9.0 WETLANDS, STREAMS, RIPARIAN AREAS, AND WATERSHED AREAS

9.1 BACKGROUND AND SETTING

Chapter 4.0, Section II, of the Draft Management Plan describes the interrelationships among elements of the aquatic ecosystem complex in Humboldt Bay by noting:

> From a management perspective (and also a regulatory perspective), essentially all of the areas subject to the District's jurisdiction are wetlands or "deep-water" habitats;[1] the majority of the Sphere of Interest is composed of wetlands. While there are several regulatory definitions of wetland and other environmentally sensitive habitat types, and while there may be subsequent discussions about regulatory jurisdictions that affect this Plan, this chapter essentially identifies the aquatic features in most of the Plan Boundary and the Sphere of Interest as wetlands or deep-water habitats.

This EIR (somewhat artificially) divides the coverage of the aquatic ecosystem elements of the bay [including the "deepwater" habitats, the shallow subtidal and intertidal areas, and the saltmarshes (which are often considered under wetland-related headings)] among Chapters 8.0, 10.0, and 11.0, as well as this chapter. This chapter summarizes the aquatic ecosystem elements that in the bay ecosystem complex. In addition, it amplifies the functional roles of the streams and sloughs that are the "watercourses" in the Humboldt Bay basin, the riparian areas that co-function with the watercourses as the upland-aquatic "border," and the diked former tidelands that are the "border" to the bay itself. Analytically and functionally Humboldt Bay, all of the aquatic elements "above" the bay, and the nearshore Pacific Ocean are elements in a unified aquatic ecosystem. This means that changes in any of the elements are linked to the rest of the elements (although the linkage may not always be a significant "forcing function" that drives the ecosystem to change).

Understanding the importance of streams and riparian areas for the Humboldt Bay ecosystem complex requires visualizing streams and riparian areas as tendrils of the bay, extending upward into the higher lands away from the bay itself. Hydrologically, the aquatic ecosystem could be mapped as an area that is "densest" in the bay and the permanent rivers and streams, with the "aquatic density" getting thinner farther away from these areas, with upland areas close to the watershed boundary being merely thin shadows of the aquatic system. Even so, all of the elements of this ecosystem complex are interconnected to greater or lesser degree, and whatever happens in even the most

1 The footnote in the Draft Plan identifies deep-water habitat areas as "aquatic habitat areas that are generally considered to be too deep for submerged or emergent aquatic vegetation; generally deep-water habitats are permanently flooded areas greater than two meters (6.6 feet) deep, but if aquatic plants grow in deeper water, the depth at which deep-water habitat begins is generally considered to be the depth at which plants no longer occur." However, this definition is only applicable in the Palustrine and Riverine system wetlands in the Humboldt Bay area. The definition of "deepwater habitats" in the tidal wetlands of the Marine and Estuarine systems is the tidal datum known as "extreme low water – spring tides."

remote parts of the ecosystem can (and usually does) affect the remainder of the ecosystem to some degree.

9.1.1 Tidal and Non-Tidal Wetlands

Wetlands are a significant regulatory consideration for the Humboldt Bay Management Plan; they provide a context that is regulated by federal, state, and local agencies in the Humboldt Bay area. Wetlands typically constitute a significant element in many environmental documents, because they are identified as a significant concern in the CEQA Appendix G Environmental Checklist (see Section 9.2).

<u>9.1.1.1 Wetland Identification</u>

Generally non-tidal wetland regulation by local agencies in California follows the identification conventions adopted by the State of California, which were based, initially, on identification conventions developed for regulatory approaches that implemented federal law. The wetland definition conventions adopted by the federal and state governments do differ, however, sufficiently that some areas are regulated by the State of California that are excluded under federal regulation.

Federal Wetland Definition. The "official" identification of what constitutes a wetland subject to federal regulation pursuant to Section 404 of the Clean Water Act includes the following text, excerpted from the Army Corps of Engineers (ACOE) wetlands manual (Environmental Laboratory 1987):

> "The following definition, diagnostic environmental characteristics, and technical approach comprise a guideline for the identification and delineation of wetlands.
>
> "a. Definition: The ACOE (Federal Register, Section 328.3(b), 1991) and the EPA (Federal Register, Section 230.4(t), 1991) jointly define wetlands as: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.
>
> "b. Diagnostic environmental characteristics: Wetlands have the following general diagnostic environmental characteristics:
>
>> "Vegetation: The prevalent vegetation consists of macrophytes that are typically adapted to areas having hydrologic and soil conditions described in (a) above. Hydrophytic species, due to morphological, physiological, and/or reproductive adaptation(s), have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions.
>>
>> "Soil: ~~Soils are present and have been classified as hydric, or they possess characteristics that are associated with reducing soil conditions~~. [2]
>>
>> "Hydrology: The area is inundated either permanently, or periodically at mean water depths <6.6 ft. (~2 m), or the soil is saturated to the surface at some time during the growing

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2 The characterization of "hydric soils" in the online version of the 1987 manual (see URL: http://www.spk.usace.army.mil/pub/outgoing/co/reg/wlman87.pdf, viewed January 2006) is now described by federal agencies as "obsolete." This is the text in the quotation that is shown in "strikethrough." The description in the currently available online manual provides a link to a Natural Resource Conservation Service website offering an NRCS "Field Book for Describing and Sampling Soils," which is intended to provide procedural information that should be used to identify wetland soils. The updated URL for this manual (Schoeneberger and others 2002) is: ftp://ftp-fc.sc.egov.usda.gov/NSSC/Field_Book/FieldBookVer2.pdf (viewed January 2006).

season of the prevalent vegetation. The period of inundation or soil saturation varies according to the hydrologic/soil moisture regime and occurs in both tidal and non-tidal situations

"c. Technical approach for the identification and delineation of wetlands: Except in certain situations defined in this manual, evidence of a minimum of one positive wetland indicator from each parameter (hydrology, soil, and vegetation) must be found in order to make a positive wetland determination."

Thus, an area can be identified as wetland subject to federal regulation if at least one positive indication each exists of wetland characteristics for vegetation, soil, and hydrological site characteristics. However, in actual practice an area may be identified as wetland subject to federal regulation notwithstanding a possible lack of strict conformance with one (or occasionally more) of the parameter requirements. The practical objective in identifying wetlands is, in essence, to use the overall site conditions in an "informed judgement" to determine whether a potential project area falls under federal jurisdiction.

The underlying scientific basis for this federal definition includes the understanding that wetlands are transitional between terrestrial and aquatic ecosystems. This circumstance requires adaptations allowing organisms to survive and reproduce under conditions that differ from both terrestrial and aquatic zones. Primary among these for plants and microorganisms is the ability to function in the anoxic soil conditions that occur in wetlands. These conditions lead to identifiable characters in the vegetation and in soil, and it is these recognizable characters that are used in the identification and delineation processes summarized in this section.

State Wetland Definition. The State of California has not adopted a unified guideline for identifying wetlands. For the purposes of this EIR, the understanding of wetland characteristics shared by the California Department of Fish & Game (CDFG) and the California Coastal Commission is the most relevant consideration, inasmuch as the Coastal Commission must issue an approval for this project to proceed, based on the advice of CDFG staff.

A relevant definition of "wetland" in these circumstances is found in Section 30121 of the California Coastal Act (1976):

"Wetland means lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, or fens."

The Coastal Commission's Administrative Regulations (section 13577 (b)) indicate a more technically focused perspective on how Commission staff identify a wetland:

"Wetlands are lands where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salt or other substance in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some

> time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitats." [3]

Wetlands under state jurisdiction are areas that have one or more of the following: (1) vegetation dominated by species showing adaptations for living in periodically or permanently saturated conditions, (2) soils that demonstrate the chemically reducing conditions found in wet environments, or (3) an indication of the hydrological circumstances that cause the relevant soil chemistry and vegetational adaptations.

9.1.1.2 Wetland Classification

When an area has been identified as a wetland according to one or more of the regulatory programs in effect in California, there is generally a need to place the wetland into an organizational framework, partly in order to help in describing the wetland to decision-makers and members of the public. The following excerpt from Chapter 4.0, Section II, of the Draft Plan describes a classification for wetlands that occur in the Humboldt Bay wetland context:

> A classification system (which may be considered as a useful way of organizing aquatic habitat areas that helps to recognize them and order them in discussions) that is generally recognized for wetlands and deep-water habitats is the classification used for the National Wetland Inventory (NWI); this system is based on the classification system established in Cowardin and others (1979). The wetlands and deep-water habitats in Humboldt Bay have been classified and mapped (by the U. S. Fish and Wildlife Service) according to the NWI protocol ...
>
> The NWI process places wetlands into one of five "systems," each of which contains two or more "subsystems," each of which contains two or more "classes." Most classes have two or more "subclasses," and a series of "modifiers" are available for salinity, duration of inundation, vegetation type, and other such factors. Humboldt Bay essentially lacks wetlands classifiable in the **Lacustrine** system, pertaining to lakes. A second system, the **Marine** system, is represented in the area by two wetland types; this system refers to ocean-exposed wetlands. The **Riverine** system (pertaining to in-channel river wetlands) is represented by one or two types. A number of wetland types occur in the **Estuarine** system, and an even larger number in the **Palustrine** system (which includes all wetlands not assignable to any of the other four systems). Because the NWI classification is widely used, an appropriate NWI code is presented for each wetland identified in this subsection. A summary of study area wetland types is included in EIR Table 9-1, which summarizes the wetland types by NWI system, and which also provides vernacular name.

