuary. This sanctuary was designated under Section 302(a) of Title III of the Marine Protection, Research and Sanctuaries Act of 1972. The sanctuary encompasses an area of the waters adjacent to the coast of California north and south of the Point Reyes Headlands, between Bodega Head and Rocky Point and the Farallone Islands (including Noonday Rocks). NOAA is a cooperating agency in the preparation of this EIR/EIS.

## EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

**Table 4.9-3**

Evaluation Criteria with Point of Significance - Aquatic Biological Resources

| Evaluation Criteria | As Measured by | Point of Significance | Justification |
|---|---|---|---|
| 1. Will the Project cause loss of individuals or occupied habitat of endangered, threatened, or rare aquatic wildlife or plant species[1]? | a) Number of individuals that will be lost<br>b) Acres of occupied or critical habitat lost | a) Greater than 0 individuals<br>b) Greater than 0 acres | FESA, CESA (Sections 2062 and 2067), CEQA (Article 5, Section 15065), and California Native Plant Protection Act (CDFG Code Sections 1900-1913) |
| 2. Will the Project cause loss of individuals of CNPS List 2, 3, or 4 aquatic plant species? | Number of species that will experience a loss of individuals | Greater than 15 percent of known occurrences in Sonoma and Marin counties | California Native Plant Protection Act (CDFG Code Sections 1900-1913), CEQA (Article 5, Section 15065), Caitlin Bean, Biologist, CDFG, Yountville, meeting January 1994. |
| 3. Will the Project cause loss of potential or occupied habitat of aquatic species of aquatic wildlife concern? | Acres of potential or occupied habitat lost | Greater than 20 percent of potential habitat in local watershed | FESA, CESA (Sections 2062 and 2067), CEQA (Article 5, Section 15065), and California Native Plant Protection Act (CDFG Code Sections 1900-1913) |

# Table 4.9-3

## Evaluation Criteria with Point of Significance - Aquatic Biological Resources

| Evaluation Criteria | As Measured by | Point of Significance | Justification |
|---|---|---|---|
| 4. Will the Project cause permanent loss of sensitive aquatic plant communities and associated wildlife habitats (i.e., freshwater marsh, brackish marsh, vernal pools)? | Acres of sensitive aquatic plant communities lost | Greater than 0 acres | CEQA (Article 5, Section 15065), California Native Plant Protection Act (Fish and Game Code, Sections 1900-1913), See Also Jurisdictional Wetlands Section 4.10, CDFG (CNDDB 1994, 1995) |
| 5. Will the Project cause permanent loss of aquatic habitat (i.e., streams and ponds)? | a) Linear feet of coolwater Type A and coolwater Type B stream habitat permanently lost<br>b) Linear feet of warmwater Type A stream habitat permanently lost<br>c) Linear feet of warmwater Type B stream habitat permanently lost<br>and<br>d) Acres of pond habitat permanently lost | a) Greater than 0 linear feet<br>b) Greater than 15% of habitat type in local watershed (linear feet and acreage respectively)<br>c and d) Greater than 25% of habitat type in local watershed (linear feet and acreage respectively) | CEQA (Article 5, Section 15065), with concurrence from Bill Cox (CDFG fisheries biologist, Region 3 [Yountville])<br>Note: See Criterion #1 of Jurisdictional Wetlands Section |
| 6. Will the Project cause a change to the physical condition of aquatic habitat in the Estero Americano or Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary? | Change in salinity[4] in parts per thousand (ppt) in the Esteros | Greater than 0 ppt salinity change | National Marine Sanctuaries Act (16 U.S.C. 1436), National Oceanic and Atmospheric Administration (15 CFR 922), CEQA (Article 5, Section 15065) |
| 7. Will the Project substantially block or disrupt major fish or aquatic wildlife migration or travel corridors? | Number of corridors substantially blocked or disrupted | Greater than 0 corridors | CEQA (Appendix G) |

# Table 4.9-3

## Evaluation Criteria with Point of Significance - Aquatic Biological Resources

| Evaluation Criteria | As Measured by | Point of Significance | Justification |
|---|---|---|---|
| 8. Will the Project cause a decrease in streamflows, affecting aquatic habitat or aquatic life downstream from proposed dam sites? | Linear feet of warmwater stream habitat where 50 percent decrease in wet season streamflow or any decrease in dry season streamflow occurs | Greater than 0 linear feet<br><br>Greater than 0 linear feet | CEQA (Article 5, Section 15065) |
| 9. Will the Project result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)? | Ecological quotient[2] (EQ) | EQ Greater than 10 | Menzie et al. 1993 |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:

CDFG California Department of Fish and Game
CNPS California Native Plant Society
USFWS United States Fish and Wildlife Service
FESA Federal Endangered Species Act
CESA California Endangered Species Act
CEQA California Environmental Quality Act

1. Endangered, threatened, or rare is defined here as:
   - federally listed endangered, threatened, or proposed plant or wildlife species
   - state listed endangered, threatened, rare or proposed plant or wildlife species
   - federal candidates for listing
   - CNPS List 1B plant species
2. Species of concern wildlife are defined here as:
   - wildlife designated as “species of special concern” by the California Department of Fish and Game
   - wildlife listed as “fully protected” in California
3. Ecological quotient is the ratio of the exposure concentration or exposure rate to the appropriate benchmark value (i.e., reference values for potential effects on site organisms).
4. Salinity is measured by total dissolved solids, which measures all of the salts.

## METHODOLOGY

The following section provides a brief discussion of the survey and analytical methodologies utilized in assessing aquatic biological resource impacts within the Area of Direct Impacts and Area of Indirect Impacts. *Biological Resources, Volume 1* provides a more detailed description of specific survey methodologies and survey results (Harland Bartholomew & Associates, Inc. 1996a).

Aquatic biological resources potentially impacted by Project actions were identified through literature review, California Natural Diversity Data Base (CNDDB) record searches, consultation with natural resource experts, and field surveys. The CNDDB contains occurrence records for special-status plant and animal species, as well as sensitive natural vegetation communities. Special-status aquatic species include:

- those plants and animals that are legally protected, proposed, or candidates for protection under the California Endangered Species Act (CESA) and Federal Endangered Species Act (FESA);
- plants and animals defined as endangered or rare under the California Environmental Quality Act (CEQA);
- animals designated as "species of special concern" by the California Department of Fish and Game;
- animals listed as "fully protected" in California (Fish and Game Code Sections 3511, 4700, 5050); and
- plants identified and classified in the California Native Plant Society's (CNPS) *Inventory of Rare and Endangered Vascular Plants of California* (1994).

CNDDB record searches were conducted in 1994 and 1995 for each 7.5 minute USGS quadrangle that contains portions of the Area of Indirect Impacts. In addition, resource agency representatives U.S. Fish and Wildlife Service, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, the California Department of Fish and Game, and local natural resource experts (e.g., Sierra Club - Sonoma Group, Marin Conservation League, Resource Conservation League of Sonoma, Marin and Madrone Chapters of the National Audubon Society, and the Russian River Watershed Protection Committee, California Native Plant Society) were consulted to acquire available occurrence data.

Field surveys were conducted at the site of Project components in order to describe, inventory, and map the existing aquatic biological resources. The results of CNDDB record searches, field observations, and field mapping of aquatic biological resources were entered into a Geographic Information System (GIS) data base. Acreage and locations of vegetation communities, wetlands, and wildlife habitats, and number and location of special-status species occurrences present within the construction zone boundary of each Project component were generated. These data were then used to describe the existing conditions for aquatic biological resources and evaluate potential impacts to these resources. For a more thorough discussion of analytical methods refer to *Biological Resources, Volume 1* (Harland Bartholomew & Associates, Inc. 1996a).

In conducting aquatic habitat assessments, the aquatic resource was mapped as a stream, pond, or estuary. Habitats were classified into one of six categories, four that apply to streams, one to ponds, and one to estuaries. The four stream categories are coolwater A, coolwater B, warmwater A, and warmwater B. The pond category includes perennial standing water bodies of any size, including irrigation and stock ponds, as well as existing municipal reservoirs. The Estero Americano and Estero de San Antonio were included under the estuary category. Each of these habitat categories is described in detail and depicted on maps in *Aquatic Habitat Survey Results* (Merritt Smith Consulting 1996b).

Plant surveys, vegetation community mapping, and wildlife habitat mapping are described in the Methodology Section of Terrestrial Biological Resources, Section 4.8. Survey methodologies specific to aquatic biological resources are briefly summarized below.

## Storage Reservoir Sites

Aquatic biological resource surveys were conducted at each of the 10 storage reservoirs. Aquatic biologists visually surveyed streams within the construction zone of each storage reservoir, including the reservoir site, construction areas, and areas of ancillary structures and access roads.

### *Aquatic Habitat / Aquatic Life Surveys*

Streams associated with the storage reservoirs were assessed to determine the quality of aquatic habitat and to sample the existing aquatic fauna (Merritt Smith Consulting 1996d). These surveys were conducted from May 1994 through August 1995. The aquatic habitat found at each survey site was examined and sampled, but particular emphasis was placed on the least degraded sections of the streams (i.e., habitat most likely to support special-status species and high faunal diversity of native species). In areas where access was not permitted, stream habitat assessments usually consisted of observations made from bridges at public road crossings. In accessible areas, more extensive stream habitat surveys were conducted. These latter surveys consisted of visual descriptions (including photographs of each site) and estimates of important habitat elements including stream flow (in cubic feet per second, based on professional judgment), substrate, vegetation, and level of disturbance (Merritt Smith Consulting 1996b). While traversing the stream, the habitat features associated with each surveyed stream segment were recorded on a standard inventory form. Careful visual searches for special-status aquatic animal species and an assessment of suitable habitat for these species were also conducted concurrently with the general habitat surveys. Observations were recorded on standardized data sheets. Maps of the habitats observed can be found in *Aquatic Habitat Survey Results* (Merritt Smith Consulting 1996b).

All streams associated with the storage reservoirs were intensively sampled for aquatic wildlife species during May 1995 (Merritt Smith Consulting 1996d). The stream habitat types found at each survey site were sampled for invertebrates and vertebrates. This sampling was conducted by two fisheries biologists using either a seine (a large fishing net with floats along the top and weights along the bottom) or dipnet. The majority of captured organisms were quickly identified and released at the capture site. Voucher specimens were collected in some cases for later microscopic examination and identification in the laboratory. All vertebrate and invertebrate aquatic species captured were catalogued. Surveys to determine the presence of special-status species at sampling locations and the likelihood of special-status species occurring downstream of sampling locations were conducted (Merritt Smith Consulting 1996d). This information was recorded on standardized field inventory forms.

### *Special-Status Species Surveys*

Focused surveys were conducted for all state and federally listed, proposed, and candidate endangered and threatened aquatic wildlife species that could potentially be impacted by the construction and operation of storage reservoirs. Those species requiring focused surveys included California red-legged frog, California freshwater shrimp, vernal pool fairy shrimp, longhorn fairy shrimp, Conservancy fairy shrimp, and vernal pool tadpole shrimp, California tiger salamander, northwestern pond turtle, Tomales isopod, California linderiella and foothill yellow-legged frog. Surveys for federal candidate species with similar habitat requirements (e.g., California tiger salamander, northwestern pond turtle, Tomales isopod, California linderiella, and foothill yellow-legged frog) were conducted concurrently with the focused surveys. The federal status of California linderiella, northwestern pond turtle, Tomales isopod, and foothill yellow-legged frog changed in March 1996. All were dropped from the United States Fish and Wildlife Service candidate species list. The analysis was altered to reflect this change. Established protocols developed by the United States Fish and Wildlife Service, California Department of Fish and Game, and Larry Serpa were utilized by qualified wildlife biologists (i.e., possessing at least a Bachelor's degree in biology, wildlife and fisheries biology, zoology, or other related natural resources field; field experience with special-status species; and possession of current appropriate scientific collecting permits from California Department of Fish and Game and United States Fish and Wildlife Service). These protocols are identified in Table 4.9-4.

## Table 4.9-4

Special-Status Species Survey Methodologies

| Species | Protocol Date | Comments |
|---|---|---|
| Vernal pool crustaceans | January 19, 1995 | Developed by USFWS |
| California freshwater shrimp | 1991 | Informal protocol developed by Larry Serpa, Nature Conservancy entomologist, and approved by CDFG and USFWS |
| California tiger salamander, foothill yellow-legged frog, and California red-legged frog | April 26, 1994 | Informal protocol developed by John Brode, staff herpetologist, CDFG, in discussions with HBA biologists |

Source: Harland Bartholomew & Associates, Inc. 1996

Following the first heavy rains of the year (late November 1994), all reservoir sites were assessed for the presence of vernal pools. In areas where vernal pools were identified, a wet sampling series for special-status vernal pool crustaceans was conducted by United States Fish and Wildlife Service-permitted wildlife biologists in accordance with United States Fish and Wildlife Service guidelines (United States Fish and Wildlife Service January 19, 1995). California tiger salamander surveys were conducted concurrently with the vernal pool crustacean surveys according to the informal protocol developed by the California Department of Fish and Game (April 26, 1994). Vernal pools were sampled once every two weeks until the pools dried in late spring (i.e., late November 1994 through early May 1995). Refer to *Biological Resources, Volume 1* (Harland Bartholomew & Associates, Inc. 1996a) for a more detailed discussion of this protocol.

