Little Chico Creek Watershed Existing Conditions Report

Vegetation, Fish & Wildlife, Water Quality, Land Use

Prepared by
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EXECUTIVE SUMMARY

This document represents a partial Existing Conditions Report (ECR) for the portion of Little Chico Creek watershed that is located in Butte County. The ECR contains a landscape overview of the watershed, information on the history of the Little Chico Creek Watershed Group, stream and fish surveys, water quality, land use, and a summary of significant findings. Activities to engage stakeholders in watershed management efforts are summarized. This project was funded by Proposition 204, The Safe, Clean, Reliable Water Supply Act. Proposition 204 was a State bond measure that the voters approved in 1999. This report is only a partial ECR because there are several elements typically contained in an ECR that are not contained in this document. These elements include additional chapters and discussion of cultural history, laws and regulatory inventory, recreation inventory, fire history and fire management inventory, and environmental education. These additional chapters should be added to this ECR as resources become available.

Acknowledgements

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1 INTRODUCTION

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1.1 LITTLE CHICO CREEK WATERSHED LOCATION

Little Chico Creek Watershed (LCCW) is located in northwestern Butte County, trending generally northeast to southwest (Figure 1.1). The watershed spans two distinct geomorphic provinces: the Cascade Range Province and the Great Valley Province (Harwood et al., 1981). Elevations range from approximately 115 ft (35 m) near the Sacramento River to slightly over 3,510 ft (1,070 m) in the lower Cascade Range. The topography of the watershed is diverse, including the relatively flat valley floor, the low angle slope of the creek's alluvial fan, lower canyons, and steep-sloped headwaters. The total land area of Butte County is approximately 1,670 mi^2 (4,325 km^2) or 1,072,707 acres (434,109 ha). The LCCW watershed project area covers 85,050 acres or approximately 8 percent of the land area within Butte County boundaries.

Platte Mountain is located at the northern terminus of the watershed. Well-defined ridge-top watershed boundaries occur along the northwest (generally following State Highway 32) and on the southeast (along Doe Mill Ridge) (Figure 1.1). Watershed boundaries are subtler along the alluvial fan and on the valley floor. Human alteration of the watershed below the alluvial fan compounds the difficulty of boundary delineation, especially in areas where urban and agricultural land use has modified surface drainage patterns. The scope of this project report is confined to that portion of the LCCW that lies within Butte County (Figure 1.2).

To organize this report and provide a basis for future watershed management efforts, the LCCW has been subdivided into four zones: mountain, canyon, urban, and agricultural (Figure 1.3). These zones reflect dominant local ecological, physiographic, and land-use conditions that influence watershed processes. Each of these zones is described in detail in Chapter 2 as part of the Stream and Fish Survey.

1.2 GEOLOGY

Most of LCCW rests on top of a horizontally layered sequence of three formations consisting of Cretaceous, Tertiary and Quaternary rocks. These strata have been uplifted approximately four percent to the northeast by the deep underlying granite of the Sierra Nevada batholith (Rowe 1991). Over fairly recent tectonic history, the Chico Monocline formed and represents a major geologic structure in the watershed. This monocline is a southwest-facing structural feature that includes a gentle downwarping (to the southwest) of the Tuscan Formation and underlying rocks over a deeper high-angle reverse fault dipping steeply to the east (Harwood and Helley, 1987). The age of this monocline is estimated to be between 1.0 and 2.5 million years before present.

1.3 SOILS

Soils in LCCW (as a part of Butte County) are in the process of being remapped by the Natural Resource Conservation Service (NRCS). In general, soils grade out according to their position on Little Chico Creek's alluvial fan. Upland soils tend to have a much higher rock fragment content, derived from both alluvial and hillslope sources. Soil profiles also tend to be shallower in the Mountain and Canyon Zones compared with the Urban and Agricultural Zones. LCCW soils in the lower two zones are very deep with well-developed horizons, being part of a large, old alluvial fan of eroded Tuscan rock (DWR 1994).

1.4 CLIMATE

The climate in the Sacramento Valley and adjoining Cascade Range mountains is termed Mediterranean, with cool wet winters and hot dry summers. Thus, stream flow in Little Chico Creek is generated through winter rainfall since the upper watershed area is below the elevation where a significant snowpack occurs. The precipitation distribution over the watershed is strongly orographic, with rainfall increasing as storms rise up over the Sierra Nevada range (NRCS, 2000).