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3 Historically the Commission adopted "Wetland Siting Guidelines" in 1981, still policy for the Commission, which included essentially the same specification for identifying wetlands. The 1981 Siting Guidelines were based on federal agency practices at the time. Hence the Coastal Commission's process for identifying wetlands stems from the same roots as does the federal process.

EIR Table 9-1. A Summary of Common Wetland Types Found Within the Humboldt Bay Region. (Notes: This table has been modified slightly with respect to Table 4-4 in Chapter 4.0, Volume II, of the Draft Plan.)

NWI Code	NWI Description	Common Name in Region
Marine System		
M2US	Marine intertidal unconsolidated shore	Beach
M2RS	Marine intertidal rocky shore	Jetty; rip-rap
Estuarine System		
E1UB	Estuarine subtidal unconsolidated bottom	Bay bottom; shallow and deep channels; may be subcategorized by bottom type
E1AB	Estuarine subtidal aquatic bed	Vegetated subtidal channels and bottom
E2AB	Estuarine intertidal aquatic bed	Eelgrass beds; algal beds
E2UB	Estuarine intertidal unconsolidated bottom	Low tidal flats
E2US	Estuarine intertidal unconsolidated shore	Most tidal flats; dike; levee; shoreline; may be subcategorized by bottom type
E2RS2	Estuarine intertidal rocky shore (rubble)	Rip-rapped shoreline
E2EM1	Estuarine intertidal persistent emergent marsh	Saltmarsh
Riverine System		
R1UB / R2UB	Riverine unconsolidated bottom, tidal/lower perennial	Unvegetated river bottom or stream bottom
R1AB / R2AB	Riverine aquatic bed, tidal/lower perennial	Vegetated river bottom or stream bottom
Palustrine System		
PUB	Palustrine unconsolidated bottom	Cutoff slough streams; major drainage channels; seasonal creeks; unvegetated beds and flowing water
PAB	Palustrine aquatic bed	Vegetated seasonal creek beds and major drainage channels with flowing water
PEM1	Palustrine persistent emergent	Brackish and fresh emergent marshes with persistent vegetation; non-woody riparian corridors; some dune hollows
PEM1C	Palustrine persistent emergent, seasonally flooded	Farmed wetlands; diked former tidelands
PSS	Palustrine scrub-shrub	Isolated willow thickets; short-statured riparian corridors; swamps; some dune hollows [woody vegetation <6 m (20 feet) tall]
PFO1/4	Palustrine forested deciduous/coniferous	Floodplain riparian forests; swamps; some dune hollows [woody vegetation >6 m (20 feet) tall]

The classification process is not intended to (and does not) indicate the functional importance of the identified wetlands. The classification or identification of affected wetlands also does not identify possible wetland impacts or mitigation requirements. The qualitative or quantitative identification of wetland impacts and mitigation needs requires the application of analytical procedures that differ according to wetland category.[4] The classification process is used in developing impact assessments and identifying mitigation requirements.

9.1.1.3 Summary Description of Tidal Wetlands and Deepwater Areas Occurring in Humboldt Bay

Humboldt Bay is a tidal marine embayment, and the entire bay constitutes either a wetland or a "deepwater" area (see footnote 1 in this chapter). The general classification of these areas according to the National Wetland Inventory (NWI) was included in Section 4.4.1.1 in Chapter 4.0, Section II, of the Draft Plan (the ecological dynamics of Humboldt Bay are considered in Chapter 8.0 of this EIR and the tidal dynamics are considered in Chapter 4.0; these elements are not summarized here):

> The NWI mapping for Humboldt Bay identified approximately 7139 (sic) hectares (17,639 acres) of intertidal and subtidal wetland and deepwater habitat in Humboldt Bay (EIR Table 9-2). An alternative ecological differentiation within this classification of wetlands and deepwater areas is to consider subtidal areas and intertidal areas (EIR Figure 9-1); even the highest subtidal areas are seldom exposed, and marine species may occupy subtidal areas continuously without the physiological stress that accompanies periodic sub-aerial exposure. EIR Figure 9-1 also illustrates intertidal emergent marshes that were identified by the Fish and Wildlife Service.

EIR Table 9-2. Areas of NWI Intertidal and Subtidal Wetlands and Deepwater Habitats in Humboldt Bay.

NWI Wetland/Deepwater Category	Area (Hectares/Acres)
Estuarine Subtidal Aquatic Bed	107 / 264
Estuarine Subtidal Unconsolidated Bottom	2389 / 5901
Estuarine Intertidal Aquatic Bed	1605 / 3964
Estuarine Intertidal Unconsolidated Shore Mud	2624 / 6481
Estuarine Intertidal Unconsolidated Shore Sand	24 / 60
Estuarine Intertidal Emergent Marsh	392 / 969
Total Area	**7141 / 17,639**

> It should be noted that the NWI mapping criteria result in identifying intertidal flats as "unconsolidated shore," and the majority of the Bay's mudflats are included in the category in EIR Table 9-2 named "Estuarine Intertidal Unconsolidated Shore Mud." Aquatic bed categories include both eelgrass- and algae- dominated areas; the majority of the "Estuarine Intertidal Aquatic Bed" area identified in EIR Table 9-2 is eelgrass bed.

4 See, for example, the methodology developed as the "California Rapid Assessment Methodology" [URL: http://www.wrmp.org/cram.html (viewed January 2006)].

EIR Figure 9-1. Intertidal and Subtidal Wetland Areas in Humboldt Bay. (Source: National Wetland Inventory database.)

The descriptions of these habitats in Chapter 4.0, Volume II, of the Draft Plan emphasize the ecological functions provided by these wetlands, a subject covered in Chapter 8.0 of this EIR. The Draft Plan identified four broad wetland and deepwater habitat categories:

- Tidal Channels and Tidal Flats
- Bay Waters
- Eelgrass
- Saltmarsh

The NWI habitat areas identified in EIR Table 9-2 are best regarded as approximations of the extent of these habitat types in Humboldt Bay. The extents of aquatic-bed habitats, in particular, are known to vary on annual and decadal bases. In a larger sense, the potential for changing long-term dynamic relationships (such as the relationship between sea level and the elevations of the bay bottom; see Chapter 4.0) has implications regarding the extent, and even the location, of various wetland and deep-water habitat types in Humboldt Bay.

Chapter 4.0, Volume II, in the Draft Plan includes the following summary regarding tidal channels and flats, bay waters, saltmarsh, and other habitat areas[5] [owing to its ecological importance in the bay, as well as for this Plan, eelgrass is covered in this EIR in a separate chapter (Chapter 10.0)]. This EIR adopts the summary as an adequate setting identification of these wetlands for CEQA purposes, even though the EIR acknowledges that substantial additional information is necessary for managing the bay's ecosystem (see Chapter 8.0).

> *Tidal Channels and Tidal Flats*. The channels and tidal flats in Humboldt Bay are the habitat locus for the majority of the invertebrate species found in the Bay. The summary provided of invertebrate usage in Barnhart and others (1992: Appendix B) identifies invertebrate habitat usage according to the predominant habitat used by each species; the majority of the described species are associated with sandy and/or muddy substrates. On this basis alone the tidal channels and tidal flats in the Bay must be considered to be significant habitat types.
>
> Most of the larger invertebrate species burrow into the Bay bottom or into channel walls; these species are often referred to as "benthic infauna;" the contrary habitat use, on the bottom itself, is often referred to as "benthic epifauna." Other invertebrate species are "epifaunal" on other organisms, often eelgrass. Appendix B in Barnhart and others (1992) indicated that there were at least 300 invertebrate species in Humboldt Bay; an accurate (i.e., current) assessment of the invertebrate fauna of Humboldt Bay does not exist, but the number of invertebrate species known from the Bay now exceeds 500. It is likely that this number will continue to increase, both because species that are already present in the Bay ("cryptic species") will continue to be discovered and because additional species are likely to be introduced. In addition, some native West Coast species that currently are restricted to the region south of Humboldt Bay are likely to colonize the bay because of ocean warming and related changes.

5 Minor editing changes are included in the included text, which will be incorporated into the text of the Final Management Plan.

The benthic invertebrate fauna in Humboldt Bay is intimately linked to the importance of the Bay for human interests. (T)he energy relationships in the Bay flow from primary producers ... through an essentially mysterious invertebrate fauna into larger, commercially or recreationally valuable invertebrates (such as crabs, clams, and oysters) or into commercially or recreationally valuable vertebrates like fish and birds. The relationship that supports this pattern is called a "food pyramid," which is founded on a broad trophic base of primary production, and in which the thick middle levels of the pyramid are the countless millions of invertebrates that form the food supply for the fewer and larger predators near the top of the pyramid. Without an adequate and thriving population of the primary invertebrate consumers (and equally healthy levels of plants and other producers below that), Humboldt Bay cannot support the top levels of the pyramid.

The tidal flats also include two of the primary sources of fixed sunlight that support the rest of the community: algae and eelgrass (see EIR Chapter 8.0). The tidal flats are often considered to be "barren," but (especially in the summer) the surfaces of the flats are covered with a "biofilm" of diatoms, other algae, and bacteria that are producing significant amounts of both dissolved and particulate organic material. The significance of this organic material is second only to that of eelgrass in terms of sustaining the ecosystem in Humboldt Bay.

See the summary in Chapter 4 in Barnhart and others (1992) for additional information.