Suitable habitat containing a permanent source of water was surveyed for both California freshwater shrimp and Tomales isopod. All fair, good, or excellent habitat was sampled for the shrimp and isopod. Habitat quality was rated by a combination of features known to be important to the shrimp, including water depth, presence or absence of undercut banks, and the quality and quantity of tree roots and herbaceous vegetation hanging into the water (Serpa 1995). Sampling of aquatic invertebrates was conducted by vigorously disturbing the vegetation below the waterline and collecting with submerged aerial insect nets. These surveys were completed in a single site visit during the week of August 21 to August 25, 1995. Refer to the *Survey for the California Freshwater Shrimp at*

*Proposed Reservoir Sites* for more details on methods and results associated with these surveys (Serpa 1996).

California red-legged frog and foothill yellow-legged frog surveys were conducted simultaneously. Surveys consisted of an initial habitat assessment and subsequent night-time survey at areas determined to have suitable habitat. The goal of the habitat assessment was to identify the quality, extent, and location of potential habitat in preparation for the night-time surveys. The primary goal of the night-time surveys was to determine whether red-legged frogs or yellow-legged frogs currently occur at the storage reservoir sites. These surveys followed the informal protocol developed by the California Department of Fish and Game (April 26, 1994). Refer to *Biological Resources, Volume 1* for a more detailed discussion (Harland Bartholomew & Associates, Inc. 1996a).

Suitable habitat for red-legged frog and yellow-legged frog is also suitable for northwestern pond turtle. Surveys for northwestern pond turtle were conducted during the daytime habitat assessments for red-legged frog and yellow-legged frog. These surveys consisted of scanning (with binoculars) for turtles in suitable habitat within and along streams and stock ponds. All observations were recorded on data sheets and aerial photographs.

### Agricultural Irrigation Areas

Due to the large acreage associated with the agricultural irrigation areas and limited permissible site access, single-visit surveys (often performed from adjacent public rights-of-way) were conducted for aquatic wildlife species and aquatic wildlife habitat. Due to the homogeneity of the agricultural irrigation areas, these surveys are considered adequate to provide a general characterization of streams. Aquatic habitat within irrigation areas was assessed utilizing methodologies similar to those presented in the aquatic life surveys for storage reservoirs.

A more detailed description of survey methodologies can be found in *Biological Resources*, *Volume I* (Harland Bartholomew & Associates, Inc. 1996a) and *Aquatic Habitat Survey Results* (Merritt Smith Consulting 1996b).

### Pipelines

All stream crossings along the pipeline alignments were assessed for their aquatic habitat quality. Surveys were conducted from June 12 to August 3, 1995 (Merritt Smith Consulting 1996c). The surveys were conducted following the end of a wet winter with record rainfall. As a consequence there were persistent flows in many of the streams that will normally be expected to be dry during the summer months. Surveys were conducted at all stream crossings with suitable habitat and flow to support aquatic life, but were conducted without entering the streams. The data collection forms were therefore developed to describe the aquatic habitat at pipeline crossings with this constraint in mind. Limited permissible access prohibited the kind of in-stream surveys typically conducted for this type of analysis (Merritt Smith Consulting 1996c). In most cases, the surveys were conducted from the bridge crossing the streams in the public road right-of-way. However, the information collected on the forms (e.g., permanence, type of substrate, embeddedness, in-stream shelter, and percent canopy closure) provides an effective method for characterizing aquatic habitat given the restrictions of access (Merritt Smith Consulting 1996c). The locations for all of the identified stream crossings are shown in Maps E-1 through E-21 of *Biological Resources, Volume 4E* (Harland Bartholomew & Associates, Inc. 1996f).

### Ecological Risk Assessment

An ecological risk assessment of representative scenarios under the various Project alternatives was undertaken to evaluate potential adverse effects to ecological resources as a result of exposure to chemical constituents in reclaimed water. The primary objective of the ecological risk assessment was to identify and characterize the potential risks posed to environmental receptors (i.e., individual species) as a result of the alternative uses of the reclaimed water.

Two main routes of exposure were identified for evaluation of ecological risk to terrestrial and aquatic organisms due to the implementation of the Project: direct contact with the media (surface soil, water, and sediment) and indirect exposure by dietary intake. Specific ecological receptors were selected to evaluate potential effects on aquatic biota and wildlife exposure through food ingestion. Key ecological receptors, representative of various trophic levels, were evaluated, including red-legged frog, steelhead trout, mallard duck, harbor seal, and great blue heron. Ecological receptors are species which potentially could be exposed to the chemical constituents of concern.

Monitoring data for reclaimed water of the Laguna Plant storage ponds were used as the basis for assessment of ecological risk assessment to aquatic organisms in for reclaimed water storage. This approach assumes that future water quality in the reservoirs will be similar to the current reclaimed water quality in the storage ponds. Water quality data were evaluated in terms of potential effects on aquatic organisms (including amphibians) by direct exposure. The assessment of potential effects associated with exposure to sediments in storage reservoirs was based on the use of monitoring data for existing reclaimed water storage ponds of the Santa Rosa water reclamation facility. This approach assumes that future sediment conditions in the reservoirs will be similar to, or better than, those in existing ponds because reclaimed water quality has improved in recent years and will be maintained following implementation of the Project.

The assessment of ecological risk was based on the calculation of the ecological quotients (EQs). The quotient is calculated as the ratio between exposure concentration for a given chemical substance and an applicable benchmark value that identifies possible adverse effect levels on ecological receptors. The characterization of potential effects on receptor organisms was based on the following guidelines (EPA 1989; Watkins and Stelljes 1993; Menzie et al., 1993):

1. Adverse effects are not expected for EQ values equal to, or less than, 1;
2. A low potential for environmental effects is indicated by an EQ value between 1 and 10;
3. A significant potential for adverse effects is indicated by an EQ value greater than 10; and
4. EQs in excess of 100 identify a very high probability for adverse effects on ecological receptors and biological communities.

   Six major pathways were identified for the potential exposure of aquatic organisms and wildlife to the reclaimed water: 1) direct exposure to the reclaimed water in Santa Rosa Creek and the Laguna de Santa Rosa; 2) exposure of organisms associated with the Russian River at 1 percent, 5 percent, 10 percent, and 20 percent Russian River Discharge with Russian River and Laguna discharge sites; 3) exposure of rooted vegetation, benthic organisms, and waterfowl to sediments in the Laguna de Santa Rosa and the Russian River; 4) exposure of aquatic and terrestrial vegetation by reclaimed water application to irrigation fields; and 6) potential releases from pipelines along the transfer route to the geysers injection area. Exposure risks include effects of existing discharges along the Russian River. For more detailed information on the ecological risk assessment methodology and results, see the *Ecological Risk Assessment* (Parsons Engineering Science, Inc. 1996).

## ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

### No Action (No Project) Alternative

**Table 4.9-5**

Aquatic Biological Resources Impacts by Component - No Action Alternative

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.1.1. Will the pipeline component cause loss of individuals or occupied habitat of endangered, threatened or rare aquatic wildlife or plant species? | a) Greater than 0 species<br>and<br>b) Greater than 0 acres | None | C | == |

# Table 4.9-5

## Aquatic Biological Resources Impacts by Component - No Action Alternative

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.1.2. Will the pipeline component cause loss of individuals of CNPS List 2, 3, or 4 aquatic plant species? | Greater than 15% of existing occurrences or populations in Sonoma and Marin counties | None | C | == |
| 9.1.3. Will the pipeline component cause loss of potential or occupied habitat of aquatic wildlife species of concern? | Greater than 20% of potential habitat in local watershed | None | C | == |
| 9.1.4. Will the pipeline component cause a permanent loss of sensitive native aquatic plant communities? | Greater than 0 acres | None | C | == |
| 9.1.5. Will the pipeline component cause a permanent loss of aquatic habitat and associated wetlands? | Greater than 15% of warmwater A habitat; or<br>Greater than 25% of warmwater B or pond habitat | None | C | == |
| 9.1.6. Will the pipeline component cause a change in the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary? | Greater than 0 parts per thousand salinity change | None | C | == |
| 9.1.7. Will the pipeline component substantially block or disrupt major fish or aquatic wildlife migration or travel corridors? | Greater than 0 corridors | None | C | == |
| 9.1.8. Will the pipeline component cause a decrease in streamflows, affecting aquatic habitat or aquatic life downstream from proposed dam sites? | Greater than 0 linear feet | None | C | == |

## Table 4.9-5

Aquatic Biological Resources Impacts by Component - No Action Alternative

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.1.9. Will the pipeline component result in ecological risk to terrestrial plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)? | Ecological Quotient (EQ) greater than 10 | EQ values range from 0.0 to 4.64 | O&M | ❍ |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:

1. Type of Impact:
   - C — Construction
   - O&M — Operation and Maintenance
   - -- — Not Applicable
   - P — Permanent

2. Level of Significance:
   - ❍ — Less than significant impact; no mitigation proposed
   - ⊙ — Significant impact before mitigation; less than significant impact after mitigation
   - == — No Impact

**Impact: 9.1.1-8. Will the No Action Alternative impact aquatic biological resources based on evaluation criteria 1 through 8?**

Analysis: *No Impact; Alternative 1.*

There will be no construction of facilities under the No Action (No Project) Alternative. Therefore, Alternative 1 will not affect aquatic habitat.

Mitigation: No mitigation is needed.

**Impact: 9.1.9. Will the No Action Alternative result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)?**

Analysis: *Less than Significant; Alternative 1.*

Continued or increased discharge through the Laguna to the Russian River will result in an increased ecological risk, EQ ranging from 0.0 to 4.64, which is slightly higher than the current discharge but well below the point of significance (EQ>10).

Mitigation: No mitigation is proposed.

### Headworks Expansion Component

**Impact: 9.2.1-9. Will the headworks expansion component impact aquatic biological resources based on evaluation criteria 1 through 9.**

Analysis: *No Impact; All Alternatives.*

The headworks expansion will be accomplished by replacing the existing pumps with six new higher-capacity pumps. This process will not require additional land and as a consequence no new impacts are expected to occur. There will be no impact to aquatic biological resources associated with the headworks expansion.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is needed.

### Urban Irrigation Component

**Impact: 9.3.1-9. Will the urban irrigation component impact aquatic biological resources based on evaluation criteria 1 through 9?**

Analysis: *No Impact; All Alternatives.*

The acreage and rate of application of irrigation water at the urban irrigation sites will remain the same. The only change will be associated with the source of the irrigation water. Currently, these sites are supplied with water from wells and city water. The Project will provide for the use of reclaimed water. Since both the rate of application and the area irrigated will not change as a result of this Project, there will be no impacts to aquatic biological resources.

Alternatives 1, 4, and 5 do not have an urban irrigation component.

Mitigation: No mitigation is needed.

## Pipeline Component

# Table 4.9-6

Aquatic Biological Resources Impacts by Component - Pipelines

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.4.1. Will the pipeline component cause loss of individuals or occupied habitat of endangered, threatened or rare aquatic wildlife or plant species? | a. Greater than 0 species<br>and<br>b. Greater than 0 acres | None | C | == |
| 9.4.2. Will the pipeline component cause loss of individuals of CNPS List 2, 3, or 4 aquatic plant species? | Greater than 15% of existing occurrences or populations in Sonoma and Marin counties | None | C | == |
| 9.4.3. Will the pipeline component cause loss of potential or occupied habitat of aquatic wildlife species of concern? | Greater than 20% of potential habitat in local watershed | None | C | == |
| 9.4.4. Will the pipeline component cause a permanent loss of sensitive native aquatic plant communities? | Greater than 0 acres | None | C | == |
| 9.4.5. Will the pipeline component cause a permanent loss of aquatic habitat and associated wetlands? | Greater than 15% of warmwater A habitat; or<br>Greater than 25% of warmwater B or pond habitat | None | C | == |
| 9.4.6. Will the pipeline component cause a change in the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary? | Greater than 0 parts per thousand salinity change | None | C | == |

## Table 4.9-6

### Aquatic Biological Resources Impacts by Component - Pipelines

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.4.7. Will the pipeline component substantially block or disrupt major fish or aquatic wildlife migration or travel corridors? | Greater than 0 corridors | None | C | == |
| 9.4.8. Will the pipeline component cause a decrease in streamflows, affecting aquatic habitat or aquatic life downstream from proposed dam sites? | Greater than 0 linear feet | None | C | == |
| 9.4.9. Will the pipeline component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)? | Ecological Quotient (EQ) greater than 10 | EQ values range from 0.04 to 1.44 | O&M | ❍ |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
❍ Less than significant impact; no mitigation proposed
== No Impact

**Impact: 9.4.1-8. Will the pipeline component impact aquatic biological resources based on evaluation criteria 1 through 8?**

Analysis: *No Impact; All Alternatives.*

Though special-status species and sensitive aquatic plant communities are potentially present within pipeline construction corridors, final pipeline locations will avoid all occupied habitats.

