# CHAPTER 2.0

# WATERCOURSE AND WETLAND INVENTORY METHODS

This chapter describes the methods used to inventory the watercourses and wetlands in the City of Santa Cruz. This includes development of base maps; identification of the primary hydrologic and habitat characteristics for each watercourse and wetland, including stream type, source of stream flow, habitat types, special status species where relevant, and presence of invasive species; and methods for identifying riparian and wetland habitat, special status species assessments and mapping of the centerline of watercourses.

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2.1 Base Map Development
2.2 Inventory of Watercourse and Habitat Characteristics
2.3 Habitat Surveys and Species Assessments
2.4 Watercourse Surveys


## 2.1 BASE MAP DEVELOPMENT

A Geographic Information System (GIS) database was developed for the project using ArcMAP Environmental Systems Research Institute (ESRI) software. This database includes watercourse layers that serve as the baseline dataset to depict existing and proposed development setbacks. The GIS database base map layers provided by the City of Santa Cruz include a set of high-resolution, ortho-rectified, color aerial photos and an updated assessor's parcel boundary layer. The parcel layer was updated in June of 2000 by Lynx Technologies and merged into the Santa Cruz County parcel layer by County staff. The aerial photos were flown by Sanborn Maps in June of 2003, generating a set of photos with a pixel resolution of six inches. The parcel layers then was digitized from the aerial photos with an estimated ground accuracy of $\pm$ two feet.

Using the ortho-rectified aerial photos and parcel layer, a series of base maps were generated at a scale of one inch = 200 feet. These printed base maps were used, along with the digital version of the aerial photos to determine the approximate location and extent of watercourses and riparian vegetation within the City of Santa Cruz, with the exclusion of open space areas that were already part of an existing management plan or not within the jurisdiction of the City. Each identified watercourse was later visually verified and evaluated in the field. These maps are considered suitable for planning purposes, but the data cannot be considered survey quality as the project did not include a high accuracy Global Positioning System (GPS) survey along each watercourse or surveying the centerline of each watercourse using traditional surveying methods.

The aerial photo base maps are included under separate cover. The full-size parcel-based maps (1 inch = 200 feet) are available at the City of Santa Cruz Planning and Community Development Department office for review. The information is also available on the City's website under the Department of Planning and Community Development webpage at: www.ci.santa-cruz.ca.us.

## 2.2 INVENTORY OF WATERCOURSE AND HABITAT RESOURCE CHARACTERISTICS

The primary hydrologic and habitat characteristics of the City's watercourses and wetlands were identified and documented for each watercourse and wetland in the City. The inventory records information of different types of riparian and wetland vegetation, stream channel type (i.e., perennial or intermittent flow), source of flow, known or potential use by special status wildlife species and the presence of invasive, non-native plant species. The definition of a riparian corridor and wetlands is included as Appendix A. Several private properties contain ponds or wetlands. Wetland delineations were not conducted as a part of this *Management Plan*; therefore site-specific review would be required to document the existing resources and establish an appropriate setback for these areas. The *Management Plan* does not address the drainage capacity or flooding potential of City watercourses and wetlands.

Field surveys were conducted by the consultant team on a limited basis during the spring, summer and fall of 2000 and additional field surveys conducted by City staff in 2003. Not every parcel was visited, but many were viewed from adjacent private properties in an attempt to view adequate numbers of properties for each reach. Changes in vegetation patterns since this time may have occurred; in addition, high winter storm flows can cause the centerline of the channel to migrate, which may have occurred for some channels.

The watercourse and habitat characteristics that were inventoried are summarized below.

- STREAM TYPE. Recorded as either:
    - Perennial
    - Intermittent

- SOURCE OF STREAM FLOW. The source of flow describes the contributing area that provides flow to the watercourse of interest, and is defined as one of the following:
    - Storm Drain
    - Curb/Gutter
    - Natural Area
    - Mixed Source
    - Seeps/Springs

- PRIMARY HABITAT TYPES. Seven primary habitat types were recorded along the watercourses and wetlands within the City. Appendix J presents a detailed description of each of the primary habitat categories documented within the City, which include:
    - Herbaceous riparian and wetland
    - Mixed riparian woodland
    - Oak riparian woodland
    - Non-native riparian woodland
    - Riparian scrub
    - Open water
    - Modified Channels

- SECONDARY HABITAT FEATURES. The dominant plant species were recorded for each habitat type, or, for modified channels, the type of stream bank armoring was recorded, where documented. Table 2-1 summarizes the secondary habitat (vegetation) features for each primary habitat.