Bay Waters. The waters in Humboldt Bay compose a second major division of the Bay's overall ecosystem. The Bay's waters are the "home" of the fish that occur in the Bay. Barnhart and others (1992) identify more than 100 species within the Bay; current information indicates that more than 120 species are present, and additional species are likely to be identified in the future. A number of these species are commercially and recreationally important (see EIR Chapter 11.0).

In a basic sense, Humboldt Bay exists as an ecosystem because the Bay's waters are the medium in which nutrients for plant growth and food for animal growth are moved across the channels and flats. That is, the waters of the Bay are both an essential habitat for many species of organisms while at the same time being a necessary ecological "solvent" or "vehicle" that carries the nutrients and food to the living species in the Bay, so that they can grow and reproduce.

The Bay's waters do not have a repeatably observable "structure," in the sense that the ecosystem will appear the same over extended time intervals; even identifying the dynamics of tidewater flow has proved difficult, but there do not appear to be well-described zones or strata within the Bay's waters. (T)he Bay's waters do develop temporal variations (both seasonal and daily) in temperature and salinity (see EIR Chapter 4.0), and these variations appear to be associated with real effects in the biological communities in the Bay; however, it is unknown whether these variations have any particular ecological or evolutionary significance.

Perhaps the most salient fact about the Bay's waters is, however, their sensitivity to effects occurring externally. (F)or example, when upwelling occurs off the coast, the dissolved oxygen levels in the Bay decline. When runoff from the watershed resulting from early fall storms reaches the Bay, the pollutant loading in the water ceases to meet requirements for commercial mariculture established by the state Department of Health Services. The water in Humboldt Bay is the "integrator" of the changes that occur in the entire Bay watershed as well as those in the nearby Pacific Ocean. The District has identified a policy approach for maintaining the conservation values in Humboldt Bay that is closely related to the "health" of the Bay's waters. ...

Saltmarshes. Saltmarshes in the Humboldt Bay region mostly occur outside levees, where the land surface is exposed to tidewater; remnants of salt-tolerant vegetation also may persist in diked former tidelands that are not heavily managed, although these areas are not hydrologically tidal. Saltmarshes in Humboldt Bay are dominated by the introduced dense-flowered cordgrass (*Spartina densiflora*) and native pickleweed (*Salicornia virginica*). At progressively higher elevations the salt content of the water is reduced by rainwater, and other plant species may appear, including jaumea (*Jaumea carnosa*), arrowgrass (*Triglochin maritimum*), spearscale (*Atriplex triangularis*), saltmarsh bulrush (*Scirpus robustus*), tufted hairgrass (*Deschampsia cespitosa*), and gumplant (*Grindelia stricta* var. *stricta*). Many of these higher-elevation species occupy a remnant "high marsh plain," which was the surface of the saltmarsh in Humboldt Bay at the time of European colonization.

Saltmarshes in the Bay have been reduced substantially in area with respect to their pre-settlement extent, and they continue to be lost. In addition, the extant saltmarshes are degraded by the dominant presence of dense-flowered cordgrass. The benefits of shoreline-protecting saltmarshes for stabilizing sediment and protecting shoreline structures from wave impacts combine with a conservation focus on maintaining or restoring saltmarshes to make the restoration or enhancement of salt marshes an important concern for the District.

The ecological dynamics that occur within saltmarshes in Humboldt Bay are not completely understood. The roles that saltmarshes play in ecosystem food webs, nutrient cycling, and other ecological processes are not well described. The effects of the invasive cordgrass species, *Spartina densiflora*, in altering the roles of saltmarsh dynamics in Humboldt Bay is also not well known. (A. Pickart, *in lit*.).

Other Habitats. As indicated in Barnhart and others (1992), there are additional subtidal and intertidal habitat types that are important for invertebrate species in Humboldt Bay, such as rocks or pilings. A number of the invertebrate species that occur in Humboldt Bay are "fouling" species and typically colonize the outsides of (or burrow into) hard substrates such as these. Other, more mobile species use these habitats as refuges or foraging areas at appropriate tidal elevations.

The ecological and conservation significance of these other habitat types is not well understood. Because some of them are associated with shoreline structures and shoreline management, the District has identified a need to develop additional information about these habitat types, as well as to consider suitable methods for compensating for losses that may be associated with harbor-related projects.

9.1.1.4 Summary Description of Nontidal Wetlands Occurring in the Humboldt Bay Region

The intertidal and subtidal wetlands and deepwater habitats summarized above are within the District's direct jurisdiction. As noted in Chapter 4.0, Section II, of the Draft

Plan, there are additional wetland areas that are germane when considering the Plan's environmental reach:

> The District's "Sphere of Interest" ... includes a substantial area of lands that are currently not subject to the ebb and flow of the tide, although many, but not all, of these areas appear to have been part of the intertidal area of Humboldt Bay at the time California became a state, and as such most of this area is subject to the Public Trust. As noted previously, Monroe (1973) estimated the area of the "diked former tidelands" to be about 11,000 acres (about 4330 hectares).

As noted in the Draft Plan, many of the non-tidal wetland areas are diked former tidelands that are currently in agricultural use:

> The dominant species in these grass-dominated former saltmarsh habitats today usually are the introduced Eurasian perennials velvetgrass (*Holcus lanatus*) and vernalgrass (*Anthoxanthum odoratum*); a number of other Eurasian species may be present, depending on location and site history. Fescue (*Festuca*) species, orchardgrass (*Dactylis glomerata*), and one or more ryegrass (*Lolium*) species are common. Redtop (*Agrostis stolonifera*) and tall fescue (*F. arundinacea*) are common components in farmed wetlands. The native water foxtail (*Alopecurus geniculatus*) may dominate very wet sites. An invasive species, reed canary grass (*Phalaris arundinacea*), is becoming increasingly prevalent in diked former tidelands in the Arcata Bay region.
>
> The grasses commonly co-occur with herbaceous broadleaved forbs, such as one or more *Hypochoeris* (false dandelion) species, English plantain (*Plantago lanceolata*), and one or more trefoil (*Lotus*) species. The variety of forb species that occur in grasslands is considerable, and is only partly dependent on degrees of wetness. In wet pastures, silverweed (*Potentilla anserina*) and creeping buttercup (*Ranunculus repens*) are common in mowed/grazed areas; taller vegetation generally lacks the shorter-statured forbs.
>
> Most pastures in the Humboldt Bay region, at nearly all elevations, have rushes (*Juncus*); the most common is soft rush (*J. effusus*), although several other species may be found. Other narrow-leaved monocots that may be present (or even dominant) include spike-rush (typically *Eleocharis macrostachya*) and sedges, especially slough sedge (*Carex obnupta*) and (recently in some parts of the watershed) Lyngbye's sedge (*C. lyngbyei*). Many of these perennial wetland dominants are more common near "cutoff" former sloughs or depressions that receive more flooding than in pasture areas (A. Pickart, *in lit.*; see Leppig and Pickart 2005 for additional information).

The area of "agricultural lands" in the Humboldt Bay watershed that are effectively diked former tidelands has not been established reliably. Monroe (1973:41) identified only 6,670 acres (2700 hectares) of "agriculture" in the bay's watershed. However, it is apparent that Monroe's mapping (e.g., Monroe's Plate 7) included neither all of the diked former tidelands nor all of the agricultural areas in the bay's watershed. The Shapiro report (Shapiro and Associates 1980) identified a total of 14,053 acres (5687 ha) of "agriculture." However, the Shapiro mapping (e.g., Shapiro's Plate 10) includes areas that are not part of the Humboldt Bay watershed. On balance, it is likely that most, but not all, of the 11,000 acres (ca. 4450 ha) that Monroe identified as "diked former tideland" in the watershed currently are or were until about 1980 in agricultural use.[6]

Non-tidal wetland categories in the watershed include areas that are not in agricultural use. Some of these wetland areas appear to be derived from former stream floodplain and riparian corridors (see the following subsection), and others appear likely to be "reclaimed" former tidelands that have developed characteristics that differ from the agricultural areas. The salinity changes that result over time from separating the diked former tidelands from the bay produce ecological conditions similar to those in floodplain areas, and the former saltmarshes can come to resemble floodplain forests through a process call *ecological succession*. As described in Chapter 4.0, Section II, of the Draft Plan:

> The pastures invariably are colonized by low-growing woody vines and shrubs, and dense stands of sedges intermixed with vines, unless removed, ultimately tend to replace the grasslands. Blackberry (*Rubus ursinus*) is virtually ubiquitous; hymalayaberry (*R. discolor*) is favored in disturbed areas. Coyotebrush (*Baccharis pilularis*) usually colonizes mounded soil and levees. If seed sources occur nearby, wild rose (*Rosa nutkana*) may colonize near moist areas. In very wet areas, cascara (*Rhamnus purshiana*) is a common colonist, and willows [*Salix* spp., especially arroyo willow (*S. lasiolepis*)], may invade. These areas would likely become "riparian forest" if the woody species were not regularly removed, as has happened in diked former tidelands in the Eel River delta and the Redwood Creek estuary; the community structure in such forested areas eventually becomes dominated by Sitka spruces (*Picea sitchensis*) and other wetland-associated conifer species (see following subsection).