Results of habitat assessments on and adjacent to the pipeline locations indicate that many of the current pipeline locations provide suitable habitat for a variety of endangered, threatened, rare or other sensitive aquatic plant and wildlife resources. Table 4.9-6 presents the width of streams (linear feet) potentially impacted by pipeline construction and that may support special-status species. See *The Stream Crossings Assessment* for more information (Merritt Smith Consulting 1996c). Table 4.9-7 presents sensitive aquatic plant communities located along the current pipeline alignments. The point locations for sensitive native aquatic plant communities found along the pipeline routes are identified on maps bound in *Biological Resources, Volume 4E* (Harland Bartholomew & Associates, Inc. 1996g). Table 4.9-8 presents a summary of aquatic habitat crossed by pipelines.

Measure 2.2.5, Avoid Sensitive Biological Resources, adopted as part of the Project, establishes procedures for avoidance of construction impacts to sensitive aquatic wildlife or plant species, their habitats and sensitive aquatic plant communities. Preconstruction surveys will be conducted for sensitive biological resources prior to final Project design. Project siting and design will provide avoidance of these resources through realignment of pipelines and establishment of associated exclusionary buffers where no activity will be allowed.

The pipelines will not cause a change in the physical condition of aquatic habitat in the Estero Americano and Estero de San Antonio since the construction zones are located well outside the National Marine Sanctuary and there will be no impact to the esteros.

Measure 2.2.5 establishes that no construction will occur within a perennial stream and construction in ephemeral streams will occur in the dry season and be temporary in nature. Therefore, there is no potential for pipelines to substantially block or disrupt major fish travel or affect stream flows.

## Table 4.9-7

### Pipeline Stream Crossings Potentially Supporting Sensitive Aquatic Wildlife Species

| Alternatives | Perennial (linear feet in width of stream crossing) | Seasonal / Intermittent (linear feet in width of stream crossing) |
|---|---|---|
| Alternative 2A | 74 linear feet (2 crossings) | 659 linear feet (15 crossings) |
| Alternative 2B | 74 linear feet (2 crossings) | 659 linear feet (15 crossings) |
| Alternative 2C | 74 linear feet (2 crossings) | 659 linear feet (15 crossings) |

## Table 4.9-7

### Pipeline Stream Crossings Potentially Supporting Sensitive Aquatic Wildlife Species

| Alternatives | Perennial (linear feet in width of stream crossing) | Seasonal/Intermittent (linear feet in width of stream crossing) |
|---|---|---|
| Alternative 2D | 74 linear feet (2 crossings) | 659 linear feet (15 crossings) |
| Alternative 3A | 2,364 linear feet (5 crossings) | 220 linear feet (9 crossings) |
| Alternative 3B | 2,274 linear feet (5 crossings) | 225 linear feet (9 crossings) |
| Alternative 3C | 2,364 linear feet (5 crossings) | 220 linear feet (9 crossings) |
| Alternative 3D | 2,364 linear feet (5 crossings) | 220 linear feet (9 crossings) |
| Alternative 3E | 2,364 linear feet (5 crossings) | 220 linear feet (9 crossings) |
| Alternative 4 | 480 linear feet (8 crossings) | 124 linear feet (7 crossings) |
| Alternative 5A | 15 linear feet (1 crossings) | 0 linear feet (0 crossings) |

Source: Harland Bartholomew and Associates, Inc., 1996

## Table 4.9-8

### Sensitive Aquatic Plant Communities Identified in Pipeline Construction Corridors to Be Avoided

| Alternatives | Pipeline Segments | Brackish Marsh (Acres) | Vernal Pools (Acres) |
|---|---|---|---|
| Alternative 2A | S-16 (South County) | 0 | 0.04 |
| Alternative 2B | S-16 (South County) | 0 | 0.04 |
| Alternative 2C | S-16 (South County) | 0 | 0.04 |
| Alternative 2D | S-16 (South County) | 0 | 0.04 |
| Alternative 3A | W-128 (West County) | 0.96 | 0 |
| Alternative 3B | W-128 (West County) | 0.96 | 0 |
| Alternative 3C | W-128 (West County) | 0.96 | 0 |
| Alternative 3D | W-128 (West County) | 0.96 | 0 |
| Alternative 3E | W-128 (West County) | 0.96 | 0 |
| Alternative 4 | -- | 0 | 0 |
| Alternative 5A | -- | 0 | 0 |

Source: Harland Bartholomew & Associates, Inc., 1996

## Table 4.9-9

### Summary of Identified Aquatic Habitat Crossed by Pipelines

| Alternatives | Perennial (linear feet of stream crossing) | Seasonal/Intermittent (linear feet of stream crossing) |
|---|---|---|
| Alternative 2A | 464 linear feet (9 crossings) | 11,918 linear feet (61 crossings) |
| Alternative 2B | 464 linear feet (9 crossings) | 11,056 linear feet (28 crossings) |
| Alternative 2C | 464 linear feet (crossings) | 12,062 linear feet (152 crossings) |
| Alternative 2D | 74 linear feet (14 crossings) | 374 linear feet (16 crossings) |

**Table 4.9-9**

Summary of Identified Aquatic Habitat Crossed by Pipelines

| Alternatives | Perennial (linear feet of stream crossing) | Seasonal/Intermittent (linear feet of stream crossing) |
|---|---|---|
| Alternative 3A | 2,761 linear feet (14 crossings) | 3,676 linear feet (143 crossings) |
| Alternative 3B | 2,621 linear feet (13 crossings) | 3,311 linear feet (46 crossings) |
| Alternative 3C | 2,761 linear feet (14 crossings) | 5,591 linear feet (157 crossings) |
| Alternative 3D | 2,704 linear feet (12 crossings) | 3,426 linear feet (152 crossings) |
| Alternative 3E | 2,704 linear feet (12 crossings) | 3,434 linear feet (153 crossings) |
| Alternative 4 | 420 linear feet (9 crossings) | 6,858 linear feet (147 crossings) |
| Alternative 5A | 270 linear feet (3 crossings) | 6 linear feet (2 crossings) |

Source: Harland Bartholomew & Associates, Inc., 1996

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: No additional mitigation is needed.

**Impact: 9.4.9. Will the pipeline component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5A.*

Rupture of pipelines could occur due to earthquakes along irrigation or geysers pipelines and could result in acute exposure of aquatic organisms to chemical constituents of the reclaimed water. This analysis addresses the risk of short-term exposure of freshwater organisms to reclaimed water constituents in creeks along either the geysers pipeline alignment or irrigation pipelines (*Ecological Risk Assessment* Parsons Engineering Science, Inc. 1996).

These scenarios are based on the assumption that undiluted reclaimed water is discharged to streams on an occasional basis without a significant dilution from the receiving waters. Consequently, the risk evaluation was based on short-term (i.e., acute) exposure of aquatic organisms to reclaimed water constituents. No chronic exposure or bioaccumulation will be expected to occur.

For all organic and inorganic chemicals detected in the effluent, calculated Ecological Quotient (EQ) values (i.e., $0.04 \leq EQ \leq 1.44$) [the EQ is greater than or equal to 0.04 but less than or equal to 1.44] were below the threshold value of 10 indicative of potential significant adverse effects on freshwater organisms. Any potential impacts will therefore be less than significant.

*No Impact; Alternatives 1 and 5B.*

These alternatives do not have a pipeline component.

Mitigation: No additional mitigation is proposed.

### Storage Reservoir Component

The storage reservoir component table is presented as a separate table for each criterion to present the information more clearly.

## Table 4.9-10

Aquatic Biological Resources Impacts by Component - Storage Reservoirs
Criterion #1

| Evaluation Criteria | Point of Significance | Impact[1] | | Type of Impact[2] | Level of Significance[3] |
|---|---|---|---|---|---|
| 9.5.1. Will the storage reservoir component may cause loss of individuals or occupied habitat of endangered, threatened, or rare aquatic wildlife or plant species? | a) Greater than 0 individuals<br>b) Greater than 0 acres of occupied habitat | | | | |
| **California red-legged frog** | | **Individuals** | **Acres** | | |
| • Tolay Extended | | 2 | 4.1 | C, P | ⊙ |
| • Adobe Road | | 0 | 0 | C, P | == |

## Table 4.9-10

Aquatic Biological Resources Impacts by Component - Storage Reservoirs
Criterion #1

| Evaluation Criteria | Point of Significance | Impact[1] | | Type of Impact[2] | Level of Significance[3] |
|---|---|---|---|---|---|
| • Tolay Confined | | 2 | 4.1 | C, P | ⊙ |
| • Lakeville Hillside | | 4 | 1.7 | C, P | ⊙ |
| • Sears Point | | 2 | 2.1 | C, P | ⊙ |
| • Two Rock | | 11 | 8.4 | C, P | ⊙ |
| • Bloomfield | | 1 | 3.6 | C, P | ⊙ |
| • Carroll Road | | 0 | 0 | C, P | == |
| • Valley Ford | | 2 | 8.4 | C, P | ⊙ |
| • Huntley | | 8 | 1.2 | C, P | ⊙ |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:

1. See note at end of analysis.
2. Type of Impact:
   - C Construction
   - P Permanent
3. Level of Significance codes:
   - ⊙ Significant impact before mitigation; less than significant impact after mitigation
   - == No impact

**Impact:** **9.5.1. Will the storage reservoir component cause a loss of individuals or occupied habitat of endangered, threatened, or rare aquatic wildlife or plant species?**

Analysis: *Significant; Alternatives 2, 3A, 3B, 3D, and 3E.*

Tolay Extended, Tolay Confined, Lakeville Hillside, Sears Point, Two Rock, Bloomfield, Valley Ford, and Huntley Reservoirs and associated facilities (including dams, access roads, pump stations, and diversion channels) will result in the loss of at least one California red-legged frog and greater than zero acres of occupied California red-legged frog habitat. Maps B-1 through B-7 of the *Biological Resources, Volume 4B* illustrate the California red-legged frog occurrences identified for each storage reservoir site (Harland Bartholomew & Associates, Inc. 1996d). Impacts of the Adobe Road site are discussed under No Impact below.

No other endangered, rare, or threatened species or their habitat was found.

*No Impact; Alternatives 1, 3C, 4, and 5.*

Adobe Road and Carroll Road reservoirs and associated facilities will not result in the loss of individuals or occupied habitat of federally proposed or listed or federal candidate aquatic wildlife or plant species and therefore there is no impact.

Note: There are two closely related subspecies of red-legged frog in the Project area: California and northern. The identity of the species within any one alternative is unclear. Northern red-legged frogs are a California Department of Fish and Game species of special concern. The California red-legged frog is federally-threatened.

The recent federal ruling establishing the final status of California red-legged frog as federally-threatened provided the geographic range of the species. Red-legged frogs in the Walker Creek, Sonoma Creek, Petaluma River, and Tolay Creek watersheds are identified as the California subspecies and are considered federally-threatened (Miller 1996.) All other red-legged frogs in the Project area appear to be the northern subspecies, although final confirmation as not been received.

In the current analysis, all red-legged frogs in the Project area are considered to be the California subspecies though the status will be confirmed prior to the Final EIR/EIS. All red-legged frogs not determined to be the California subspecies will be evaluated as a species of special concern. Findings of significance and proposed mitigation are not expected to change.

No other endangered, rare, or threatened species or their habitat was found.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: *Alternatives 2, 3A, 3B, 3D, and 3E.*

2.3.11. Sensitive Resource Conservation Program

2.4.4. California Red-legged Frog Capture and Relocation Program

*Alternatives 1, 3C, 4, and 5.* No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3A, 3B, 3D, and 3E.*

California red-legged frog habitat will be created (one acre created to one acre impacted) or restored (two acres restored to one acre impacted) in conjunction with other associated biological resource mitigation (e.g. jurisdictional wetlands, aquatic habitat, and sensitive vegetative communities). Red-legged frogs on site will be captured and relocated to the mitigation site.

**Impact:** **9.5.2. Will the storage reservoir component cause loss of populations of CNPS List 2, 3, or 4 aquatic plant species?**

## Table 4.9-11

Aquatic Biological Resources Impacts by Component - Storage Reservoirs

Criterion #2

| Evaluation Criteria | Point of Significance | Impact | | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|---|
| 2. Will the storage reservoir component cause loss of individuals of CNPS List 2, 3, or 4 aquatic plant species? | Greater than 15 percent of known occurrences in Sonoma and Marin counties | | | | |
| **Lobb's aquatic buttercup** | | **Species Occurrence s** | **% of known occurrences** | | |
| • Huntley | | 1 | 3% | C | ❍ |
| • All other reservoirs | | 0 | 0 | C | == |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction

2. Level of Significance codes:
❍ Less than significant impact; no mitigation proposed
== No impact

Analysis: *Less than Significant; Alternative 3E.*

Construction of the Huntley storage reservoir and associated facilities (including dams, access roads, pump stations, and diversion channels) will result in the loss of one population of Lobb's aquatic buttercup. Map C-7 of the *Biological Resources, Volume 4C* illustrates the Lobb's aquatic buttercup occurrence identified for the Huntley storage reservoir site. (Harland Bartholomew & Associates, Inc. 1996e). Lobb's aquatic buttercup is a CNPS List 4 species with known occurrences in Sonoma and Marin counties. Though CNPS List 4 plants are limited in distribution, a loss of 15 percent or less of the occurrences in the region of the Project will not cause a substantial range contraction, resulting in Lobb's aquatic buttercup becoming threatened with extinction, or substantially diminishing the habitat of Lobb's aquatic buttercup (CEQA Section 15065). The loss of one population represents three percent of the known occurrences of this species and therefore will constitute a less than significant impact.