**TABLE 2-1. CLASSIFICATION SYSTEM FOR PRIMARY AND SECONDARY HABITAT TYPES, SPECIAL STATUS WILDLIFE SPECIES HABITAT, AND INVASIVE, NON-NATIVE PLANT SPECIES**

| Primary Habitat Type | Secondary Habitat Type |
|---|---|
| Herbaceous Riparian and Wetlands | Seasonal Wetlands<br>Freshwater Marsh<br>Salt or Brackish Water Marsh<br>Seeps and Springs<br>Wet Meadows |
| Mixed Riparian Woodland | Willow-dominated<br>Willow and Red Alder -dominated<br>Box Elder and Maple- dominated<br>Willow and Freshwater Marsh<br>Sycamore-dominated |
| Oak Riparian Woodland | Coast Live Oak and Willow-dominated<br>Coastal Live Oak and Redwood-dominated |
| Non-native Riparian Woodland | Blue Gum Eucalyptus-dominated<br>Monterey Pine-dominated<br>Acacia-dominated<br>Other Landscape Plants dominant |
| Riparian Scrub | California Blackberry, California Rose and Poison Oak-dominated<br>Willow, Sedge and California Blackberry-dominated<br>Coyote Brush, Poison Oak and Coffee Berry-dominated |
| Open Water | Pond or Lake<br>Coastal Lagoon |
| Modified Channels | Earthen Channel<br>Concrete-lined Ditch<br>Storm Drain<br>Other Channel Type |

- KNOWN OR POTENTIAL TO SUPPORT SPECIAL STATUS WILDLIFE SPECIES. The occurrence of known or potential habitat for special status wildlife species was noted for each reach as summarized in Table 2-2 below, and as described in more detail in Appendix J. The special status wildlife species that are known to occur or have the potential occur within or adjacent to aquatic, wetland or riparian habitats are summarized on Table 2-2 at the end of this chapter. Two special status plant species were identified as occurring or potentially occurring in grasslands adjacent to riparian and wetland habitats. The primary special status wildlife species recorded for the *Management Plan* are listed below.
    - Steelhead, a federally-listed threatened species
    - Coho salmon, a federally-listed threatened species and a state-listed endangered species
    - Tidewater goby, a federally-listed endangered species
    - Raptors (nesting)
    - Monarch butterfly (over-wintering sites), City of Santa Cruz locally unique species
    - California red-legged frog, a federally-listed threatened species
    - Southwestern pond turtle, a federal and state species of special concern

- Tri-colored blackbird (nesting), a federal and state species of special concern
- Yellow warbler (nesting), a federal and state species of special concern
- Yellow-breasted chat (nesting), a federal and state species of special concern
- San Francisco dusky-footed woodrat, a federal and state species of special concern
- Yuma myotis and Townsend's western big-eared bat, , federal and state species of special concern

- PRESENCE OF INVASIVE, NON-NATIVE VEGETATION. Invasive, non-native plant species were documented for each reach. Table 4-6 (page 4-16) and Appendix C present a complete listing of potentially problematic species that may invade central coast riparian area. Currently, the most problematic of these species are:

  - Periwinkle
  - Ivy (cape, English or Algerian)
  - Acacia (blackwood, green wattle or black wattle)
  - Broom (French, Scotch or Portuguese)
  - Poison hemlock
  - Cotoneaster
  - Himalaya berry
  - Eucalyptus (blue gum or other species)
  - Giant reed
  - Thistles (bull thistle, Italian thistle or star thistle)
  - Pampas grass
  - Monterey cypress

## 2.3 HABITAT SURVEYS AND SPECIES ASSESSMENTS

### 2.3.1 Habitat Survey Methods

A general riparian and wetland survey was conducted to identify the primary and secondary habitat features (as relevant) along each watercourse and wetland in the City. This was accomplished through a review of existing reports, consultation with resource agency personnel and other knowledgeable individuals, aerial photo interpretation and field reconnaissance. Primary habitat features were interpreted from aerial photo base maps and field reconnaissance. Secondary habitat features, as well as other habitat characteristics that could be discernable in the field were also entered on the field data sheet, as relevant.

Field surveys were first conducted by the consulting plant ecologist and wildlife biologist along the watercourses and wetlands during April through August, and October and December 2000. These field surveys were primarily conducted along public streets, public parks and where watercourses cross public streets. Habitat features and other classification attributes assigned to each reach were often ascertained by viewing the watercourse from a nearby road (for privately-owned parcels). Private property was not field-surveyed by the consultants unless site access was granted by the landowner. For portions of a watercourse that were inaccessible due to private property, the habitat features and characteristics were determined from aerial photo interpretation and, if available, previous reports or documents. Additional field surveys were conducted by City staff in 2003 per the direction of the Planning Commission and City Council. For the 2003 survey, City staff utilized aerial photos at a greater scale than was

previously utilized and staff was able to obtain permission from private property owners in order to view as many private properties as possible since this was not previously conducted in any level of detail.