Some areas of diked former tidelands (e.g., certain areas north of Fields Landing) appear to have escaped the changes that resulted from conversion to agricultural uses, and appear today to function as "brackish marshes" that include saltmarsh plant species (e.g., *J. carnosa*, *D. cespitosa*, and *T. maritimum*) with species more typical of freshwater hydrology (e.g., *E. macrostachya*, *R. repens*, *A. stolonifera*, and *P. anserina*). Other areas of diked former tidelands that have not been in agricultural use for a long period (possibly never) are dominated by slough sedge (*C. obnupta*) meadows (e.g., in the South Broadway area in Eureka and along the west side of Walker Ridge in the Indianola area).

The variation in current wetland physiognomy that is associated with wetlands that appear likely to have been or that definitely were saltmarsh when the Humboldt Bay region was colonized by European-Americans reflects the natural variation in wetlands

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6 In the 1980s the Department of Fish and Game and the U.S. Fish and Wildlife Service began acquiring diked former tideland areas for habitat restoration or enhancement purposes. As noted in the Draft Plan, approximately 3350 acres of these lands are now in public ownership, and the management by public agencies has resulted in significant changes in vegetation and hydrology. These lands still receive some agricultural use, but the management is not focused on those uses.

The difficulty in identifying the areas of "agricultural wetlands" extends to other wetland classifications in the Humboldt Bay watershed. At the present time there is no credible data-based identification of non-tidal wetland areas in the watershed. Prior descriptions vary widely. For example, Monroe (1973) identified 40 acres of freshwater marsh, while the Shapiro report identified 182 acres. Similarly, Monroe (1973) did not include an area for brackish wetlands, while the Shapiro report identified 253 areas of "brackish marsh."

that were undoubtedly present in the watershed before that time, although the areas dominated by plant species that were not salt-tolerant were undoubtedly far smaller than they are currently.

9.1.1.5 Wetland Functions

Wetland impact assessments conducted pursuant to the Clean Water Act are required to evaluate impacts by considering the *functions* that are provided by the affected wetlands. The U. S. Army Corps of Engineers has adopted a "Regulatory Guidance Letter" (RGL 02-2) that establishes Corps policy to evaluate wetland impacts and mitigation proposals in the context of wetland functions.[7] Wetland functions are, generally, the "services" provided by the wetlands (EIR Table 9-3), which may be impaired or lost if wetlands are modified or filled.[8] There is no universally adopted categorization of wetland functions, although it is generally recognized that wetland functions fall into three broad categories: (1) water quality functions, (2) hydrological functions, and (3) habitat functions. The categorization shown in EIR Table 9-3 is based on a model developed originally for linear highway projects by Adamus and others (1991), modified from Schneider and Sprecher (2000).

EIR Table 9-3. Summary of Wetland Functions within the Humboldt Bay Watershed.

Wetland Function	Summary Description of Function
Hydrological Functions	
Groundwater Recharge or Discharge	Groundwater recharge occurs when water resides on the surface of the land long enough to percolate into the underlying aquifer. Many wetlands that perform this function occur in uplands. Riverine wetlands are frequently sites of groundwater discharge rather than recharge.
Flood flow Alteration	Wetlands in upland areas and riparian-zone wetlands on floodplains can delay the delivery of runoff peaks into streams, increase infiltration, and impede passage of overbank flows downstream during storm events.
Shoreline and Bank Stabilization	Wave or current erosion can be reduced when wetland plant roots bind together soil that would otherwise be eroded by water movement from an adjacent river, lake, or ocean, protecting adjacent upland sites from erosion and protecting downstream sites from sedimentation.
Water Quality Functions	
Sediment / Toxicant Retention	Wetlands can trap and remove sediments and any attached toxic chemicals, such as pesticides, heavy metals, or excess nutrients/ fertilizers. Wetlands that provide this function must be located

7 RGL 02-2 may be downloaded, as a medium-sized PDF, from links on either the San Francisco District or the Sacramento District website. Both links currently point to the same URL: http://www.usace.army.mil/inet/functions/cw/hot_topics/RGL_02-2.pdf (viewed January 2006). RGL 02-2 directs District staff to identify any function assessment methodologies that should be used in meeting its requirements. To date the San Francisco District has not identified function assessment methodologies to be used for applications in the District.

8 Functions are frequently contrasted with "values," a concept that involves a measure of social utility, whereas "functions" may be understood as resulting simply from the wetland's existence.

Wetland Function	Summary Description of Function
	downstream of the sediment source and must retard water velocity sufficiently for suspended sediments to settle out; most of these wetlands are riparian.
Nutrient Removal or Transformation	Nutrient removal and transformation are physical and biological processes by which wetlands improve water quality. Excess nitrogen, phosphorus, and other biogenic elements (including fertilizers and a variety of compounds that act similarly) in runoff are removed from the water column, which may have significant benefits for downstream waters.
Habitat Functions	
Production Export	Biological production export results when organic carbon compounds from a wetland are transported downstream by flowing water. Wetlands with flowing water and a highly productive biological community usually provide this function. Organic matter is transported out of the wetland and is subsequently utilized by organisms downstream.
Aquatic Diversity / Abundance	Aquatic diversity is provided when wetlands support aquatic ecosystems with their populations of aquatic plants and (especially) animals, including invertebrates, fish, amphibians, and aquatic-foraging mammals. Water temperature, aeration, pH, salinity, turbidity, velocity, and other factors affect this function.
Terrestrial Diversity / Abundance	Terrestrial diversity is provided when wetlands support terrestrial ecosystems with their populations of nonaquatic life, including plants and the invertebrates, amphibians, birds, and mammals for which wetlands provide habitat elements or food.

At the present time there is no generally applicable assessment methodology for identifying or characterizing wetland functions in all parts of the United States, and very little work has been done on this subject in California. A variety of assessment methodologies have been proposed; among the most widely applied have been the Wetland Evaluation Technique (WET; Adamus and others 1991) and the Hydrogeomorphic Method (HGM; Brinson 1993, Smith and others 1995). However, the development of assessment methodologies has not progressed far enough for any of them to be applied or recommended for application in the Humboldt Bay watershed (for additional information see Bartoldus 2000, Fennessy and other 2004). In the absence of well-established analytical approaches, scientists and wetland-related regulatory and trustee agency staff continue to develop *ad hoc* approaches to identifying or quantifying wetland functions (see, e.g., Tiner 2005).

Wetland practitioners and regulatory agencies generally recognize that the functions provided by wetlands vary geographically within a river basin, so that wetlands in headwaters provide higher orders of some functions than others, and wetlands in headwaters often provide different functions from wetlands near the outlets of river basins.[9] For example, because the floodplains of larger (i.e., higher-order) streams are

9 This recognition that wetland functions are related to the location of an evaluated wetland in a physical sense is one of the core precepts in the HGM. The geographic context for wetland functions seems likely to remain an element of future federal, state, and local assessment

typically wider than those of smaller (lower-order) streams, the relative contribution of floodplain wetlands and riparian forests to flood protection or desynchronization increases with stream order; additionally, wide, dense riparian corridors are beneficial for pollutant removal (Brinson 1993). The presence of narrower floodplains and riparian corridors in smaller (lower-order) streams near basin headwaters does less to alter flood dynamics, but these wetlands provide a "filtering" effect higher in the stream basins, and Brinson (1993) opined that the water-quality functions provided by riparian wetlands adjacent to the smaller streams are more important, on a watershed basis, for basin water quality than are those provided by wetlands in large, high-order floodplains.

9.1.2 Rivers, Streams, and Riparian Areas

Prior to Euro-American modification, the Humboldt Bay wetland complex undoubtedly included a salinity gradient from freshwater to saltwater that lay, geographically, between the bases of the hills surrounding the baylands and the open water of Humboldt Bay (the area of greatest mixing would have varied somewhat seasonally, though less so than with the current amount of development in the watershed). The runoff from the uplands and the discharge of groundwater would have released low-salinity water that provided suitable ecological conditions for many of the "brackish" plant species in the area's marshlands today – the occurrences of these species were unquestionably related to the patterns of discharge and flow established by streams and sloughs.

The occurrences of "riparian" (a term that means "edge-of-the-water") vegetation were similarly dependent on freshwater discharge patterns. In general the seasonal runoff pattern in the Humboldt Bay region is dominated by rains between about October and April, with little precipitation outside of that period. Runoff following the onset of each individual rainfall event appears to be characteristic of the hydrographs described in hydrology texts (e.g., Dunne and Leopold 1978; also see EIR Figure 4-1 in Chapter 4.0). Early-season rains produce limited runoff until the soil's field capacity is saturated, after which each storm event results in a short-term runoff increase that gradually declines until streamflow is composed mostly of discharged groundwater (the base flow). See Chapter 4.0 for additional consideration regarding hydrological dynamics in the bay's watershed.

In a general sense, freshwater flows according to an energy gradient, and the significant reduction in stream gradient where a stream draining the uplands adjacent to the bay encounters the "marsh plain" means that the tributary streams would always have become sluggish and swollen downstream from the gradient change. In addition, the effect of rising tidewater elevations in the bay and its tributaries is transmitted upstream *above* the elevation of the tidewater. The net result of these factors is that most of the larger bay tributaries undoubtedly had extensive, wet floodplain areas at elevations not directly reached by tidewaters.[10]

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methodologies regardless of the ultimate level of development of the HGM or other specific assessment methods.

10 Most likely the influence of the tidewater hydraulic dams extended upstream in the waterways to the extent of low-sloped floodplains. Downstream from these locations the streams likely had too much water to remain within their banks during the rainy periods in the Humboldt Bay area, leading to common floodplain inundation. The out-of-channel flows would also have carried any sediment in the streamflow out of the channel, eventually constructing a relatively low-gradient

Recently there has been substantial interest in the relationships among watercourses and related floodplain and riparian ecosystem elements, because the quality of the habitat on the floodplain is a function of the dynamics of the stream/riparian interaction. Further, the condition in the floodplain ecosystem is related to the quality of the water that reaches the stream itself and the receiving water to which the stream flows.