*No Impact; Alternatives 1, 2, 3A, 3B, 3C, 3D, 4 and 5.*

Results of special-status plant surveys within the construction zone boundaries of the Tolay Extended, Adobe Road, Tolay Confined, Lakeville Hillside, Sears Point, Two Rock, Bloomfield, Carroll Road, and Valley Ford storage reservoir sites indicate that none of these sites currently support populations of CNPS List 2, 3, or 4 aquatic plant species. Therefore, construction of the storage reservoir will not result in impacts to these species.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: No mitigation is proposed.

**Impact: 9.5.3. Will the storage reservoir component cause loss of occupied or potential habitat of aquatic wildlife species of concern?**

## Table 4.9-12

Aquatic Biological Resources Impacts by Component - Storage Reservoirs
Criterion #3

| Evaluation Criteria | Point of Significance | Impact | | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|---|
| 9.5.3. Will the storage reservoir component cause loss of occupied or potential habitat of aquatic wildlife species of concern? | Greater than 20 percent of habitat in local watershed | a. Linear feet of warm water habitat; b. Acres of pond habitat | % of habitat in local watershed | | |

# Table 4.9-12

## Aquatic Biological Resources Impacts by Component - Storage Reservoirs Criterion #3

| Evaluation Criteria | Point of Significance | Impact | | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|---|
| **Northwestern pond turtle habitat** | | **Linear Feet and Acres** | **% of Habitat** | | |
| • Tolay Extended | | a. 15,300 lf<br>b. 1.3 acres | 29%<br>100% | C | ⊙ |
| • Adobe Road | | 0.0 acres | 0% | C | == |
| • Tolay Confined | | a. 10,600 lf<br>b. 1.3 acres | 14%<br>100% | C | ⊙ |
| • Lakeville Hillside | | 0.0 acres | 0% | C | == |
| • Sears Point | | 0.0 acres | 0% | C | == |
| • Two Rock | | a. 3,000 lf<br>b. 3.9 acres | 4%<br>7% | C | ❍ |
| • Bloomfield | | a. 5,200 lf<br>b. 0.0 acres | 9%<br>0% | C | ❍ |
| • Carroll Road | | a. 1,500 lf<br>b. 2.6 acres | 6%<br>9% | C | ❍ |
| • Valley Ford | | a. 2,000 lf<br>b. 2.0 ac | 6%<br>12% | C | ❍ |
| • Huntley | | a. 4,000 lf<br>b. 0.5 acres | 4%<br>0% | C | ❍ |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction

2. Level of Significance codes:
⊙ Significant impact before mitigation; less than significant impact after mitigation
❍ Less than significant impact; no mitigation proposed
== No impact

Analysis: *Significant; Alternatives 2A and 2C.*

Construction of either of the Tolay storage reservoirs will result in the loss of up to 15,300 lf (warmwater) and 1.3 acres (pond) of occupied northwestern pond turtle habitat (*Biological Resources, Volume 4B*, Maps B-3 and B-4, [Harland Bartholomew & Associates, Inc. 1996d]). The northwestern pond turtle is listed as a species of special concern by the California Department of Fish and Game. Although the species of special concern designation does not warrant any formal protection under the state Endangered Species Act, populations are monitored closely by the California Department of Fish and Game. A loss of 20 percent of potential habitat in the local watershed at any one storage reservoir site will seriously threaten the survival of the turtle populations living there. Reservoir construction and inundation will cause a 29 percent loss of warmwater habitat and 100 percent loss of pond habitat in the local watershed at Tolay Extended or 14 percent loss of warmwater habitat and 100 percent loss of pond habitat at the Tolay Confined site. Therefore this impact is considered significant.

No other species of special concern were identified within the reservoir construction zones.

*Less than Significant; Alternative 3.*

Construction of Two Rock, Bloomfield, Carroll Road, Valley Ford, and Huntley reservoirs will result in the loss of less than 20 percent of potential habitat in the local watershed of any one of the proposed storage reservoir sites (*Biological Resources, Volume 4B*, Maps B1, B6, and B7 [Harland Bartholomew & Associates, Inc. 1996d]).

No other species of special concern were identified within the reservoir construction zones.

*No Impact; Alternatives 1, 2B, 2D, 4, and 5.*

Results of special-status aquatic wildlife and plant surveys indicate that there is no occupied habitat of state species of special concern or state fully protected aquatic wildlife species on the Adobe Road, Lakeville Hillside, and Sears Point reservoir sites. Construction of these storage reservoirs will therefore not result in a loss of occupied habitat of state species of special concern or state fully protected aquatic wildlife species nor impact these species.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: *Alternatives 2A and 2C.*

2.3.11. Sensitive Biological Resources Conservation Program

*Alternatives 1, 2B, 2D, 3, 4, and 5.* No mitigation is proposed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2A and 2C.*

Western-pond turtle habitat will be created or degraded habitat will be restored. Each linear foot or acre of western pond turtle habitat will be replaced by the restoration or creation of one linear-foot or acre. This mitigation will be conducted in conjunction with mitigation proposed for other biological resources impacts (e.g. aquatic habitat and jurisdictional wetlands).

## Table 4.9-13

### Aquatic Biological Resources Impacts by Component - Storage Reservoirs Criterion #4

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.5.4. Will the storage reservoir component cause loss of sensitive aquatic plant communities? | Greater than 0 acres | | | |
| **Freshwater marsh** | | | | |
| • Two Rock | | 0.41 acres | C | ⦿ |
| • All Other Reservoirs | | 0 | C | == |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction

2. Level of Significance codes:
⦿ Significant impact before mitigation; less than significant impact after mitigation
== No impact

**Impact:** **9.5.4. Will the storage reservoir component cause permanent loss of sensitive native aquatic plant communities?**

Analysis: *Significant; Alternative 3A.*

Construction of the Two Rock storage reservoir and associated facilities will result in the loss of approximately 0.4 acres of freshwater marsh (*Biological Resources, Volume 4C*, Map C-1 [Harland Bartholomew & Associates, Inc. 1996e]). This plant community has undergone tremendous reduction in distribution and acreage over the last 100 years and is considered sensitive by the California Department of Fish and Game. Any loss of this plant community will be a significant impact.

*No Impact; Alternatives 1, 2, 3B, 3C, 3D, 3E, 4, and 5.*

Construction of all other storage reservoir components will not result in the loss of sensitive aquatic plant communities and therefore there is no impact.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: *Alternative 3A.*

2.3.11. Sensitive Biological Resources Conservation Program

*Alternatives 1, 2, 3B, 3C, 3D, 3E, 4, and 5.* No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 3A.*

Measures of the program will require creation of an equivalent acreage of freshwater marsh or restoration of two times the acreage impacted in conjunction with other biological resources mitigation (e.g. aquatic habitat and jurisdictional wetlands).

## Table 4.9-14

Aquatic Biological Resources Impacts by Component - Storage Reservoirs
Criterion #5

| Evaluation Criteria | Point of Significance | Impact | | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|---|
| 9.5.5. Will the storage reservoir component cause loss of aquatic habitat? | | | | | |
| **a) Coolwater Type A stream habitat** | **Greater than 0 linear feet** | **Linear Feet** | **Percent** | | |
| • All reservoirs | | 0 | 0% | C, P | == |
| **(b) Coolwater Type B stream habitat** | **Greater than 0 linear feet** | **Linear Feet** | **Percent** | | |
| • Carroll Road | | 2,700 | 100% | C, P | ⊙ |
| • All Other Reservoirs | | 0 | 0% | C, P | == |
| **(c) Warmwater Type A stream habitat** | **Greater than 15% of habitat in watershed** | **Linear Feet** | **Percent** | | |
| • Tolay Extended | | 1,850 | 29% | C, P | ⊙ |

# Table 4.9-14

## Aquatic Biological Resources Impacts by Component - Storage Reservoirs
## Criterion #5

| Evaluation Criteria | Point of Significance | Impact | | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|---|
| • Adobe Road | | 0 | 0% | C, P | == |
| • Tolay Confined | | 1,850 | 29% | C, P | ⊙ |
| • Lakeville Hillside | | 0 | 0% | C, P | == |
| • Sears Point | | 5,200 | 53% | C, P | ⊙ |
| • Two Rock | | 6,000 | 6% | C, P | ❍ |
| • Bloomfield | | 0 | 0% | C, P | == |
| • Carroll Road | | 3,400 | 6% | C, P | ❍ |
| • Valley Ford | | 5,300 | 9% | C, P | ❍ |
| • Huntley | | 4,100 | 4% | C, P | ❍ |
| **d) Warmwater Type B stream habitat** | **Greater than 25% of habitat in watershed** | **Linear Feet** | **Percent** | | |
| • Tolay Extended | | 27,300 | 31% | C, P | ⊙ |
| • Adobe Road | | 7,000 | 18% | C, P | ❍ |
| • Tolay Confined | | 12,500 | 17% | C, P | ❍ |
| • Lakeville Hillside | | 10,100 | 54% | C, P | ⊙ |
| • Sears Point | | 13,100 | 17% | C, P | ❍ |
| • Two Rock | | 7,700 | 4% | C, P | ❍ |
| • Bloomfield | | 14,500 | 14% | C, P | ❍ |
| • Carroll Road | | 6,900 | 7% | C, P | ❍ |
| • Valley Ford | | 4,000 | 4% | C, P | ❍ |
| • Huntley | | 7,000 | 3% | C, P | ❍ |
| **e) Pond habitat** | **Greater than 25% of habitat in watershed** | **Acres** | **Percent** | | |
| • Tolay Extended | | 1 | 6% | C, P | ❍ |
| • Adobe Road | | 3 | 67% | C, P | ⊙ |
| • Tolay Confined | | 1 | 6% | C, P | ❍ |
| • Lakeville Hillside | | 1 | 100% | C, P | ⊙ |
| • Sears Point | | < 1 | 3% | C, P | ❍ |

## Table 4.9-14

### Aquatic Biological Resources Impacts by Component - Storage Reservoirs
### Criterion #5

| Evaluation Criteria | Point of Significance | Impact | | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|---|
| • Two Rock | | 6 | 5% | C, P | ❍ |
| • Bloomfield | | 1 | 3% | C, P | ❍ |
| • Carroll Road | | 3 | 10% | C, P | ❍ |
| • Valley Ford | | 2 | 7% | C, P | ❍ |
| • Huntley | | 1 | 1% | C, P | ❍ |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
1. Type of Impact:
- P Permanent
- C Construction

2. Level of Significance:
- ⦿ Significant impact before mitigation; less than significant impact after mitigation
- ❍ Less than significant impact; no mitigation proposed
- == No impact

**Impact: 9.5.5. Will the storage reservoir component result in loss of aquatic habitat?**

Analysis: **a) Coolwater Type A Stream Habitat**

*No Impact; All Alternatives.*

Construction of the reservoirs will not result in the loss of any Coolwater Type A stream habitat.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

**b) Coolwater Type B Stream Habitat**

*Significant; Alternative 3C.*

The Carroll Road reservoir will result in the loss of 2,700 linear feet of coolwater B stream habitat. This represents 100 percent of the coolwater B habitat in the watershed.

*No Impact; Alternatives 1, 2, 3A, 3B, 3D, 3E, 4, and 5.*

Construction of the other reservoirs will not result in the loss of any Coolwater Type B stream habitat.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

**c) Warmwater Type A Stream Habitat**

*Significant; Alternatives 2A, 2C, and 2D.*

Tolay Extended, Tolay Confined, and Sears Point storage reservoir component will result in the loss of greater than 15 percent of Warmwater A stream habitat.

*Less than Significant; Alternatives 3A, 3C, 3D, and 3E.*

The Two Rock, Carroll Road, Valley Ford, and Huntley reservoirs will result in the loss of less than 15 percent of Warmwater Type A stream habitat in each watershed.

*No Impact; Alternatives 1, 2B, 2D, 3B, 4, and 5.*

The Adobe Road, Lakeville Hillside, and Bloomfield reservoirs will not result in the loss of any Warmwater Type A stream habitat.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

**d) Warmwater Type B Stream Habitat**

*Significant; Alternatives 2A, 2B, and 2D.*

The Tolay Extended and Lakeville Hillside Reservoirs and associated facilities will result in the loss of greater than 25 percent of Warmwater Type B stream habitat in each watershed.

*Less than Significant; Alternatives 2C and 3.*

All other reservoirs will result in the loss of less than 25 percent of Warmwater Type B stream habitat in each watershed.

*No Impact; Alternatives 1, 4, and 5.*

Alternatives 1, 4, and 5 do not have a storage reservoir component.

**e) Pond Habitat**

*Significant; Alternatives 2B and 2D.*

The Adobe Road and Lakeville Hillside Reservoirs and associated facilities will result in the loss of greater than 25 percent of pond habitat in each watershed.

*Less than Significant; Alternatives 2A, 2C, and 3.*

All other reservoirs will result in the loss of less than 25 percent of Pond habitat in each watershed.