It should be noted that not every parcel was visited, but many were viewed from adjacent private properties in an attempt to view adequate numbers of properties for each reach. Although every attempt was made to map all watercourses and wetland areas within the City, there may be some areas that were missed due to lack of information, site access or the occurrence of a previously unknown resource. If unknown wetland or riparian areas are found following the adoption of this plan, they would be subject to additional biological and environmental review to document the existing resources and establish a setback.

### 2.3.2 Special Status Species Assessment

The occurrence or potential occurrence of special status wildlife species was determined by a wildlife biologist based on data provided by CDFG (California Natural Diversity Data Base [CNDDB] Rarefind database), existing studies, reports and other data, field observations of habitat conditions, and consultation with other knowledgeable biologists. Some information, such as the known or potential presence of a special status wildlife species was determined through the biologist's evaluation of the habitat features or from existing reports or data that determined presence. Field surveys mapped potential habitat for special status species, where for example, watercourses met the criteria for use by the California red-legged frog, steelhead, tidewater goby or over-wintering monarch butterflies. No focused species surveys were conducted as part of the *Management Plan*.

Watercourses or wetlands with known or potential presence of special status species are noted in the *Management Plan*. Protocol-level surveys (i.e., surveys conducted to standards acceptable to regulatory agencies, such as CDFG and USFWS) will be necessary to determine the presence or absence of such species if developments are proposed in and/or adjacent to potential habitat areas. The current survey protocol for further biotic review is presented in Appendix B. If a survey is required for a particular special status species, a protocol-level survey would be required following standards accepted by that particular regulatory agency.

The City is currently in the process of obtaining a permit from NOAA and the USFWS for public projects that may affect federally listed wildlife. The City is preparing a Habitat Conservation Plan (HCP) as part of the permit application. Information from this permit may be applicable to other activities in the City and may provide additional presence/absence data that could be added to the City's database. If approved by the NOAA and USFWS, City projects will likely be covered under the permit and governed by the conditions set forth in the HCP. Private projects would require project-level environmental review, and would be required to comply with the Endangered Species Act and other applicable state and federal requirements.

## 2.4 WATERCOURSE SURVEYS

### 2.4.1 Watercourse Mapping and Survey Methods

The purpose of the watercourse survey was to map, to the extent possible, locations within the city limits where watercourses occur and provide information as part of the *Management Plan*

about the condition and hydrologic character of these resources. The extent and type of vegetation, the proximity of existing development, and the watercourse data layer were compared to each other to separate the watercourses into distinct segments based on their vegetative and land use characteristics. Each watercourse was divided into distinct channel reaches that could then be used to refine the City's existing 100-foot setback policy based on channel and habitat characteristics. A separate book of aerial photo maps displays the watercourse reaches utilized as part of the *Management Plan*. In addition, watershed boundaries were determined to provide information about the area and land uses that contribute to each watercourse. The U.S. Geological Survey (USGS) 1:24,000 topographic maps were used to determine subwatershed boundaries in areas of steeper terrain or locations where existing data was not available.

Using the initial mapping of the watercourse centerline from the aerial photos, a field reconnaissance was conducted to determine the hydrologic and physical condition of the mapped watercourses. New watercourses, previously unidentified, were also mapped during the field reconnaissance and included on the base maps. Field reconnaissance was conducted in July and August 2000 to determine if the watercourses were intermittent or perennial. Since field mapping was only conducted for a single year, the determination of flow regime only represents conditions for that particular year, though in most cases it would not change from year-to-year. The field surveys also identified specific information about segments of channel, such as where segments of stream have been put underground, where they daylight and whether channels have been modified or are in a more natural condition. Field verification occurred at publicly accessible locations or where landowner access was provided.

### 2.4.2 Mapping the Centerline of Watercourses

Initial mapping of the centerline of each watercourse involved collection and review of existing data depicting the location of this feature. These datasets included the USGS 1:24,000 Digital Line Graphs (DLG), which are digital versions of the USGS 1:24,000 topographic maps, and Santa Cruz County stream layer, which was digitized from USGS quadrangles and County Assessor's parcel maps. After review of this data in conjunction with the aerial photos and parcel base maps, it became clear that the resolution and accuracy of these existing data sources would not be adequate to meet the accuracy goals required by the *Management Plan* as they were incomplete in terms of the number of watercourses that were mapped compared to the number of watercourses that are present, and were too generalized to provide the necessary level of confidence.