Annual precipitation in the lowermost watershed can be represented by Chico at elevation 174 ft (53 m), which receives approximately 25 inches (635 mm) during an average year (California Data Exchange Center, 2002). Based on regional precipitation patterns, mid-elevation rainfall within the LCCW can be approximated using the Paradise rain gage (located just to the south of

LCCW), which is located at an elevation of approximately 1,750 ft (533 m). The variability of annual precipitation since 1925 for the Paradise gage is summarized on Figure 1.4. Mean annual precipitation for the period 1925-2002 at Paradise was 50 inches (1270 mm), or approximately twice the amount recorded in Chico (California Data Exchange Center). Normal annual precipitation for the highest elevation, 3,510 ft (1,070 m), is over 71 inches (1,800 mm).

The mean annual temperature at Chico is approximately 61^{o} F (16^{o} C). Minimum monthly temperatures of 45^{o} F (7^{o} C) occur during December and January, and the maximum monthly temperature of 77^{o} F (25^{o} C) occurs in July (NCDC). According to Department of Water Resources (DWR) data (CIMIS, 1996), reference evapotranspiration (ET) for the LCCW area (for grass species) is approximately 52 inches (1310 mm), with over 75% of the ET occurring between April and September.

1.5 HISTORY OF THE LITTLE CHICO CREEK WATERSHED GROUP

The Little Chico Creek Watershed Group was initiated in January 1998 by Jeff Mott and Jean Hubbell, two landowners that live in the watershed. A public meeting was organized at the Chico City Council meeting room on June 18, 1998, and approximately 60 people attended, including interested landowners, public agency representatives, and local citizens. The goal of the meeting was to determine if a watershed group should be formed, and if grant funding should be procured. The general consensus from this meeting was to establish a watershed organization and to procure funding to conduct an Existing Conditions Report. Toward the end of this meeting, we documented the following list of issues and concerns currently impacting Little Chico Creek:

-equal votes in the process for all stakeholders
-urban and rural runoff and its effect on flooding and water quality
-garbage
-Teichert Ponds
-a proposed gravel pit on the M&T Ranch
-the role of the homeless in possible bacterial contamination of the creek
-salmon and other fish species of concern
-the exact status of LCC including headwaters, termination, and whether it is naturally an intermittent stream,
-the Humboldt dump site, and
-farming concerns.

At the fall 1998 stakeholder meeting the following Steering Committee of 14 people was created to hold meetings in the interest of establishing a watershed group for Little Chico Creek. The founding Steering Committee was comprised of the following individuals:

Roger Cole, Landowner, Ecologist
Les Gerton, Environmentalist
Don Holtgrieve, Landowner, Environmental Planner
Tom Hood, Family Landowner
Jean Hubbell, Landowner, Plant Ecologist
Rob Katz, Student, Citizen
Jason Larrabee, Landowner, Farmer, Resource Manager
Catherine S. Linden, Landowner
David Linden, Landowner, Attorney
John Merz, Citizen, Environmental Activist
Jeff Mott, Landowner, Environmental Programs Manager
Ryan Schohr, Rice Farmer, Farm Bureau Member
Dallas Smith, Landowner
Anne Stephens, School Teacher.

The Steering Committee began meeting on a semi-monthly basis and additional public meetings have been conducted bi-annually. The Steering Committee selected the name *Little Chico Creek Watershed Group* to reflect that it was a working group of landowners, concerned citizens, and agencies with a diversity of viewpoints. This committee developed the following mission statement:

> *The Little Chico Creek Watershed Group was established to preserve, protect, restore and enhance the ecological integrity and economic vitality of the Little Chico Creek Watershed through the cooperative effort of private citizens and public agencies.*

The Steering Committee discussed the development of by-laws and incorporation and decided that was not the direction the group wanted to go at the time, but that it should be considered again in the future. It was agreed that LCCWG would provide a forum to share information about the watershed in its first efforts to fulfill the mission statement and that specific projects would wait for the Existing Conditions Report (ECR). Thus topics of interest to the group have been the focus of Steering Committee meetings. Grant writing efforts, announcements of local events of interest, and eventually ECR review were also included on meeting agendas. Steering Committee meetings were organized and run by Jean Hubbell or Jeff Mott until funding provided for a watershed assistant. Meetings that focused on the ECR review were organized and run by

David L. Brown since he is the Project Director. At this writing LCCWG has decided to redirect its focus to creek projects and only meet twice a year to agree on projects or project types to support. The meetings are open to the public and announced in the local media.