*No Impact; Alternatives 1, 4, and 5.*

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Maps B-1 through B-7 of the *Biological Resources, Volume 4B* (Harland Bartholomew & Associates, Inc. 1996d) illustrate all of the aquatic habitat types mapped for each storage reservoir site that are described in the aforementioned analysis.

Mitigation: *Alternatives 2 and 3C.*

2.3.11. Sensitive Biological Resources Conservation Program

*Alternatives 1, 3A, 3B, 3D, 3E, 4, and 5.* No mitigation is proposed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3C.*

Implementing the measures of the Sensitive Resource Conservation Program will result in creation of aquatic habitat and habitat function (one acre created to one acre lost) or restoration of habitat and function (two acres restored to one acre lost). Mitigation will be completed in association with other biological resource mitigation (e.g. jurisdictional wetlands, aquatic habitat, and red-legged frog habitat).

## Table 4.9-15

### Aquatic Biological Resources Impacts by Component - Storage Reservoirs
### Criterion #6

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.5.6. Will the Project cause a change in the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary? | Greater than 0 ppt salinity change | | | |
| • South County Reservoirs | | 0 ppt | C, P | == |
| • West County Reservoirs | | Greater than 0 ppt | C, P | ● |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
- P Permanent
- C Construction
- ppt parts per thousand

2. Level of Significance codes:
- ● Significant impact before and after mitigation
- == No impact

**Impact:** **9.5.6. Will the storage reservoir component cause a change in the physical conditions of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary?**

Analysis: *Significant; Alternative 3.*

West County reservoirs may affect salinity in the Estero Americano and Estero de San Antonio through subflow entering streams. This will be considered a significant impact.

*No Impact; Alternatives 1, 2, 4, and 5.*

Alternative 2 storage reservoir components are located in the South County and not located in watersheds that will contribute to the flows of the esteros.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: *Alternative 3.* No feasible mitigation has been identified (see Section 4.6, Surface Water Quality).

## Table 4.9-16

Aquatic Biological Resources Impacts by Component - Storage Reservoirs, Criterion #7

| Evaluation Criteria | Point of Significance | Impact (corridors) | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.5.7. Will the storage reservoir component substantially block or disrupt major fish or aquatic wildlife migration or travel corridors? | Greater than 0 corridors | | C, P | == |
| • Alternative 3C | | None | C | ❍ |
| • All others | | None | | == |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
P Permanent
C Construction

2. Level of Significance codes:
== No impact
❍ Less than significant impact; no mitigation proposed

**Impact:** **9.5.7. Will the storage reservoir component substantially block or disrupt major fish or aquatic wildlife migration or travel corridors?**

Analysis: *Less than Significant; Alternative 3C.*

During aquatic habitat assessments, one individual steelhead trout was found in the Carroll Road storage reservoir site. Though presence of an individual of a migratory presence of an individual of a migratory species may indicate a migration corridor in the vicinity, no other evidence of migration was present. There are no known corridors or breeding sites known in this tributary. The origin of this specimen is unknown. If a migration corridor is present in this stream system, it is not a major corridor. Therefore, this impact is considered less than significant.

*No Impact; Alternatives 1, 2, 3A, 3B, 3D, 3E, 4, and 5.*

All other reservoir sites will not be expected to act as barriers to the movement of migratory fish, because migratory fish species are not known to use any of those stream systems. There will be no impacts.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: No mitigation is needed.
*Alternatives 1, 2, 3A, 3B, 3D, 3E, 4, and 5*. No mitigation is needed.

## Table 4.9-17

### Aquatic Biological Resources Impactsby Component - Storage Reservoirs Criterion #8

| Evaluation Criteria | Point of Significance | Impact (percent) | Impact (linear feet) | Type of Impact | Level of Significance |
|---|---|---|---|---|---|
| 9.5.8. Will the storage reservoir component cause a decrease in streamflows, affecting aquatic habitat or aquatic life downstream from dam structures? | Greater than 0 linear feet of warmwater stream habitat where 50 percent decrease in wet season streamflow or any decrease in dry season streamflow occurs. | | | | |
| • Tolay Extended | | 53% decrease in wet season flows | 38,150 lf (18,150 lf of warmwater A and 20,000 lf of warmwater B habitat) | C, P | ⊙ |
| • Adobe Road | | less than 50% decrease in wet season flows | 0 lf | C, P | ❍ |
| • Tolay Confined | | 53% decrease in wet season flows; | 38,150 lf (18,150 lf of warmwater A and 20,000 lf of warmwater B habitat) | C, P | ⊙ |
| • Lakeville Hillside | | 60-69% decrease in wet season flows | 5,600 lf (all warmwater B habitat) | C, P | ⊙ |

## Table 4.9-17

Aquatic Biological Resources Impactsby Component - Storage Reservoirs
Criterion #8

| Evaluation Criteria | Point of Significance | Impact (percent) | Impact (linear feet) | Type of Impact | Level of Significance |
|---|---|---|---|---|---|
| • Sears Point | | less than 50% decrease in wet season flows | 0 | C, P | ❍ |
| • Two Rock | | less than 50% decrease in wet season flows | 0 | C, P | ❍ |
| • Bloomfield | | 67% decrease in wet season flows | 4,900 lf (all warmwater A habitat) | C, P | ⊙ |
| • Carroll Road | | 65% decrease in wet season flows | 6,800 lf (2,250 lf of warmwater A and 4,550 lf of warmwater B habitat) | C, P | ⊙ |
| • Valley Ford | | 81% decrease in wet season flows | 3,600 lf (all warmwater A habitat) | C, P | ⊙ |
| • Huntley | | less than 50% decrease in wet season flows | 0 | C, P | ❍ |

Source: Harland Bartholomew & Associates, Inc., 1996

| Notes: | 1. Type of Impact: | | 2. Level of Significance: |
|---|---|---|---|
| C | Construction | == | No impact |
| P | Permanent | ❍ | Less than significant impact |
| | | ⊙ | Significant impact before mitigation; less than significant impact after mitigation |

**Impact: 9.5.8. Will the storage reservoirs component cause a change in streamflows, affecting aquatic habitat or aquatic life downstream from proposed dam sites?**

Analysis: *Significant; Alternatives 2, 3B, 3C, and 3D.*

Storage reservoirs will intercept streamflow during the wet season, such that flow immediately downstream from the dam may be greatly reduced or eliminated. Four storage reservoirs have diversion structures designed for the 10 year storm level which will divert natural streamflow into the drainage downstream of the dam: Tolay Confined, Tolay Extended, Adobe Road, and Sears Point.

Dams for the Tolay Extended, Tolay Confined, and Lakeville Hillside, Bloomfield, Carroll Road, and Valley Ford reservoirs will intercept all flow coming from upstream except flows redirected through diversion channels (see Chapter 3.3 Description of Existing System and Alternatives). Dams will block downstream flows of the existing waterways within the reservoir footprints and cause a decrease of greater than 50 percent in wet season flow in stream habitat downstream of the proposed dam sites. See *Aquatic Biological Resource Impact Assessment* for more detailed analysis (Merritt Smith Consulting 1996e).

*Less than Significant; Alternatives 3A and 3E.*

The Sears Point, Two Rock, Adobe Road, and Huntley reservoirs will not cause a significant reduction in streamflow downstream from these potential dam sites and therefore will not significantly impact stream flows at these locations. See detail of analysis in *Aquatic Biological Resources Impact Analysis Report* (Merritt Smith Consulting 1996e).

*No Impact; Alternatives 1, 4, and 5.*

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: *Alternatives 2, 3B, 3C, and 3D.*

2.3.11. Sensitive Biological Resource Conservation Program

*Alternatives 1, 3A, 3E, 4, and 5.* No mitigation is proposed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3B, 3C, and 3D.*

Elements of this measure will compensate for loss of habitat acreage and function through restoration and preservation of existing degraded habitat with similar functions. Due to the limited opportunity to replace or restore hydrology on-site, existing degraded stream systems will be restored to original functions through fencing and revegetation. Restoration of warmwater B habitat to warmwater A habitat will occur as compensation for both losses to warmwater A and warmwater B habitat, on-site or as an element of a larger ecosystem-based restoration plan. Two linear feet of warmwater B will be restored and preserved for each linear foot of warmwater A affected. One linear foot of warmwater B will be restored and preserved for each linear foot of warmwater B affected.

## Table 4.9-18

Aquatic Biological Resources Impacts by Component - Storage Reservoirs
Criterion #9

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.5.9. Will the storage reservoir component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)? | EQ greater than 10 | EQ range between 0.00 and 3.27 | O&M | ❍ |

Source: Harland Bartholomew & Associates, 1996

Notes: 1. Type of Impact: O&M Operation and Maintenance
2. Level of Significance: ❍ Less than significant impact; no mitigation proposed

**Impact:** **9.5.9. Will the storage reservoir component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

This evaluation of toxicity and bioaccumulation potential of reclaimed waters in the storage reservoirs is provided because aquatic plants and wildlife will be attracted to and become resident in the storage reservoirs when they have water in them.

Based on the ecological quotient calculations, no potential significant risk was identified for direct exposure of aquatic organisms to organic chemicals and metals found at detectable levels in the effluent or the cumulative exposure to sediment. All EQ values were below the significance threshold of 10 (i.e., water is less than 3.27 and sediment is less than 2.28) and so the impacts are considered to be less than significant. In addition, bioaccumulation of metals in the diet, as measured in the mallard, were well below significance levels (EQ < 0.14). See the *Ecological Risk Assessment* for more detailed analysis (Parsons Engineering Science, Inc. 1996).

*No Impact; Alternatives 1, 4, and 5.*

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: No mitigation is proposed.

### Pump Station Component

**Impact: 9.6.1-9. Will the pump station component impact aquatic biological resources based on evaluation criteria 1 through 9.**

Analysis: *No Impact; All Alternatives*

Pump stations will not impact aquatic plants or wildlife because they are sited away from water or any sensitive aquatic biological resources and because pump stations will not result in aquatic plants or wildlife exposure to reclaimed water.

Measure 2.2.5, adopted as part of the Project, provides that, after appropriate surveys, pump stations be sited at least 30 feet from sensitive plant species and 100 feet away from all other sensitive biological resources (i.e., wetlands, and streams).

Alternatives 1 and 5 do not have a pump station component.

Mitigation: No additional mitigation is proposed.

## Agricultural Irrigation Component

### Table 4.9-19

Aquatic Biological Resources Impacts by Component - Agricultural Irrigation

| Evaluation Criteria | Point of Significance | Impact | Type of Impact | Level of Significance |
|---|---|---|---|---|
| 9.7.1. Will the agricultural irrigation component cause loss of individuals or occupied endangered threatened or rare aquatic wildlife or plant species? | a) Greater than 0 species<br>and<br>b) Greater than 0 acres | None<br><br>None | C, O&M, O&M-CP<br><br>C, O&M, O&M-CP | ==<br><br>== |
| 9.7.2. Will the agricultural irrigation component cause loss of individuals of CNPS List 2, 3, or 4 aquatic plant species? | Greater than 15 percent of presumed extant occurrences or populations in Sonoma and Marin counties | None | C, O&M, O&M-CP | == |
| 9.7.3. Will the agricultural irrigation component cause loss of potential or occupied habitat of aquatic species of concern? | Greater than 20 percent of mapped occupied habitat in all Project components | None | C, O&M, O&M-CP | == |
| 9.7.4. Will the agricultural irrigation component cause a permanent loss of sensitive native aquatic plant communities and associated wildlife habitats. | Greater than 0 acres | None | C, O&M, O&M-CP | == |
| 9.7.5. Will the agricultural irrigation component cause permanent loss of aquatic habitat? | Greater than 15% of Warmwater Type A in local watershed, or<br>Greater than 25% of Warmwater Type B in local watershed. | None | C, O&M, O&M-CP | == |

# Table 4.9-19

## Aquatic Biological Resources Impacts by Component - Agricultural Irrigation

| Evaluation Criteria | Point of Significance | Impact | Type of Impact | Level of Significance |
|---|---|---|---|---|
| 9.7.6. Will the agricultural irrigation component cause a change to the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary? | Greater than 0 ppt salinity change | | | |
| • West County irrigation areas | | Greater than 0 | C, O&M, O&M-CP | ● |
| • South County irrigation areas | | None | C, O&M, O&M-CP | == |
| 9.7.7. Will the agricultural irrigation component substantially block or disrupt major fish or aquatic wildlife migration or travel corridors? | Greater than 0 corridors | None | C, O&M, O&M-CP | == |
| 9.7.8. Will the agricultural irrigation component cause a decrease in streamflows, affecting aquatic habitat or aquatic life downstream from proposed dam sites? | Greater than 0 linear feet of affected stream habitat | None | C, O&M, O&M-CP | == |
| 9.7.9. Will the agricultural irrigation component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)? | EQ >10 | EQ values range from 0.0 to 6.90 | C, O&M, O&M-CP | ❍ |

Source: Harland Bartholomew & Associates, Inc., 1996

| Notes: | 1. Type of Impact: | | 2. Level of Significance: |
|---|---|---|---|
| C | Construction | == | No impact |
| O&M | Operation and Maintenance | ❍ | Less than significant impact; no mitigation proposed |
| O&M-CP | Operation and Maintenance - Contingency Plan | ● | Significant impact before and after mitigation |

**Impact: 9.7.1-5, 7, 8. Will the agricultural irrigation component impact aquatic biological resources based on evaluation criteria 1, 2, 3, 4, 5, 7, and 8.**

Analysis: *No Impact; All Alternatives.*

Results of habitat assessments for special-status plant and wildlife species within proposed agricultural irrigation areas indicate that some of the agricultural irrigation areas support special-status aquatic wildlife or plant species (see Table 4.9-1 for a list of these species). Several special-status species, including California red-legged frog, northwestern pond turtle, and Sebastopol meadowfoam, were observed within proposed agricultural irrigation areas. In addition, CNDDB record searches identified the following species within proposed agricultural irrigation areas: Sonoma alopecurus, Sebastopol meadowfoam, Swamp harebell, California freshwater shrimp, foothill yellow-legged frog, California tiger salamander, and northwestern pond turtle. More specific information about these occurrences is provided in *Biological Resources, Volume I, and Volume 4D* (Harland Bartholomew & Associates, Inc. 1996a,f). However, a determination of the presence of special-status species cannot be made in the absence of species-specific surveys. In addition, over the life of a reclamation Project, additional species may receive protective status that do not currently have special-status, but occupy theses lands. Therefore, there is potential for special-status species to occur on agricultural sites when they receive irrigation waters. Implementation of Project description measures will ensure that all impacts to special-status species are avoided.