9.1.2.1 Rivers, Streams, and Sloughs

The Humboldt Bay aquatic ecosystem has tendrils that extend outwards and upwards into land areas covered with trees, grasses, houses, and streets. These are the stream drainage basins that produce runoff that flows to Humboldt Bay. These include four relatively large basins and a number of smaller basins. The primary stream basins that enter the bay directly are listed in EIR Table 9-4; where secondary streams are tributary to the primary streams they are listed in the third column. The four major Humboldt Bay tributary streams are indicated in bold in the table and their locations are shown in EIR Figure 9-2.

EIR Table 9-4. Stream Basins within the Humboldt Bay Watershed.

Stream Basin	General Location	Comments
Mad River Slough/ Liscom Slough	West of Arcata; enters Humboldt Bay appr. four miles west of Arcata, at the Sierra Pacific mill.	Under current hydrological conditions the Mad River Slough seldom carries flows from the Mad River into Humboldt Bay. The lowlands west of the City of Arcata are part of the Mad River's geological delta, however, and Liscom Slough and other channels west of the City of Arcata appear to be former Mad River channels abandoned by avulsive changes in the river's course in pre-historic but geologically recent times. Liscom Slough is a general name for various largely abandoned distributary channels of the Mad River west of the City of Arcata that flow into Mad River Slough, or into Humboldt Bay directly, through diked former tidelands.
Janes Creek	Northern Arcata; enters Humboldt Bay (as McDaniel Slough) appr. ¼-mile west of Arcata Marsh Project.	Receives runoff from the western part of City of Arcata, including tributary flow from small seasonal streams. Original channel in diked former tidelands remains; not channelized. Currently has tidegate at mouth; City of Arcata has proposed to remove tidegate.
Jolly Giant Creek	HSU area, central Arcata; enters Humboldt Bay (as Butcher Slough) near South G Street.	Receives runoff from the central part of City of Arcata. Does not have tidegate.

floodplain that resembled but would have been upstream from the "marsh plain." These floodplains likely would have been as densely grown with trees and shrubs as any rainforest area along the Pacific Coast of North America.

Stream Basin	General Location	Comments
Campbell Creek/Gannon Slough[1]	Central and southern Arcata, near 14th Street to Samoa Blvd.; partly channelized east of Highway 101 to Gannon Slough, a major remnant slough in diked former tidelands	Gannon Slough is a fully tidal water of Humboldt Bay that receives the runoff from most of eastern Arcata, including Sunny Brae and Bayside. Not channelized but lacks riparian vegetation; City of Arcata has proposed enhancements. Campbell Creek has tidegate at mouth.
Fickle Hill Creek[1]	Northwest of Sunny Brea.	Channelized in diked former tidelands. Tidegate at mouth.
Grotzman Creek/Beith Creek[1]	Sunny Brae region.	Grotzman and Beith creeks are channelized and combined in diked former tidelands before entering Gannon Slough. Tidegate at mouth.
Little Jacoby Creek[1]	Bayside region.	Channelized in diked former tidelands. Tidegate at mouth.
Jacoby Creek	Large stream basin southeast of Arcata; enters Humboldt Bay north of Bayside Cutoff.	Not restricted by tidegates. Diked former tidelands do not appear to extend southeast of Old Arcata Road. Retains remnants of riparian corridor through diked former tidelands west of Old Arcata Road. Morrison Gulch is a named tributary; many other tributaries lack formally recognized names. Upper basin adjoins Freshwater Creek headwaters (to south).
Washington Gulch Creek [2]	South of Jacoby Creek. Enters Humboldt Bay south of Bayside Cutoff, near Rocky Gulch mouth.	Reach through diked former tidelands south of Bayside Cutoff channelized in recent past; tidegate at mouth.
Rocky Gulch Creek [2]	Northeast of Indianola. Enters Humboldt Bay south of Bayside Cutoff, near Washington Gulch mouth.	Lower stream course formerly channelized through diked former tidelands west of Old Arcata Road; restoration in progress. Tidegate at mouth.
Cochran Creek [3]	South of Ole Hansen Road, Indianola area, and the valley east of Walker Point Ridge.	Channelized near Myrtle Avenue. Diked former tidelands extend east of Myrtle Avenue. Tributary to Fay/Eureka Slough; tidegate at mouth.
Freshwater Creek/Eureka Slough	Large stream basin east of the City of Eureka; enters Humboldt Bay northwest of the Eureka Target store, north of Daby Island and the Eureka Inner Reach channel.	Not restricted by tidegates. Diked former tidelands extend southeast of Myrtle Avenue to near the upper end of Felt Road. *Fay Slough* is a large tidal tributary slough to Eureka Slough located in diked former tidelands north of Freshwater Creek. Numerous named tributaries, including McCready Gulch, Cloney Gulch, Graham Gulch, Little Freshwater Creek, and Ryan

Stream Basin	General Location	Comments
		Creek. Upper basin adjoins headwaters of Jacoby Creek (to north) and Elk River (to south).
Ryan Creek [3]	Located east of Cutten. Enters Eureka Slough north of Myrtle Avenue.	Not restricted by tidegates. Diked former tidelands extend south of Myrtle Avenue. Ryan Creek is the primary drainage for the eastern Cutten and Ridgewood Heights areas. Guptil Gulch and Henderson Gulch are named tributaries. Several unnamed tributaries drain terrace uplands in Mitchell Heights/Pidgeon Point area.
First, Second, and Third Sloughs [3]	Myrtletown region to Cutten; northern Eureka Terrace.	These three creeks drain the northern Eureka Terrace to Eureka Slough; all are tidal near Eureka Slough. First Slough is also called Cooper Gulch. The three basins are separated from the Martin Slough basin by high ground aligned appr. along Harris Street.
Martin Slough	Drains the southern half of the City of Eureka, Cutten, and the terrace lands west of Ridgewood Heights, entering Elk River near Highway 101.	Now part of the Elk River basin, but acted as an upland drainage tributary to an estuarine bay-margin slough (the still-tidal remnant is known as *Swain Slough*) in pre-settlement period. Diked former tidelands currently extend upstream to the southern part of the golf course. Flows through tidegates to enter Swain Slough and the Elk River estuary. The City of Eureka is considering channel enhancement in golf course region and tidewater restoration to diked former tidelands downstream of golf course.
Elk River	Large stream basin southeast of the City of Eureka; enters Humboldt Bay southwest of Bayshore Mall.	The Elk River channel is not restricted by tidegates. Diked former tidelands extend upstream to the vicinity of the community of Elk River. The upper Elk River basin has two primary branches, the North Fork and the South Fork. The North Fork receives flows from the North Branch and South Branch, McWhinney Creek, Bridge Creek, and Lake Creek. The South Fork receives flows from the Little South Fork, McCloud Creek, and Tom Gulch. The Elk River headwaters abut the Freshwater Creek basin (to north) and the Salmon Creek basin (to south).
Willow Brook /White Slough	Small stream south of the College of the Redwoods campus; flows through diked former tidelands associated with White Slough, a large tidewater	Lowlands east of Highway 101 are diked former tidelands. The northern part of this area is tributary to White Slough, which extends into South Bay. Drains through tidegates.