Development of a new set of map layers was accomplished using the 1 inch = 400 feet aerial imagery. This task involved discussions with the vegetation team and review of the City of Santa Cruz Master Drainage Plan (Hill and Associates, 1960). Watercourses were drawn on the base map as an initial estimate of their location. In most cases, the channel could not be clearly identified in the aerial photo due to dense vegetation near the channel. In cases where the channel could not be clearly identified, the centerline was mapped as either the center of identified riparian vegetation or the center of the zone of vegetation.

The initial draft mapping of watercourse centerlines was presented at a public meeting and input was provided by landowners, agency staff, and members of the public to better refine the locations of watercourse segments. In 2002 and 2003 after several public workshops and Planning Commission and City Council meetings, City Council directed staff to refine the initial field evaluations and *Management Plan* recommendations by using a combination of aerial

photos with greater resolution and scale than used before, and by conducting direct field evaluations of all watercourses City-wide. Staff was also able to utilize recently updated storm drain maps prepared by Lynx Technologies in 2002 for the Public Works Department in their field evaluations. The mapping efforts and staff recommendations of this refined field evaluations were presented at several public workshops in March of 2004.

The location of the creek centerlines portrayed on the maps in this plan is suitable for planning purposes. For some parcels, more detailed field measurements will be necessary to more accurately portray the centerline or to update to the current site condition. As stated earlier, delineation of wetlands was not conducted. Such a determination may be required if developments are proposed in or adjacent to such features. In addition, ponds are located on several private properties. The potential for resources adjacent to these ponds was not evaluated as part of this project. Site-specific review would be required for these properties prior to approval for development activities that could impact potential resources. The parcels containing and/or adjacent to wetland and/or ponding water resources that may require site-specific review have been designated as such on the aerial maps; however, further review would only be required if either the location or type of development proposed has the potential of impacting the resource. A description of the protocol for site-specific biotic review surveys and wetland delineations is described in Appendix B.

It should also be noted that the *Management Plan* maps (under separate cover), in some instances, show the setbacks from one reach to another extending out 180 degrees so that it appears the setback of one reach extends into the next reach. This is shown due to a limitation in technology; the actual setbacks from one reach segment to another do not extend beyond the reach. The only situation in which the setbacks extend out beyond the reach segment is at the end or beginning of a watercourse.

## TABLE 2-2. SPECIAL STATUS WILDLIFE SPECIES AND THEIR POTENTIAL TO OCCUR IN OR ADJACENT TO WATERCOURSES AND WETLANDS

| SPECIES | STATUS[1] | HABITAT | KNOWN OCCURRENCE WITHIN CITY WATERCOURSES OR WETLANDS | POTENTIAL OCCURRENCE WITHIN CITY WATERCOURSES OR WETLANDS |
|---|---|---|---|---|
| **Invertebrates** | | | | |
| Monarch butterfly<br>*Danaus plexippus* | * | Winter roosts in eucalyptus and pine groves protected from wind. | Known roosts at Natural Bridges, Moore Creek just north of Hwy 1, upper Arroyo Seco Creek, lower end of Pilkington Gulch, Wagner Seep, lower Branciforte Creek, and drainage along Depot Park. | Likely in non-native riparian woodlands that are dominated by eucalyptus Potential habitat in some upper portions of Carbonera, Branciforte and Hagemann Creeks, and several portions of Arana Gulch Creek. |
| **Fish** | | | | |
| Tidewater goby<br>*Eucyclogobius newberryi* | FE, CSC | Coastal lagoons and up to one mile upstream. | Known to occur in Moore Creek from mouth to 0.25 mi upstream and in the lower San Lorenzo River. | Potential in Younger Lagoon (UCSC lands) and mouth of Moore Creek (Natural Bridges State Beach) and Arana Gulch Creek.. |
| Steelhead<br>*Oncorhynchus mykiss* | FT | Creeks, rivers and their tributaries. | Known to occur in San Lorenzo River, Branciforte Creek and Arana Gulch Creek. | No other watercourses in the City are potential habitat for this species. |
| Coho Salmon<br>*Salmo gairdneri* | FT, SE<br>(State listing deferred until a Recovery Plan is prepared, Current petition for Federal Listing) | Creeks, rivers and their tributaries. | Historically known from San Lorenzo River. Coho adults have been found in San Lorenzo River during the last several winters and coho young of the year were found in 2005 in the upstream San Lorenzo River. | Potential re-colonization of San Lorenzo River; no other watercourses in the City are potential habitat for this species. |
| **Amphibians** | | | | |
| California red-legged frog<br>*Rana aurora draytonii* | FT, CSC | Riparian woodland, marshes, estuaries and ponds. | Known to occur in Antonelli Pond, Moore Creek, marsh at Natural Bridges, Younger Lagoon and ponds near UCSC arboretum (tributary to Moore Creek, just outside City limits). | No other watercourses in the City are known to support this species. |
| **Reptiles** | | | | |
| Southwestern pond turtle<br>*Clemmys marmorata pallida* | FSC, CSC | Creeks and ponds. | Known to occur in Moore Creek, Antonelli Pond, marsh at Natural Bridges and Neary Lagoon; historic occurrence in Westlake Pond. | No other watercourses or wetlands in the City are potential habitat for this species. |
| **Birds** | | | | |
| White-tailed kite<br>*Elanus leucurus* | FPS | Oak woodland and riparian woodland. | Known to nest in Natural Bridges. | Potential habitat along portions of Moore Creek. |
| Cooper's hawk<br>*Accipiter cooperii* | CSC | Oak woodland and riparian woodland. | Known to nest along Moore Creek. | Potential nesting habitat occurs along upper portions of Arroyo Seco Creek and Arana Gulch Creek. |
| Yellow warbler<br>*Dendroica petechia brewsteri* | CSC | Nests in riparian habitats with dense willows and cottonwoods. | Formerly bred at Antonelli Pond, San Lorenzo River (Sycamore Grove), Carbonera Creek, Branciforte Creek, Westlake Pond, Neary Lagoon and Arana Gulch Creek; not currently known to nest in City. | Potential nesting habitat at Antonelli Pond, San Lorenzo River (Sycamore Grove), Carbonera Creek, Branciforte Creek, Neary Lagoon and Arana Gulch Creek. |