The City has adopted Project measures (Measure 2.2.2 and Measure 2.2.5) that will require a resource map for every potential irrigation parcel, ensure that biological surveys are verified, and protect sensitive areas within agricultural irrigation areas by establishing buffers for all sensitive biological resources located on all parcels brought into agricultural production with Project reclaimed water. Exclusionary buffers will be established around any identified sensitive plant species habitat, the riparian corridor of all linear waterways and occupied burrows of sensitive ground-dwelling species (including California tiger salamander). Therefore, agricultural irrigation will not result in the loss of individuals or populations or occupied habitat. Table 4.9-20 presents the sensitive native aquatic plant communities in agricultural irrigation areas. Table 4.9-21 presents the aquatic habitat in the proposed agricultural areas. See *Aquatic Habitat Survey Results* (Merritt Smith 1996b) for mapping of aquatic habitat in agricultural areas. Therefore, there will be no impact to aquatic special status species, sensitive plant communities, or aquatic habitat.

Results of literature review and discussions with agency experts indicate that no major migration corridors or travel corridors are located within the proposed agricultural irrigation areas. Therefore, there is no impact to migration corridors.

The same procedures to insure avoidance of impacts to endangered, threatened, or rare species will be implemented in the case of agricultural irrigation areas needed for winter irrigation, if the contingency plan is implemented. Therefore, no impacts will occur from winter irrigation.

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

## Table 4.9-20

### Sensitive Aquatic Plant Communities in Agricultural Irrigation Areas to Be Avoided

| Agricultural Irrigation Area | Brackish Marsh (acres) | Freshwater Marsh (acres) | Vernal Pools (acres) |
|---|---|---|---|
| Sebastopol | 0 | 0.6 | 0 |
| South County | | | |
| Adobe Road | 0 | 0 | 0 |
| Bay Lands | 0 | 0 | 20.4 |
| East of Rohnert Park | 0 | 0 | 5.8 |
| Lakeville | 0 | 0 | 0.8 |
| North Petaluma Valley | 0 | 0 | 0.8 |
| West County | | | |
| Americano | 3.2 | 0 | 2.7 |
| Miscellaneous | 0 | 0 | 0 |
| Stemple | 0 | 0 | 1.0 |

Source: Harland Bartholomew & Associates, Inc., 1996

Since this component does not include mechanisms which will block or dam streams, agricultural irrigation will not cause a decrease in streamflows. Therefore, there are no impacts to stream flows.

Mitigation: No additional mitigation is proposed.

**Impact: 9.7.6. Will the agricultural irrigation component cause a change to the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary?**

Analysis: *Significant; Alternative 3.*

Under various water quality models, small sub-surface wastewater flows from irrigation field leaching may discharge to reaches of the esteros, resulting in small alterations in the salinity distribution in certain reaches. See *Aquatic Biological Resources Impact Analysis Report* for more detailed analysis (Merritt Smith Consulting 1996e).

**Table 4.9-21**

Aquatic Habitat in Agricultural Irrigation Areas

| Agricultural Irrigation Area | Coolwater A (linear feet) | Coolwater B (linear feet) | Warmwater A (linear feet) | Warmwater B (linear feet) | Ponds (Acres) |
|---|---|---|---|---|---|
| Sebastopol | 0 | 25,100 | 9,300 | 5,300 | 10.5 |
| South County | | | | | |
| Adobe Road | 0 | 0 | 600 | 20,000 | 2.0 |
| Bay Lands | 0 | 0 | 0 | 16,300 | 2.5 |
| East of Rohnert Park | 0 | 5,000 | 0 | 68,000 | 8.0 |
| Lakeville | 0 | 0 | 0 | 40,800 | 23.5 |
| North Petaluma Valley | 0 | 0 | 12,500 | 3,400 | 0.5 |
| West County | | | | | |
| Americano | 0 | 0 | 61,800 | 23,500 | 26.0 |
| Miscellaneous | 0 | 0 | 0 | 8,300 | 7.5 |
| Stemple | 0 | 2,900 | 68,000 | 50,600 | 71.0 |

Source: Harland Bartholomew & Associates, Inc., 1996

Winter irrigation may occur in all irrigation areas as needed. Normal summer irrigation will lead to a salinity change in the esteros and was determined to be a significant impact. Due to its infrequency and limited duration of application, winter irrigation is expected to create a lesser alteration to the salinity in the esteros than dry season irrigation. However, significance of the impact is defined by any change and therefore winter irrigation impacts the esteros significantly.

*No Impact; Alternatives 1, 2, 4, and 5.*

Alternative 2 agricultural irrigation areas do not drain into the esteros or their watersheds.

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

Mitigation: *Alternative 3.* No feasible mitigation has been identified.

*Alternatives 1, 2, 4, and 5.* No mitigation is needed.

**Impact:** **9.7.9. Will the agricultural irrigation component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

This evaluation of toxicity and bioaccumulation potential of reclaimed water irrigation is provided because aquatic plants and wildlife may be attracted to or become resident in the irrigation areas because of the runoff catch basins below some irrigated fields and because subsurface flows from the irrigated fields may enter downgradient water bodies. Ecological quotients (EQ) were calculated for exposure to undiluted reclaimed water applied directly to agricultural irrigation fields and for the exposure of freshwater and marine organisms to agricultural runoff (including the esteros). The EQ for risk to freshwater organisms from chronic exposure to dissolved metals and pesticides in irrigated percolate water range from 0.00 to 1.08 and a cumulative EQ of 0.0 to 3.88 and the EQ for risk to aquatic organisms in the esteros from chronic exposure to dissolved metals and pesticides in irrigated percolate water range from 0.00 to 4.24 with the cumulative EQ of 0.0 to 6.9. All EQ values are below the significance threshold of 10 and therefore the impact is less than significant.

During dry winters, discharge to the Russian River may be restricted by low Russian River flows. During these periodic events, wastewater will be provided to farmers outside the normal irrigation season. Water will only be provided to areas under evaluation as summer irrigation areas.

Irrigation runoff and ponding may occur due to faulty operation or pipeline leakage. Measures adopted as part of the Project have been developed to avoid runoff and ponding. These measures include 2.2.2, Irrigation Site Resource Maps, and 2.2.5, Avoid Sensitive Biological Resources which have been designed to avoid the potential effects of runoff and ponding by providing for identification and buffering of special-status aquatic plant and wildlife species and occupied habitats. In addition, there are no direct physical effects to aquatic plant or wildlife species or permanent changes to aquatic habitat due to changes in hydrology because the effects of runoff or pipeline leakage are temporary. For indirect effects to aquatic vegetation and organisms due to release of reclaimed water refer to *Ecological Risk Assessment* (Parsons Engineering Science, Inc. 1996). Therefore, any potential impacts to the designated species and occupied habitats from irrigation pipeline rupture will be less than significant.

*No Impact; Alternative 1, 4, and 5.*

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

Mitigation: No additional mitigation is proposed.

### Geysers Steamfield Component

The following impact analysis addresses potential impacts associated with the proposed construction of two storage holding tanks, in-field pipes and access roads and the application of reclaimed water into the geysers steamfield via existing injection wells. No component table is presented for the geysers component since there are no impacts for any criterion. This component includes pipelines within the steamfield.

**Impact: 9.8.1-9. Will the geysers steamfield component impact aquatic biological resources based on evaluation criteria 1 through 9.**

Analysis: *No Impact; All Alternatives.*

No special-status aquatic species or aquatic habitat are potentially present within or adjacent to proposed tank locations and existing injection well sites. The construction associated with the storage tanks will occur on a ridge top which is not located near any aquatic habitats. Construction of the in-field pipeline may result in loss of potential or occupied habitat of aquatic species of concern.

However, Measure 2.2.5 serves to avoid environmentally sensitive areas along pipelines, pump stations, and electrical systems and establishes procedures for avoidance of construction impacts to special-status aquatic wildlife or plant species and habitats.

Because exclusionary buffers for sensitive biological resources will be incorporated in the final Project design, the potential loss of individuals or occupied habitat of aquatic wildlife or plant species will be avoided.

Alternatives 1, 2, 3, and 5 do not have a geyser steamfield component.

Mitigation: No additional mitigation is proposed.

## Discharge Component

### Table 4.9-22

Aquatic Biological Resources Impacts by Component - Discharge

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.9.1. Will the discharge component cause loss of individuals or occupied habitat of endangered, threatened, or rare candidate aquatic wildlife or plant species? | a) Greater than 0 species<br><br>b) Greater than 0 acres | None | P | == |
| 9.9.2. Will the discharge component cause loss of individuals of CNPS List 2, 3, or 4 aquatic plant species? | Greater than 15 percent of presumed extant occurrences or populations in Sonoma and Marin counties | None | P | == |
| 9.9.3. Will the discharge component cause loss of potential or occupied habitat of aquatic species of concern? | Greater than 20 percent of mapped occupied habitat in all project components | None | P | == |
| 9.9.4. Will the discharge component cause a permanent loss of sensitive native aquatic plant communities? | Greater than 0 Acres | None | P | == |
| 9.9.5. Will the discharge component cause a permanent loss of aquatic habitat? | Greater than 0 linear feet | None | P | == |
| 9.9.6. Will the discharge component cause a change to the physical condition of habitat or aquatic life in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary? | Greater than 0 ppt salinity change | None | P | == |

## Table 4.9-22

### Aquatic Biological Resources Impacts by Component - Discharge

| Evaluation Criteria | Point of Significance | Impact | Type of Impact[1] | Level of Significance[2] |
|---|---|---|---|---|
| 9.9.7. Will the discharge component substantially block or disrupt major fish or aquatic wildlife migration or travel corridors? | Greater than 0 corridors | None | P | ❍ |
| 9.9.8. Will the discharge component cause a decrease in streamflows, affecting aquatic habitat or aquatic life downstream from proposed dam sites? | Greater than 0 linear feet of affected stream habitat | None | -- | == |
| 9.9.9. Will the discharge component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)? | EQ Greater than 10 | EQ values range from 0.0 to 9.28 | O&M, O&M-CP | ❍ |

Source: Harland Bartholomew & Associates, Inc., 1996

| Notes: | 1. Type of Impact: | | 2. Level of Significance: |
|---|---|---|---|
| P | Permanent | == | No impact |
| O&M | Operation and Maintenance | ❍ | Less than significant impact; no mitigation proposed |
| O&M-CP | Operation and Maintenance - Contingency Plan | | |

**Impact:** **9.9.1-6, and 8. Will the discharge component impact aquatic biological resources based on evaluation criteria 1 through 6, and 8?**

Analysis: *No Impact; All Alternatives.*

Project Measure 2.2.5 serves to avoid environmentally sensitive areas along pipelines, pump stations, and electrical systems and establishes procedures for avoidance of construction impacts to sensitive aquatic wildlife or plant species and habitats.

Construction of a Russian River outfall will be restricted to the low flow period when the water level is below the construction area. Therefore, potential loss of individuals or occupied habitat of aquatic wildlife or plant species will be avoided.

Mitigation: No additional mitigation is proposed.

**Impact: 9.9.7. Will the discharge component substantially block or disrupt major fish or aquatic wildlife migration or travel corridors?**

Analysis: *Less than Significant; All Alternatives.*

The Russian River and Laguna de Santa Rosa have been the subject of numerous studies in recent years, sponsored by California Department of Fish and Game, Sonoma County Water Agency, and the Subregional System.

A five-year study of the effects of reclaimed water discharge on steelhead trout and coho salmon migration and production in the Laguna de Santa Rosa watershed is summarized in Merritt Smith Consulting (1995, 1996f). This study involved the evaluation of the number of adults migrating upstream to spawn, the number of juvenile produced, habitat factors affecting juvenile production, and the number of adults and juveniles returning to the sea. The number of captured migrating fish was compared to the concentration of reclaimed water in the migration corridor as one means of evaluating for potential reclaimed water impacts. Juvenile production was also evaluated relative to reclaimed water discharge.