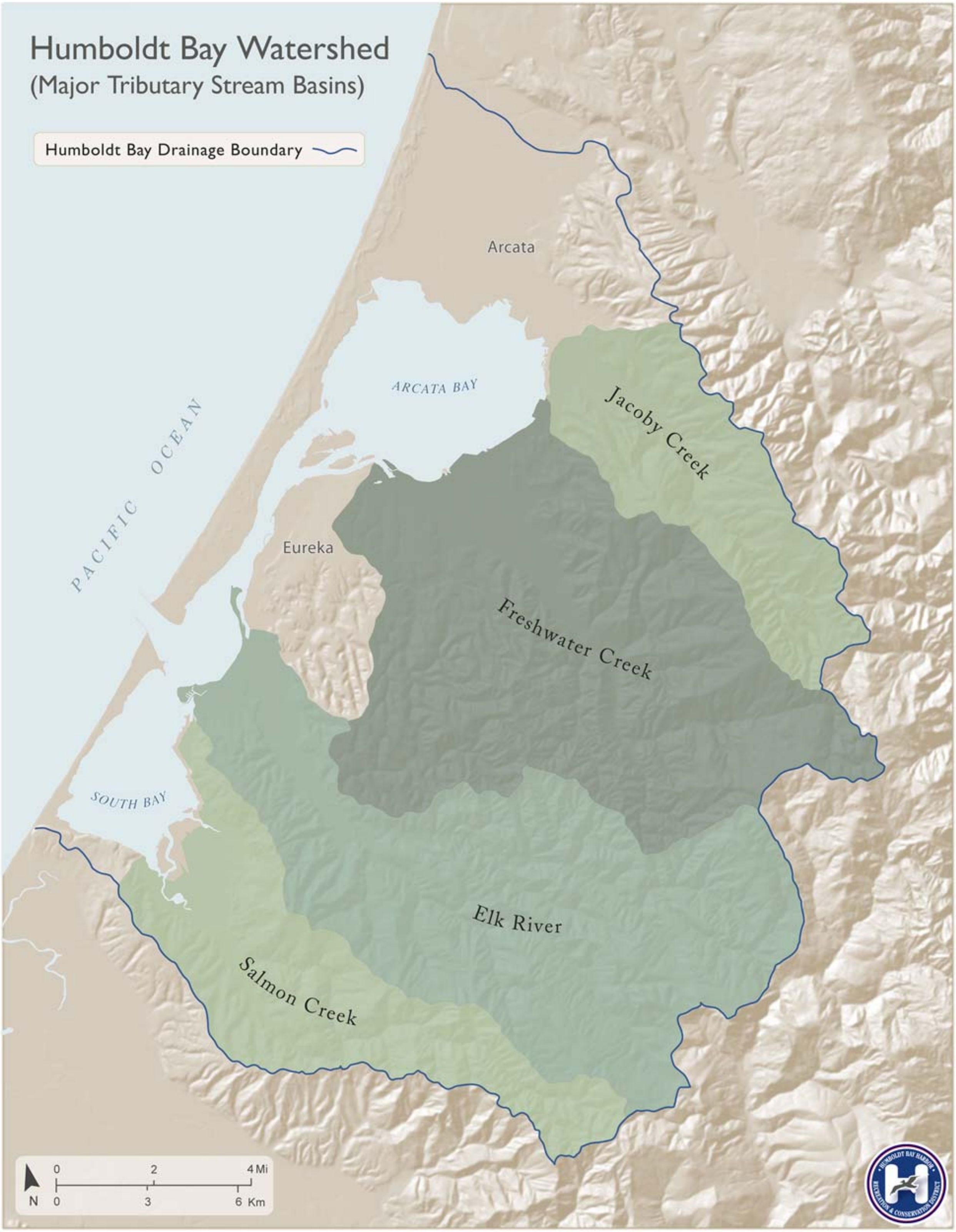
Stream Basin	General Location	Comments
	slough south of Fields Landing.	
Salmon Creek	Moderately large basin near southern boundary of Humboldt Bay watershed; enters Bay west of Hookton Road.	Restricted by tidegates west of Highway 101. Most lowlands west of Highway 101 are diked former tidelands, drained through tidegates to Hookton Slough and White Slough. Salmon Creek is partly channelized in its lowest reaches. Enters Hookton Slough, a significant tidal slough in the Humboldt Bay National Wildlife Refuge, which opens to the largest channel in South Bay. The only significant tributaries are Little Salmon Creek and Deering Creek. The Salmon Creek basin is relatively restricted to north (where it abuts the upper Elk River basin) and south (where it abuts the lower Eel River basin).

1 These channelized streams are now tributary to Gannon Slough, an embayment east of Highway 101 at the location of the junction with South G Street, but it is unclear that these locations reflect the original courses of the streams.

2 These streams enter a small tidewater embayment east of Highway 101 north of the KOA Campground.

3 These basins drain into Eureka Slough.

The Draft Humboldt Bay Management Plan applies to these stream basins indirectly, for the most part, because (except for certain tidal areas in the major stream basins) the District does not have direct jurisdiction over the lands drained by the streams or over the water above the streambeds. As noted often in the Plan (and this EIR), however, the District is strongly concerned indirectly about several aquatic ecosystem elements that are affected by activities in the stream basins. Those elements are most directly expressed in the riparian forests and wetlands on the floodplains associated with the streams in Table 9-4.



EIR Figure 9-2. Humboldt Bay Watershed Boundary. The drainage basins of the four primary sub-watersheds within the bay's watershed are shown. See text for additional information.

9.1.2.2 Riparian Ecosystem Elements

Streams constitute a type of wetland ("riverine" wetlands), and the streams are hydrologically interrelated with "palustrine" wetlands that occur on adjacent floodplains. The general focus for these ecosystems has recently evolved to accommodate the understanding that the stream, the floodplain through which the stream flows, and the riparian habitats occupying the floodplain function as interconnected elements that both provide and protect the functional utility of the aquatic ecosystem.[11] There is a general understanding that the distribution of riparian plant species is directly affected by streamflow patterns, including dry-season base flows as well as overbank "flood" flows (see, e.g., Hupp and Osterkamp 1985; see the NRC 2002 report for an overall summary). The extent and richness of riparian vegetation occupying a stream's floodplain are proportional to the degree with which the floodplain is able to remove pollutants from the streamflow (see, e.g., Peterjohn and Correll 1984; Hupp and others 1993).

Organic material produced in this riparian context often falls into streams, contributing to the ecosystem structure and productivity within the streams. The riparian vegetation shades the watercourses during the summer, helping to keep water temperatures down. Riparian trees that fall into the watercourses provide large organic structural elements that help to shelter instream organisms, including fish. In general, riparian ecosystems are understood to play highly important roles in maintaining regional biodiversity patterns (see, e.g., Thomas 1979; Naiman and others 1993), and there is a general consensus that the habitat functions are proportional to the area of riparian habitat (e.g., Keller and others 1993) and the structure of the habitat (Kelly 1987 for the Humboldt Bay region; many authors).

The Draft Plan, in Chapter 4.0, Volume II, provides a summary of the most common riparian habitat associations in the bay's vicinity.

> Red alder (*Alnus rubra*) may be the most important riparian tree species in the Humboldt Bay region, reflecting high values for this species of both prevalence and cover. The deciduous tree species with the largest individuals in these forests is black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), but this species is much less common than alder. These forests commonly also include conifers, typically Sitka spruce (*P. sitchensis*) and redwood (*Sequoia sempervirens*); in some less-modified riparian forests western red cedar (*Thuja plicata*) sometimes attains substantial coverage and western hemlock (*Tsuga heterophylla*) is still present as scattered individuals.
>
> The most common willow species in the riparian forestlands in the Humboldt Bay basin is the arroyo willow (*Salix lasiolepis*), which is a pioneer species in these forests. Three other willow species occur in Humboldt Bay deciduous riparian corridors; pacific willow (*S. lucida* ssp. *lasiandra*) is a relatively common tree, Sitka willow (*S. sitchensis*) is a commonly encountered

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11 The hydrological relationships among streams, riparian wetlands, floodplains, and adjacent uplands are described and illustrated in Winter and others (1998); this excellent reference may be downloaded (large PDF file!) from: http://water.usgs.gov/pubs/circ/circ1139/ (viewed January 2006).

shrub, and Hooker willow (*S. hookeriana*) is a shrubby species mostly but not entirely restricted to dune habitats.

The floodplain riparian forests along the northwest Pacific coast typically have an open overstory that allows a relatively dense, but short-statured, shrub layer to develop. Often the dominant species in these stands is salmonberry (*Rubus spectabilis*), which may form impenetrable "doghair" stands several meters tall. Other woody shrubs that may occur in these floodplain forests include thimbleberry (*Rubus parviflorus*), cascara (*Rhamnus purshiana*), twinberry (*Lonicera involucrata*), Oregon crabapple (*Malus fusca*), and red elderberry (*Sambucus callicarpa*).

Dominant understory plant species in these wetlands may include slough sedge (*Carex obnupta*), skunk cabbage (*Lysichiton americanum*), small-fruit bulrush (*Scirpus microcarpus*), soft rush (*Juncus effusus*), and water parsley (*Oenanthe sarmentosa*). In floodplains that lack a dense forest overstory or a dense shrub understory a "sedge meadow" may develop that is more than two meters tall. However, the floodplains typically are colonized by woody species, and the usual appearance of these floodplain wetlands would present a mixture of emergent shrubs (usually including abundant salmonberry) above an herbaceous layer dominated by slough sedge.

Riparian habitats are among the most important habitats in North America for wildlife (see, e.g., Thomas 1979, Naiman and others 1993). For example, 285 of the 378 terrestrial wildlife species (75 percent) in the Blue Mountains of eastern Oregon either depend on riparian zones or use them more than other habitats (Thomas 1979). It has generally been concluded that abundant moisture and an extensive three-dimensional structure are responsible for the well-documented high biological productivity of riparian habitats. Because of the proximity of surface drainage courses and the riparian vegetation, much of the high riparian productivity is often exported to downstream wetlands (see subsection 4.4.4 below). In addition, the variegated habitat structure apparently allows for a fine-grained subdivision of the habitat by wildlife species of virtually all taxa [see Kelly (1987) for a well-organized local study that documents the importance of riparian habitat for birds].

See Leppig and Pickart (2005) for additional descriptions of the wetland and riparian plant associations in the Humboldt Bay region.

9.1.3 Watershed Areas

Upland areas in the Humboldt Bay watershed are an indirect District concern, because these areas affect the aquatic ecosystem. The District cannot regulate actions in these areas; the authority for the land uses in the 150,000+ acres (60,700+ hectares)[12] of uplands in the Humboldt Bay watershed (about 85 percent of the total watershed area) is vested in other agencies. The areas within the incorporated cities of Arcata and Eureka

12 The "land area" of the City of Arcata is approximately 2100 hectares (about 5200 acres), and the "land area" of the City of Eureka is approximately 2450 hectares (about 6050 acres). These figures include areas of diked former tidelands, however, and consequently do not represent the areas of "uplands" within the two cities. Under any circumstances, it is evident that at least 92 percent of the nonwetland area in the Humboldt Bay watershed is subject to the land use jurisdiction of the County of Humboldt.

are regulated according to the cities' adopted General Plan documents. The County of Humboldt is currently updating its General Plan, and land use in county is currently regulated according to planning documents that were prepared as early as the 1980s. Identifying potential effects on Humboldt Bay because of the land use policies in the planning documents adopted by these jurisdictions is the direct responsibility of these agencies. The District has determined that it is no appropriate for this EIR to provide detailed assessments of the policies through which these agencies regulate upland land uses.