## TABLE 2-2. SPECIAL STATUS WILDLIFE SPECIES AND THEIR POTENTIAL TO OCCUR IN OR ADJACENT TO WATERCOURSES AND WETLANDS

| SPECIES | STATUS[1] | HABITAT | KNOWN OCCURRENCE WITHIN CITY WATERCOURSES OR WETLANDS | POTENTIAL OCCURRENCE WITHIN CITY WATERCOURSES OR WETLANDS |
|---|---|---|---|---|
| Yellow-breasted chat<br>*Icteria virens* | CSC | Nests in riparian habitats with dense willows, cottonwoods. | Probably extirpated as breeder in County; more data needed to determine current nesting status in the City. | Potential nesting habitat at Antonelli Pond, San Lorenzo River (Sycamore Grove), Carbonera Creek, Branciforte Creek, Neary Lagoon and Arana Gulch Creek. |
| Tricolored blackbird<br>*Agelaius tricolor* | CSC | Nests in freshwater marshes with dense tules and cattails. | Historically nested at Antonelli Pond and Neary Lagoon. | Potential nesting habitat at Antonelli Pond and Neary Lagoon. |
| **Mammals** | | | | |
| Yuma myotis<br>*Myotis yumanensis* | FSC, CSC | Open forests and woodlands with water nearby; roosts in buildings, caves and crevices. | No survey data for City available. | Potential habitat along Moore Creek, portions of San Lorenzo River, upper portions of Branciforte, Carbonera and Arana Gulch Creeks. |
| Townsend's western big-eared bat<br>*Corynorhinus townsendii townsendii* | FSC, CSC | Wide variety of habitats; roosts in caves, tunnels, mines, and buildings. | No survey data for City available. | Potential habitat along Moore Creek, portions of San Lorenzo River, upper portions of Branciforte, Carbonera and Arana Gulch Creeks. |
| San Francisco dusky-footed woodrat<br>*Neotoma fuscipes annectens* | FSC, CSC | Riparian and oak woodlands. | No survey data for City available. | Potential habitat along Moore Creek, Arroyo Seco, upper portions of San Lorenzo River, upper portions of Branciforte, Carbonera and Arana Gulch Creeks. |

Sources: CDFG Rarefind, 2001; Dana Bland & Associates, 2001; Dr. Jerry Smith, 2000 and 2001; Santa Cruz Bird Club, 2001

[1] Key to status:

FE = Federally listed as endangered species
FT = Federally listed as threatened species
FSC = Federal species of special concern
FPS = State designated Fully Protected Species
CSC = California species of special concern
* = Locally unique species in City of Santa Cruz General Plan and LCP
ST = State listed as threatened
SE = State listed as endangered species