A general conclusion of these studies is that the mainstem of the river is warmwater Type A habitat for at least five months of each year. During the winter, the river serves as a migration corridor for anadromous fishes (i.e., steelhead trout and coho salmon) moving to or from the Laguna drainage and other spawning and juvenile resting areas. The overall conclusion of the Russian River and Laguna studies summarized in the above-referenced document is that the discharge of reclaimed water into the migration corridor in Santa Rosa and Mark West creeks does not constitute impairment of these streams with respect to migration, reproduction, or rearing of anadromous fish. Therefore, this impact is less than significant.

Mitigation: No mitigation is proposed.

**Impact: 9.9.9. Will the discharge component result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)?**

Analysis: *Less than Significant; All Alternatives.*

Potential ecological risks were evaluated for a 20 percent design discharge to the River. The maximum contribution of reclaimed water to the

Russian River flow is likely to occur only during very dry-weather conditions. Under typical flow conditions, reclaimed water concentrations in the Russian River will be considerably smaller than those indicated by the design discharge values.

In the Laguna de Santa Rosa, reclaimed water contributions vary considerably depending on the reach of the Laguna. At the discharge point at Delta Pond on Santa Rosa Creek, the contribution will be the highest. For the purposes of the ecological risk assessment the contribution of reclaimed water in the Laguna has been chosen as the median value of an average rainfall year near the Delta Pond discharge -- 35 percent (35 percent of the Laguna is reclaimed water).

Three transfer pathways were considered for the potential exposure of Russian River and Laguna de Santa Rosa organisms to effluent constituents: direct exposure of aquatic organisms, water ingestion from the stream by wildlife species; and exposure by fish consumption by piscivorous birds and mammals. In addition, risk assessment was analyzed for chronic exposure of endangered, threatened, or other special-status aquatic species to the treated effluent. Results of cumulative ecological quotient calculations for 20 percent design discharge into the Russian River (directly to the Russian River or via the Laguna de Santa Rosa) indicate that the direct exposure of aquatic organisms ($0.00 \leq EQ \leq 2.82$), aquatic life exposure by fish ingestion ($0.00 \leq EQ \leq 9.28$), aquatic life exposure by water intake ($0.00 \leq EQ \leq 0.02$), and risk to freshwater endangered species ($0.00 \leq EQ \leq 0.17$), are less than significant. Impacts to aquatic organisms in the Laguna are assessed at 100 percent effluent exposure. EQs for the Laguna are less than 8.4. All ecological quotient values for discharge less than the threshold value of 10 and so the impacts are less than significant. See the *Ecological Risk Assessment* for more detailed analysis (Parsons Engineering Science, Inc. 1996). Impacts of lower levels of discharge for other alternatives will be less.

During dry winters, discharge to the Russian River may be restricted by low Russian River flows. During these periodic events, contributions of reclaimed water to the Russian River or Laguna will increase substantially. However, these discharges will last for very short periods, a maximum of four days. Because of such a brief exposure, it is not appropriate to apply the same chronic risk factors as for the previous risk assessment. No bioaccumulation will occur during such short exposures. Impacts will be the same as non-contingency discharge.

*No Impact; Alternatives 1 and 4.*

Alternatives 1 and 4 do not have a contingency plan for discharge.

Mitigation: No mitigation is proposed.

## CUMULATIVE IMPACTS

There are eight impacts -- either less than significant or significant -- identified in the Aquatic Biological Resources section:

**Impact:** **9.1C. Will the Project plus cumulative projects cause loss of individuals or occupied endangered, threatened, or rare wildlife plant species?**

Analysis: The Project impacts are to alternatives 2, 3A, 3B, 3D, and 3E.

Construction of storage sites will result in the loss of 1.4 to 8.7 acres of California red-legged frog habitat (except Carroll Road and Adobe Road). All losses are considered significant and will be fully mitigated through habitat creation, restoration and preservation and red-legged frog translocation. All frogs were found in marginal habitats. Mitigation will not only fully compensate for the losses, but will provide long-term preservation of their habitats.

The cumulative projects list (Appendix D-31) identifies 504 projects which are undergoing some level of review by the U.S. Corps of Engineers for wetlands fill in the cumulative project area. Many of these projects may impact red-legged frog habitat. The protection of the California red-legged frog habitat potentially affected by these projects is guaranteed through the Endangered Species Act which requires federal agencies insure that their actions (including permitting) are not likely to jeopardize the continued existence of listed species. Therefore, mitigated impacts to red-legged frogs should be minimal.

Since the impacts of the Project will be fully mitigated as well as the cumulative projects, no additional cumulative effect is identified for this impact. No additional mitigation is proposed.

**Impact:** **9.2C. Will the Project plus cumulative projects cause loss of individuals of CNPS List 2, 3, or 4 aquatic plants species?**

Analysis: The Project impacts are to alternative 3E.

The loss of one population of Lobb's aquatic buttercup at the Huntley storage site represents 3 percent of the known populations in Sonoma and Marin counties. This is less than the 15 percent point of significance and therefore is considered less than significant.

Loss of four additional populations from cumulative projects will result in a significant effect. Though it is unknown if the implementation of the projects identified on the cumulative project list will result in the loss of four additional populations of Lobb's aquatic buttercup, it is probable. Lobb's aquatic buttercup is associated with vernal pools and valley foothill grasslands. Valley foothill grasslands are a common habitat in the region and the site of many projects on the cumulative project lists. Therefore cumulative projects are considered to have a significant effect on Lobb's aquatic buttercup.

Mitigation: 2.4.15. Sensitive Plant Relocation Program. Seeds from the Lobb's aquatic buttercup population will be collected and reestablished in mitigation sites developed as a result of the Sensitive Resource Conservation Plan.

**Impact: 9.3C. Will the Project plus cumulative projects cause loss of potential occupied habitat of aquatic species of concern?**

Analysis: The Project impacts are to alternatives 2A, 2C, and 3.

Loss of western pond turtle habitat exceeds 20 percent of the potential habitat present in the local watershed at Tolay Extended, and Tolay Confined and is therefore a significant Project impact. Loss of western pond turtle habitat ranges from 4-14 percent on the remaining storage sites (except Adobe Road, Lakeville Hillside, and Sear Point), and is a less than significant impact. The significant impacts at the Tolay storage sites will be fully mitigated through western pond turtle habitat creation, restoration, and preservation in conjunction with other elements of the Sensitive Resource Conservation Program. All pond turtle habitat is also identified as Corps jurisdictional wetlands. Under criteria developed in the Jurisdictional Wetlands Section, all jurisdictional wetlands impacts will be mitigated to result in no net loss of function or acreage. Therefore there will be no net loss of western pond turtle habitat function and acreage associated with the Project.

Though projects in the cumulative projects lists may affect western pond turtles, there will be no net effect from the Project. Therefore no cumulative effects to western pond turtles will occur. No change in the finding of significance or mitigation is proposed.

**Impact: 9.4C. Will the Project plus cumulative projects cause loss of potential occupied habitat of aquatic species of concern?**

Analysis: The Project impacts are to alternative 3A.

Loss of any sensitive plant community is considered significant for this analysis. The loss of 0.41 acres of freshwater marsh at Two Rock storage site is therefore a significant impact. This impact will be fully mitigated through the creation, restoration and preservation of 0.41-1.23 acres of freshwater marsh, resulting in no net loss of community acreage or function.

Freshwater marsh is a jurisdictional wetland and therefore is a resource regulated by the Corps. In keeping with the no net loss of wetlands policy set by the executive branch of the federal government, the Corps will require mitigation for freshwater marsh losses associated with any project identified as undergoing Corps review on the cumulative project lost.

Effects of projects in the cumulative project lists on freshwater marsh will be minimal and all impacts associated with the Project are mitigated. Therefore there are no additional cumulative effects. No change in the findings of significance or mitigation is proposed.

**Impact: 9.5C. Will the Project plus cumulative projects cause permanent loss of aquatic habitat?**

Analysis: The Project impacts are to alternatives 2 and 3.

All south county (Alternative 2) and Carroll Road (Alternative 3C) storage sites will result in significant loss of aquatic habitat (greater than 25 percent loss of the habitat type in the local watershed). All other storage sites will result in less than significant loss of aquatic habitat. The portions of these habitats identified as waters of the U.S. will be mitigated as jurisdictional wetlands (see Jurisdictional Wetlands Resources Section) on all reservoir sites irrespective of the findings of significance in this section. Impacts to aquatic habitat significantly affected will be completely mitigated through creation of new or restoration of existing habitats proximal to the impact area resulting in no net loss of acreage or function.

Many of the projects included in the cumulative project list will impact aquatic habitat but none will affect the local watersheds associated with the storage sites of the Project. In addition, all cumulative projects affecting waters of the U.S. will be subject to Corps review and should be required to mitigate as an element of the federal no net loss policy. All aquatic habitat in streams will, in addition, require California Department of Fish and Game review and issuance of a Section 1601-1603 Streambed Alteration Agreement. Therefore, though there will be small losses of aquatic habitat associated with the Project after mitigation, they are restricted to local watersheds and are not additive to cumulative projects.

**Impact:** **9.6C. Will the Project plus cumulative projects cause a change to the physical condition of aquatic habitat on the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary?**

Analysis: The Project impacts are to alternative 3.

Operation of the west county storage facilities and irrigation system will result in additional freshwater flows to the esteros resulting in an alteration to the salinity in the Gulf of the Farallones National Marine Sanctuary. This impact is unavoidable and no feasible mitigation has been identified.

The cumulative project list includes many projects in the watershed of Stemple and Americano creeks. Even though these projects are limited in size, they have the potential to contribute pollutants to the creeks, and thence to the esteros. Some of these pollutants may overlap with the impacts of the Project, and total impacts to the esteros will be greater than those for the Project alone. Impacts for the project have already been determined to be significant and mitigation has been found to be infeasible. Mitigation for cumulative impacts will also be infeasible.

**Impact:** **9.8C. Will the Project plus cumulative projects cause a decrease in stream flows, affecting aquatic habitat or aquatic life downstream from proposed dam sites?**

Analysis: The Project impacts are to alternatives 2 and 3.

The impoundment of stream flows associated with the drainages in each storage site watershed of the Project will diminish stream flows seasonally downstream of the dam sites. Dams of the Tolay Extended, Tolay Confined, Lakeville Hillside, Bloomfield, Carroll Road, and Valley Ford storage sites will block at least 50 percent of the flow during the wet season resulting in significant impacts. Dam at Sears Point, Two Rock, Adobe Road, and Huntley storage sites will not significantly block flows (less than 50 percent in the wet season). Significant impact will be mitigated through restoration of existing stream habitat.

The cumulative project list contains four new storage sites (see above analysis). Of these potential storage sites only the City of Petaluma Wastewater facilities projects are placed close enough to the Project storage facilities to have a cumulative effect. Storage sites identified in the City of Petaluma Wastewater facilities projects Revised Draft EIR are in neighboring watersheds to the Tolay, Adobe Road, and Lakeville Hillside storage sites (Alternative 2). Both potential sites of the Petaluma reservoir will diminish stream flows downstream of the dam sites at Higgins and Wheat Creeks. These creeks are not confluent with either the creek below the Adobe Road storage site, Tolay Creek, or the small ephemeral creek flowing through the Lakeville Hillside storage site. Because of this, no cumulative impacts to stream flow from storage sites are expected. No change in the level of significance or mitigation is proposed.

**Impact:** **9.9C. Will the Project plus cumulative projects results in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation)?**

Analysis: The Project impacts are to alternatives 2, 3, and 5.

**Exposure at Storage Sites and Agricultural Irrigation Systems.** There are less than significant impacts (EQ less than or equal to 10) associated with the operation of storage site and irrigation system (EQ ranging from 0.01 to 5.8).

Several cumulative projects are located near the storage reservoirs or agricultural irrigation areas. However, the ecological risk assessment at these sites assumed 100 percent exposure to reclaimed water and found no significant risk to aquatic organisms. Potentially cumulative projects could not contribute greater than 100 percent exposure, so Project impacts adequately describe total cumulative impacts.

**Exposure at the Russian River or Laguna de Santa Rosa.** In the Laguna, exposure was assessed at 100 percent effluent, similar to the storage and irrigation sites discussed in the previous paragraph. The *Ecological Risk Assessment* does not show significant risk to aquatic life in the Laguna (EQ less than 5), and cumulative projects could not contribute more than the 100 percent exposure already discussed (Parsons Engineering Science, Inc. 1996).

In the Russian River, the *Ecological Risk Assessment* assumed the maximum design discharge rate of 20 percent of river flow (20 percent exposure). The risk assessment identified an EQ of 9.28 for harbor seals (largely due to aluminum, EQ = 9.21), a less-than-significant impact, but close to the point of significance of EQ = 10 (Parsons Engineering Science, Inc. 1996). Because there are many point and non-point sources of discharge into the Russian River in the cumulative projects list, it is possible that aluminum concentrations may increase enough to cumulatively exceed the EQ = 10 threshold. This is considered a significant cumulative impact.

For other aquatic life besides harbor seals, the *Ecological Risk Assessment* identified an EQ of less than 1.4, far below the point of significance.