In addition, the District has determined that it is not necessary for this EIR to include such an assessment, because the subjects that are germane for the District's consideration of the Draft Plan are addressed in other contexts in this EIR. Water quality and hydrological considerations associated with the land uses in the watershed are included in this chapter and in Chapters 4.0 and 6.0. Chapter 5.0 includes a consideration of erosion and sedimentation effects on the bay. The ecological effects of watershed processes are considered in Chapter 8.0, and Chapter 11.0 considers watershed processes on fish and wildlife resources.

Because all of the ecological elements that are germane for the District's consideration of the environmental effects of the Management Plan are addressed in other chapters and in other subsections of this chapter, the EIR does not include a detailed consideration of the effects of land uses in the 150,000+ acres of the Humboldt Bay watershed that are within the jurisdictions of other agencies. Instead, the District will address its management concerns for the watershed in implementing the Draft Plan's policies (e.g., CAE-3 and CAE-4) regarding cooperative planning efforts with the appropriate regulatory agencies.

9.2 Issues to be Addressed and Thresholds of Significance

The Initial Study process identified potential biological effects (see Appendix A) related to in Section IV, including the following: item VIII (b), which addresses potential effects on riparian habitats as those are recognized by the Department of Fish and Game; item IV (c), addressing effects on wetlands, specifically as those might be identified by the U. S. Army corps of Engineers; and item IV (d), which addresses possible impacts on migration corridors, a concern that is directly related to impacts on floodplains and riparian corridors.

Comments received in response to the Notice of Preparation indicated that commenters believed that the Draft EIR should address "other waters of the United States" in addition to wetlands; the EIR does so in this chapter, because the streams and riparian areas (in addition to the bay's wetlands and deepwater areas) include the "other waters" in the Humboldt Bay region. Additional commenters indicated that the Plan's policies should address practices related to the use of biocidal chemicals for logging activities within the bay's watershed. These considerations are addressed in Chapter 4.0 (addressing hydrology), Chapter 5.0 (addressing erosion and sedimentation), and Chapter 6.0 (addressing water quality). Some commenters also stated a conclusion that the Draft Management Plan represented a commitment to intensifying land uses that could be associated with increasing runoff, resulting in indirect drainage and water quality impacts that should be addressed in the EIR; such considerations are addressed programmatically in this chapter, although "land use" is considered in Chapter 12.0, and the EIR finds that there is no evidence to support a conclusion that the District's implementation of the Plan would lead to changes in land use near Humboldt Bay. Finally, one commenter requested that the EIR consider the relationship between Plan policies and an enhanced focus on restoration of wetland ecosystem elements in the bay watershed.

As noted throughout this EIR, thresholds of significance in programmatic environmental documents for management plans are problematical. In this EIR the "threshold of significance" convention that is used throughout the EIR is that the potential environmental effect of the plan policies would be "significant" if the proposed policies increased the potential that a possible environmental impact would be increased beyond the degree that would exist if the policies were not carried out. Assessing the effect of the plan requires a judgement regarding the likelihood that the policy will lead to actions that create or exacerbate adverse conditions that would not occur without the plan. If a reasonable argument is possible that the policies would exacerbate a possible adverse condition, or create a new adverse condition that does not occur at the present time, then the effect of the policies are judged to be significant

9.3 ENVIRONMENTAL EFFECTS OF PLAN ALTERNATIVES

9.3.1 "No Project" (Existing Master Plan)

The 1975 Master Plan incorporated "use" designations that included "conservation" purposes for most of Arcata Bay and South Bay. The Master Plan provides direction to the District that "(T)he natural environment shall be protected and enhanced" (Master Plan page IV-4). The Master Plan also includes, in the description of the use "Conservation – Water," the statement that "(t)his use … provides for conservation of natural resources, habitat and wildlife."

In implementing the Master Plan the District adopted Ordinance No. 7 in 1976. Ordinance No. 7 includes a general policy direction in Section 9:

> "(a) Maintenance and improvement of environmental quality shall be primary objectives for the use and development of all areas of Humboldt Bay and not just those designated as 'Conservation Water' and 'Public Open Space Lands.' "

This policy provides direction to District staff and decision-makers that can be interpreted as a policy to protect wetlands, streams, rivers, and riparian areas. However, this is essentially the extent of policy guidance for such areas under the Master Plan and Ordinance No. 7.

On the bases of the Master Plan commentary and the content of Ordinance No. 7, this EIR finds that the "No Project" alternative does address wetlands, streams, rivers, and riparian areas. The explicit policy direction provided by this alternative is far less extensive for tidal wetlands and other areas discussed in this chapter than is the Draft Plan, and on this basis the EIR finds that the Draft Management Plan is superior to existing policy guidance. However, the District's existing approach to participating in the management of nontidal wetlands, streams and rivers, and riparian and floodplain areas that are outside of the District's direct jurisdiction, when compared to management that will result from policies in the Draft Plan, are expected to be about the same as management will be under the Draft Plan. The reason for this conclusion is that these areas do not actually fall under the District's jurisdiction under either the 1975 Master Plan or the proposed Management Plan.

9.3.2 Proposed Management Plan

The environmental resources that are the subject of this chapter range from the tidewater regions of the bay to the upper watershed. From an ecosystem-management perspective the distinctions about location are largely immaterial, but from the perspective of the Harbor Management Plan the location of the ecosystem elements is a significant factor, because the District has no direct jurisdiction outside of tidewater areas (except on District-owned land). As with other elements of the bay ecosystem, possible impacts to wetland elements may be direct and adverse, and activities that may be approved pursuant to the Draft Plan may be immediately responsible for adverse impacts on wetlands, eelgrass, fish, or other ecosystem elements. In other cases the potential wetland-related impacts from the Plan's policies may be indirect, and the impacts may occur because an action authorized by the Plan subsequently results in impacts to ecosystem elements that were not initially anticipated.

The following policies in the Draft Plan appear to have a potential for producing adverse effects on elements and functions of the Humboldt Bay aquatic ecosystem, including wetlands, streams, and riparian elements (it should be noted that a number of other policies in the Draft Plan would have positive or beneficial effects on the bay ecosystem).

<u>Harbor Policies:</u>

- HLU-3: Assist in removing potential constraints for marine-dependent or coastal-dependent land uses along the Samoa Peninsula, Fields landing Channel, Eureka shoreline, and other harbor-related areas (from Harbor Revitalization Plan)
- HLU-6: Develop "specific plans" for District-owned parcels
- HSM-2: Develop standards for new and existing Humboldt Bay shoreline protection
- HSM-6: Require the use of non-structural shoreline protection where feasible and appropriate
- HWM-2: Dredging may be authorized to meet Plan purposes
- HWM-3: Re-deposition of dredged materials within Humboldt Bay may be authorized to meet Plan purposes
- HWM-4: Placement of fill within Humboldt Bay may be authorized to meet Plan purposes
- HWM-5: Potential dredged-material management options and alternative disposal methods shall be identified in a Long Term Management Strategy for Humboldt Bay
- HWM-6: Sediment dynamics in Humboldt Bay shall be identified and a sediment management approach for Humboldt bay shall be identified
- HFA-4: Identify additional aquaculture opportunities in Humboldt Bay
- HFA-5: Designate a Preferred Aquaculture Use Area in Arcata Bay, and require Best Management Practices to meet environmental constraints

<u>Recreation Policies:</u>

- ROP-3: Identification of designated recreational use areas

- RFA-2: Project approvals shall incorporate public access and associated services and amenities where appropriate
- RFA-3: Water-oriented recreation facilities; access for fishing and shellfish harvesting
- RFA-5: Environmentally sensitive areas
- RFA-8: Minor amounts of fill authorized
- RSA-1: Improvement and provision of boat launch sites
- RSA-2: Assistance to, maintenance of, and consideration of marinas
- RSA-6: Protect District-owned beaches for recreational uses
- RSA-9: Support for a water trails program for Humboldt Bay
- RIO-3: Directing recreational users toward appropriate areas of the Bay

Conservation Policies:

- CAE-3: Work cooperatively to develop and implement a restoration and enhancement plan for Humboldt Bay's aquatic ecosystems
- CAS-5: Fill placement may be used for habitat enhancement purposes
- CEP-1: Impacts to streams, wetlands, estuaries, and coastal waters may be authorized for specific purposes or project types
- CEP-2: Dredging may be approved under specified conditions
- CEP-3: Revetments, breakwaters, and other shoreline structures may be approved under specified conditions

The Draft Management Plan is intended to provide a "self-mitigating" programmatic management program for Humboldt Bay. The goal in that approach is to assure that policies that could result in adverse effects are accompanied by other policies that moderate or prevent possible adverse effects. For example, while the policies listed above could be associated with activities having adverse effect on the bay's aquatic ecosystem elements and functions, policies CEP-4 through CEP-11 in the Management Plan explicitly assure that the District will identify and adopt appropriate measures to assure that no adverse long-term impacts remain as a consequence of Plan implementation. However, as noted throughout this EIR, the Plan's success in avoiding impacts depends entirely on the full implementation of all of the Plan's policies.