Although cumulative projects in the Russian River watershed may increase the concentration of some chemicals evaluated in the risk assessment, contributions from cumulative projects will not be able to increase pollutants in the River sufficient to increase the EQ to 10 or greater (Parsons Engineering Science, Inc. 1996). This is because the concentration of chemicals of concern will need to increase several fold in order to increase risk levels to that extent.

Mitigation: 2.4.16. Ecological Risk Monitoring and Source Control Program. A monitoring plan shall be undertaken to collect additional toxicity data (Kelley Ponds, Russian River) over a two-year period. The data shall be used in an ecological risk assessment to determine if the existing system the Project, and cumulative project discharges will result in an EQ exceeding 10 for harbor seals in the Russian River. If it is determined that the EQ for harbor seal exceeds 10, then the City shall undertake a program to identify sources of aluminum and to reduce the cumulative EQ for aluminum to less than 10.

Aluminum in effluent may be derived from the addition of alum sulfate during wastewater treatment to enhance solids removal and disinfection. Options for reducing aluminum in effluent include substituting ferric chloride or an organic polymer during treatment, identifying primary sources (aside from treatment), and implementing a control program.

## SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES

**Table 4.9-23**

Summary of Significant Impacts and Mitigation Measures-

Aquatic Biological Resources

| Impact | Level of Significance | Mitigation Measure |
|---|---|---|
| **Storage Reservoir Component** | | |
| 9.5.1. The storage reservoir component may cause loss of individuals or occupied habitat of endangered, threatened, or rare aquatic wildlife or plant species. | Alt 2 - ⦿<br>Alt 3A - ⦿<br>Alt 3B - ⦿<br>Alt 3D - ⦿<br>Alt 3E - ⦿ | 2.3.11. Sensitive Resource Conservation Program<br>2.4.4. California Red-legged Frog Capture and Relocation Program |

# Table 4.9-23

## Summary of Significant Impacts and Mitigation Measures-
## Aquatic Biological Resources

| Impact | Level of Significance | Mitigation Measure |
| --- | --- | --- |
| 9.5.3. The storage reservoir component may cause loss of potential or occupied habitat of aquatic species of concern. | Alt 2A - ⦿<br>Alt 2C - ⦿ | 2.3.11. Sensitive Resource Conservation Program |
| 9.5.4. The storage reservoir component may cause permanent loss of sensitive aquatic plant communities and associated wildlife habitats. | Alt 3A - ⦿ | 2.3.11. Sensitive Resource Conservation Program |
| 9.5.5. The storage reservoir component may cause permanent loss of aquatic habitat. | Alt 2 - ⦿<br>Alt 3C - ⦿ | 2.3.11. Sensitive Resource Conservation Program |
| 9.5.6. The storage reservoir component may cause a change in the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary. | Alt 3 - ● | No feasible mitigation has been identified. |
| 9.5.8. The storage reservoir component may cause a change in stream flows, affecting aquatic habitat or aquatic life downstream from proposed dam sites. | Alt 2 - ⦿<br>Alt 3B - ⦿<br>Alt 3C - ⦿<br>Alt 3D - ⦿ | 2.3.11. Sensitive Resource Conservation Program |
| **Agricultural Irrigation Component** | | |
| 9.7.6. The agricultural irrigation component may cause a change in the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary. | Alt 3 - ● | No feasible mitigation has been identified. |

# Table 4.9-23

## Summary of Significant Impacts and Mitigation Measures- Aquatic Biological Resources

| Impact | Level of Significance | Mitigation Measure |
|---|---|---|
| **Cumulative Impacts** | | |
| 9.2C. The Project plus cumulative projects may cause loss of individual of CNPS List 2, 3, 0r 4 aquatic plant species. | Alt 3E - ⊙ | 2.4.15. Sensitive Plant Relocation Program. |
| 9.9C. The Project plus cumulative projects may result in ecological risk to aquatic plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation). | Alt 1 - ●<br>Alt 5 - ⊙ | 2.4.16. Ecological Risk Monitoring and Source Control Program. |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: Level of Significance:
⊙ Significant impact before mitigation; less than significant impact after mitigation
● Significant impact before and after mitigation

## SUMMARY OF IMPACTS BY ALTERNATIVE

### Table 4.9-24

Summary of Impacts by Alternative -Aquatic Biological Resources

| Component | Alt 1 | Alt 2A | Alt 2B | Alt 2C | Alt 2D | Alt 3A | Alt 3B | Alt 3C | Alt 3D | Alt 3E | Alt 4 | Alt 5A | Alt 5B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Action (No Project) Alternative | ❍ | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Headworks Expansion | -- | == | == | == | == | == | == | == | == | == | == | == | == |
| Urban Irrigation | -- | == | == | == | == | == | == | == | == | == | -- | -- | -- |
| Pipelines | -- | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | -- |
| Storage Reservoirs | -- | ⊙ | ⊙ | ⊙ | ⊙ | ● | ● | ● | ● | ● | -- | -- | -- |
| Pump Stations | -- | == | == | == | == | == | == | == | == | == | == | -- | -- |
| Agricultural Irrigation | -- | ❍ | ❍ | ❍ | ❍ | ● | ● | ● | ● | ● | -- | -- | -- |
| Geysers Steamfield | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | == | -- | -- |
| Discharge | -- | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Cumulative | ● | == | == | == | == | == | == | == | == | ⊙ | == | ⊙ | ⊙ |

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: Level of Significance Codes

- -- Not applicable
- == No impact
- ❍ Less than significant impact; no mitigation proposed
- ⊙ Significant impact; less than significant after mitigation
- ● Significant impact before and after mitigation

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## References

### *HBA Team Documents*

Dames and Moore. 1995. *Dam Break Inundation Analysis.* (Appendix J-1).

Harland Bartholomew & Associates, Inc. 1996a. *Biological Resources, Volume 1*. (Appendix K-1).

Harland Bartholomew & Associates, Inc. 1996b. *Biological Resources, Volume 2*, Special Status Species Accounts. (Appendix K-2).

Harland Bartholomew & Associates, Inc. 1996c. *Biological Resources, Volume 4A - Terrestrial Wildlife Habitat and Special Status Wildlife Occurrences on Storage Reservoirs.* (Appendix K-5).

Harland Bartholomew & Associates, Inc. 1996d. *Biological Resources, Volume 4B - Aquatic Habitat and Special Status Aquatic Species Occurrences on Storage Reservoirs.* (Appendix K-5).

Harland Bartholomew & Associates, Inc. 1996e. *Biological Resources, Volume 4C - Vegetation Communities and Special Status Plant Occurrences on Storage Reservoirs.* (Appendix K-5).

Harland Bartholomew & Associates, Inc. 1996f. *Biological Resources, Volume 4D - Irrigation Area Vegetation Communities and Special Status Species Occurrences.* (Appendix K-5)

Harland Bartholomew & Associates, Inc. 1996g. *Biological Resources, Volume 4E - Index to Biological, Aquatic, and Wetland Resources Along Pipelines and Pump Stations.* (Appendix K-5)

Merritt Smith Consulting. 1995. *Anadromous Fish Migration Study Program, 1991-1994*. April 11. (Appendix L-1)

Merritt Smith Consulting. 1996a. *Environmental Conditions in West County Waterways.* June 30. (Appendix I-3)

Merritt Smith Consulting. 1996b. *Aquatic Habitat Survey Results.* June 29. (Appendix L-4)

Merritt Smith Consulting. 1996c. *Stream Crossings Assessment*. June 30. (Appendix I-15)

Merritt Smith Consulting. 1996d. *Aquatic Life Survey Results*. June 30. (Appendix L-5)

Merritt Smith Consulting. 1996e. *Aquatic Biological Resources Impact Analysis Report*. (Appendix L-7)

Merritt Smith Consulting. 1996f. *Anadromous Fish Migration Study Program, 1991-1995*. (Appendix L-2).

Parsons Engineering Science, Inc. 1996. *Ecological Risk Assessment.* (Appendix K-5).

Sycamore Environmental Consultants, Inc. 1996. *Biological Resources, Volume 3*. (Appendix K-3).

### *Other References*

Barnhouse, L. W., G. W. Suter II, S. M. Bartell, J. J. Beauchamp, R. H. Gardner, E. Linder, R. V. O'Neill, and A. E. Rosen. 1986. *User's Manual for Ecological Risk Assessment, (*Environmental Services Division, Oak Ridge National Laboratory, Publication) No. 2679, ORNL-6251.

Brown & Caldwell and Jones & Stokes Associates. 1994. *Petaluma Wastewater Treatment and Storage Facilities Project - Draft Environmental Impact Report.*

Buell and Associates. 1988. *Estero Americano Study, Reclamation Alternative Evaluation. Freshwater Resident/Anadromous Fisheries Developmental Potential*.

California State Coastal Commission. 1987. *Draft Sonoma County Wetlands Enhancement Plan.*

Commins, Marcie, J. Roth, and M. Fawcett. 1990. *Long-Term Detailed Wastewater Reclamation Studies* - *Santa Rosa Subregional Water Reclamation System* - (Technical Memorandum No. E8A).

Connors, P. G., and J. L. Maron. 1989. *Estero Americano Bird Population Study*. (Long-Term Detailed Wastewater Reclamation Studies Santa Rosa Subregional Water Reclamation System Technical Memorandum No. E13).

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* United States Fish and Wildlife Service, Washington, D. C.

De Mars, John, et al. 1977. *Laguna de Santa Rosa Environmental Analysis and Management Plan.* California State College, Sonoma.

EIP Associates. 1990. *Santa Rosa Subregional Water Reclamation System: Long-Term Wastewater System Draft Environmental Impact Report/Statement.*

Elford, C. R. 1964. *Climate of Sonoma County*. United States Department of Commerce, Weather Bureau.

Environmental Science Associates. 1994. *Southeast Regional Wastewater Treatment Plant Facilities Improvements Project and Geysers Effluent Pipeline Project - Draft EIR/EIS (Volume 1 of 2)*.

EPA. 1989. *Risk Assessment Guidance for Superfund, Vol. II Environmental Evaluation Manual. Interim Final. USEPA, EPA/54011-89/001.*

Goldman, C. R., and A. J. Horne. 1983. *Limnology*. McGraw-Hill Book Company, San Francisco.

Goodwin, P., and C. K. Cuffe. 1994. *Russian River Estuary Study 1992-1993*.

Grenfell, Jr., W. E. 1988. Valley-foothill riparian. Pages 86-87 *in* Mayer, K. and W. Laudenslayer Jr. (eds.). *A Guide to Wildlife Habitats of California*. California Department of Forestry and Fire Protection, Sacramento, CA.

Harvey, T. 1990. *Evolution of Wetlands in the Estero Americano.* Long-Term Detailed Wastewater Reclamation Studies Santa Rosa Subregional Water Reclamation System Technical Memorandum No. W9.

Jones & Stokes Associates, Inc. 1981. *Ecological Characterization of the Central and Northern California Coastal Region, Volume II, Part 1, Regional Characterization*.

Madrone Associates. 1977. *The Natural Resources of Esteros Americano and de San Antonio*. California Department of Fish & Game, Sacramento, CA.

Menzie, C., J. Cura, J. Freshman, and S. Svirsky. 1993. Evaluating ecological risks and developing remedial objectives at forested wetland systems in New England. Pp. 89-100 in *Application of Ecological Risk Assessment to Hazardous Waste Site Remediation.* Workshop Proceedings. USEPA Science Advisory Board.

PAS & Associates. 1992. *City of Sebastopol General Plan Background Report #3 - Existing Plans, Environment and Infrastructure*.

Prunuske Chatham, Inc. 1994. *Stemple Creek/Estero de San Antonio Watershed Enhancement Plan*.

Roth, J., M. Commins, M. Fawcett, and R. Maddox. 1993. *Steelhead Trout Migration in Mark West Creek and Santa Rosa Creek, 1991-1993. Laguna de Santa Rosa Intensive Monitoring Program Draft Technical Memorandum.*

Schoenherr, A. A. 1992. *A Natural History of California*. University of California Press, Berkeley and Los Angeles, California.

Serpa, L. 1991. *Stemple Creek Rare Invertebrate Survey.*

Serpa, L. 1995. *Survey for the California Freshwater Shrimp (Syncaris pacifica) at proposed reservoir sites for the Santa Rosa Wastewater Project.*

Smith, David W. Consulting & CH2M Hill. 1988. *Status Report - Reclamation Alternative Evaluation - Estero Americano Environmental Studies*.

Smith, David W. Consulting & CH2M HILL. 1990. *History, Land Uses and Natural Resources of the Laguna de Santa Rosa.*

United States Fish and Wildlife Service. 1981. *Pacific Coast Ecological Inventory, Santa Rosa, California.*

Watkin, G. E., and M. E. Stelljes. 1993. *A Proposed Approach to Quantitatively Assess Potential Ecological Impacts to Terrestrial Receptors from Chemical Exposure, Environmental Toxicology and Risk Assessment: $2^{nd}$ Volume, STP*

*1216,* J. W. Gorsuch, F. J. Dwyer, C. G. Ingersoll, and T. W. La Point, eds., American Society for Testing and Materials, Philadelphia.

Will, M. E. and G. W. Suter II. 1994. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process.* Oak Ridge National Laboratory, Environmental Sciences Division. ES/ER/TM-126.

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