9.3.2.1 Tidal and Nontidal Wetlands

The Draft Management Plan already includes a significant focus on wetland-related policy issues. For example, Policy CAE-2 requires that District decision-makers protect and maintain environmentally sensitive habitat areas under their jurisdiction, including tidal and nontidal wetlands. Policy CAE-3 directs District decision-makers to develop an overall management, restoration, and enhancement plan for wetlands and other aquatic ecosystem elements. Policies CAS-3 and CAS-4 direct that the District maintain and enhance habitat for sensitive species and control or remove non-indigenous invasive species in wetlands subject to District jurisdiction. Policy CAS-1 is an overarching directive to understand and then manage wetland habitat values throughout the bay region in order to maintain the natural biological diversity patterns in the area. Many of the other policies in the Conservation section of the Draft Plan are also focused on wetlands, and this EIR finds that the existing policy framework in the Plan already provides adequate policy guidance for wetland management within areas that are under District jurisdiction. Additional Plan policies do not appear to be necessary.

As noted in the setting section of this chapter, there are also nontidal wetlands and other aquatic ecosystem elements in the bay's watershed that are geographically outside of the District's jurisdiction, and the Draft Plan's focus on these wetland areas is perforce less substantial. However, Policy CAE-3 does enfold these wetland areas, by way of a management direction to cooperate with relevant jurisdictional agencies and interested parties in developing a management approach that allows District concerns to be blended with the concerns of other parties. Because management authority over these areas cannot be created unilaterally by Plan policy statements, this EIR finds that the existing policies provide adequate direction for the District's decision-makers and staff, other agencies, and interested parties regarding District management interests.

However, it is the nontidal wetlands adjacent to the bay margin that may represent one of the more unsettled issues that the Plan may need to address during its effective lifetime. The issue is identified in Subsection 4.5.1.1 in Chapter 4.0, Section II, of the Draft Plan:

> As … much as 40 percent of the intertidal area of Humboldt Bay (about 11,000 acres out of the approximately 27,000 acres present in 1850) was separated from tidal action by the beginning of the 20th Century. Most of this "diked former tideland" was subsequently devoted to agricultural purposes. Substantial interest exists among citizens, some local agencies in the Humboldt Bay region, and some state and federal agencies about the potential for restoring or enhancing aquatic habitats in the Humboldt Bay area to conditions that more nearly resemble the conditions present a century ago.
>
> Several wetland restoration and enhancement projects have already been completed in the diked former tidelands near Humboldt Bay, including the 557-acre Mad River Slough Wildlife Area (CDFG), the 484-acre Fay Slough Wildlife Area (CDFG), the 104-acre Elk River Wildlife Area (CDFG), and approximately 2,200 acres in the Humboldt Bay National Wildlife Refuge Complex (U. S. Fish and Wildlife Service). These substantial areas represent wetland enhancements, for the most part, in that the management focus is primarily the use of rainfall to enhance wetland conditions within the existing levees.
>
> The interest in additional restoration projects includes an increased focus on intertidal restoration, or (equivalently) the restoration of tidewater access to diked former tidelands. At least three major projects were under discussion at the beginning of 2005, including the restoration of tidal action to diked former tidelands near McDaniel Slough (jointly a project of the City of Arcata and the Department of Fish and Game), a possible restoration of tidal action to the Jacoby Creek / Gannon Slough area north of Jacoby Creek (City of Arcata), and a possible restoration of tidal action near the lower end of Martin Slough, in the Elk River basin (a project suggested by the Redwood Community Action Agency but currently lacking an agency sponsor). Collectively these projects would increase the Bay's tidal area by nearly 1,000 acres (because the projects are conceptual, restored areas are conjectural).

While Policy CAE-3 directs District decision-makers and staff to consider and convey District preferences for any proposed strategies for managing nontidal wetlands, primarily in terms of how such proposals may affect the bay and wetland areas that are subject to the District's jurisdiction, the Plan's insubstantial policy focus on nontidal wetlands is essentially an indication that commenting to appropriate agencies about District concerns completes the District's expected role. This may not be the extent of the District's responsibilities.

The legislation that established the District is unequivocal that intertidal areas in the bay's watershed are subject to the District's regulatory authority pursuant to Appendix II of the Harbors and Navigation Code, adopted by the Legislature in 1970:[13]

> "Section 5.5. Jurisdiction of the District
>
> "The jurisdiction of the district to exercise its powers shall extend only over the following:
>
> "(a) All tide, submerged and other lands granted to the district.
>
> "(b) Humboldt Bay as defined in subdivision (f) of Section 3 of this act, including all rivers, sloughs, estuaries, and all areas tributary to Humboldt Bay, subject to tidal action as of the date of this act…"

Section 3 (f) of the act includes the following statement:

> "Section 3. Definitions …
>
> "(f) "Humboldt Bay" or "Humboldt Bay Harbor" shall mean the land and overlying waters, to the limit of tidal action, of what is commonly known as Humboldt Bay, including the land and overlying waters of all streams and estuaries tributary thereto to the limit of tidal action."

These legislative directions are, however, not unequivocal regarding the District's jurisdiction over "the land and overlying waters of all streams and estuaries tributary (to Humboldt Bay) to the limit of tidal action" if the estuaries or streams are tidal because of a restoration of tidal action. The District has, by tradition, concluded that the legislation directed that the District assume responsibility for estuarine areas that were formerly tidal, but currently nontidal, if those areas were restored to tidal status. Such areas would become fully subject to the policies regarding tidal wetlands in the Management Plan.

The context described above creates a conundrum for the Plan and for District decision-makers. The quoted language from Appendix II is ambiguous. It seems likely that an appropriate resolution of the District's jurisdiction may only be reached after the ambiguity is clarified, which may require action by the Legislature or a judge of competent jurisdiction, and such a clarification is not likely to occur prior to the adoption of the Plan.

In any event, this EIR concludes that the issue is only indirectly relevant to this EIR, because the existing Plan provides directional certainty for wetland areas under the District's jurisdiction and appropriate direction for District decision-makers and staff for areas that are not subject to the District's jurisdiction. Therefore this EIR does not recommend additional policies for the Management Plan to address the CEQA aspects of this issue.

13 The entire text of Appendix II is included in Appendix B in Part II of the Draft Plan.

9.3.2.2 Rivers, Streams, and Riparian Areas

The District's direct jurisdiction over rivers and/or streams in the Humboldt Bay region is expressly limited by the District's legislation of creation to the following tidal rivers and streams:[14]

- Jolly Giant Creek south of Fourth Street
- Jacoby Creek west of Old Arcata Road
- Fay Slough west of Old Arcata Road (now Myrtle Avenue)
- Freshwater Slough west of Old Arcata Road (now Myrtle Avenue)
- Ryan Slough north of Myrtle Avenue
- Second Slough north of Myrtle Avenue
- First Slough north of Myrtle Avenue, and Cooper Gulch (First Slough) east of V Street
- Swain Slough west of Pine Hill Road
- Elk River at approximately the location of Pine Hill Road[15]
- Salmon Creek west of Highway 101

Few of the areas identified in this list have riparian vegetation, and the vast majority of streams in the watershed are not covered. However, the watershed-based concerns described in this chapter (as well as the water quality concerns described in chapter 6.0) are not restricted to areas that are subject to the District's direct jurisdiction.

From a perspective of adequate environmental assessment, the policy framework in the Draft Management Plan appears likely to be substantially ineffective in providing for the District a vehicle for communicating the scope of District concerns about watershed-based effects on rivers, streams, riparian areas, and other elements of the bay's aquatic ecosystem that lie within the hinterlands around the bay's margin. Two policies in the Draft Plan appear to provide appropriate latitude to encompass this scope.

Policy CAE-3 directs District decision-makers and staff to consult with a variety of agencies and interested parties regarding the development of a management plan for the bay's aquatic ecosystem elements. The elements covered in the plan could include streams, rivers, floodplain and riparian vegetation, and similar elements, although there is no policy assurance that such elements will be covered.

Policy CAE-4 directs District decision-makers and staff to consult with a variety of agencies and interested parties regarding the development of a water-quality maintenance plan for the watershed. The elements covered in such a plan could include nonpoint source pollution of several kinds, sediment, temperature, and a variety of factors that are closely related to riparian ecosystem functions in the upstream elements of aquatic

14 These areas of jurisdiction are identified in Section 3 of Ordinance No. 7. The text in the ordinance is based on an interpretation by District Counsel, based on the text of the enabling legislation.

15 The applicability of the jurisdictional boundary identified in Ordinance No. 7 for Elk River is uncertain, since the landmark identified in the description is not located on or associated with Elk River. The approximate boundary identified in Ordinance No. 7 is far downstream from the limit of tidal action in Elk River.

ecosystems, although again there is no certainty that these elements would be addressed in such a plan.

Even though the policy basis in the Draft Plan for these important policy considerations is not extensive, this EIR does not identify additional policies that address these concerns. It is unclear at the present time that the existing policy framework in the Plan will be inadequate in application. Second, there is no clear jurisdictional extension available to the District that supports additional policy approaches for stream- and floodplain-related ecosystem elements in the watershed. That is, the existing policy formation in the Management Plan apparently incorporates the full extent of the options available to the District, and no additional feasible policy approaches are evident.

9.4 POLICY CONSIDERATIONS FOR MITIGATING POTENTIALLY SIGNIFICANT EFFECTS

Based on the programmatic assessment above, this EIR does not identify additional policy elements that should be added to the Draft Management Plan in order to address potential Plan-related concerns for tidal and nontidal wetlands, rivers, streams, and riparian areas.