Stakeholder meetings have occurred annually as noted above. The focus has been to inform the attendees of the status of the ECR and to discuss general concerns within the watershed. At a Stakeholders Meeting conducted on January 22, 2001, attendees updated the 1998 list of Issues and Concerns to include the following:

Possibility of biking/hiking trail from city to Sacramento River
Garbage after high water events
Dumping of garbage in the watershed
Trespassing
Urban pesticides
"Stakeholder" definition, possibly "Citizens" instead of "Stakeholder
Flood zone in lower watershed (FEMA mapping)
Little Chico Creek flood capacity
Non-native plants

Using input from stakeholder meetings along with discussions at Steering Committee meetings, a written survey was distributed to approximately 10% of the landowners in the LCCW in May 2001. Approximately 800 survey forms were distributed and 69 responses were received by July 2001. The survey results are summarized on Table 1.1

1.6 BACKGROUND AND OVERVIEW OF THE EXISTING CONDITIONS REPORT

An existing conditions report is designed to serve as a foundation for future projects in the watershed. The ECR is a collection of data, professional observations, and recommendations to conduct further analysis. It is usually the first phase of a larger plan to improve the condition of the watershed. The second phase entails the development of a Watershed Management Strategy (WMS). The WMS is a document that uses the existing conditions to determine what projects need to be pursued to improve the quality of the watershed. At the time of publication, a watershed management strategy has not been developed for Little Chico Creek.

Butte County served as the lead agency and administrator of the grant funding. The ECR was developed by faculty, staff and students at California State University, Chico and the Bidwell Environmental Institute. A Technical Advisory Committee (TAC) was formed to assist in reviewing the draft ECR and providing technical comments. The TAC members were chosen based upon their expertise and knowledge associated with each element of the ECR. As the ECR was being developed, the Steering Committee of the Little Chico Creek Watershed Group was given periodic progress reports on the status of the ECR. In addition, the public was invited to the three Stakeholder meetings where progress reports were presented and discussed.

During review of various drafts of the ECR, comments were received by members of the TAC, the public, and Butte County agencies. The comments received and the manner in which they were addressed is presented in Appendix A.

2 VEGETATION, FISH AND WILDLIFE WITH AN EMPHASIS ON RIPARIAN HABITAT AND FISHERIES

Contributors: Jean G. Hubbell, Paul Maslin, David L. Brown, & John W. Hunt

2.1 OVERVIEW

2.1.1 Zone descriptions

Like most drainages, Little Chico Creek's watershed changes continuously from top to bottom. For convenience, we have divided that continuum into zones within which the physical and biological characteristics are fairly similar (Figure 1.3). A jagged line on the map denotes zone boundaries because those junctions are not distinct. The Mountain Zone from the headwaters to approximately Crown Point Road has steep slopes with fairly deep soils developed from local bedrock, usually the Tuscan Formation. Precipitation is abundant ranging from approximately 71 inches (1,800 mm) in the headwaters to approximately 39 inches (1,000 mm) at Crown Point Road. Snowfall persists on the ground in the Mountain Zone between storms, but snowmelt is not a significant seasonal runoff process as is the case for higher elevations. In most places the Mountain Zone is forested with conifers and some hardwoods.

The Canyon Zone from Crown Point Road to Stilson Canyon has steep slopes that cut through many layers of rock that differ considerably in hardness and chemistry. Precipitation is less, usually falling as rain, and soils are highly variable but tend to be shallow. Vegetation varies with elevation, slope, and soil. Chaparral and various oak woodlands dominate most slopes. Along the creek montane vegetation continues well into this zone.

The Urban Zone encompasses Bruce Road to Pomona Avenue, leaving everything downstream as the Agricultural Zone. These zones are both within the Sacramento Valley with its deep alluvial soils and lower precipitation (25 in/yr or 640 mm/yr). As indicated by their names, the Urban and Agricultural Zones are dominated by human use.

2.1.2 Sampling Methods

Where trespass permission could be obtained, Little Chico Creek and its riparian corridor were surveyed for channel geomorphology, vegetation, fish and fish habitat, and birds. Other general physical characteristics and biological information were noted during the survey (e.g. number of tributaries, sightings of vertebrate species or their sign) or obtained from existing sources. Macroinvertebrates were sampled as part of the water quality survey but general ecological information from that sampling is included in this chapter. See Chapter 3 section 3.3.7 for sampling methods. Creek-side parcel maps with associated Butte County assessor information (current as of November 2000) were created as part of the GIS database developed for this project. These maps and database are on file with the Butte County Department of Water and Resource Conservation.

Channel geomorphology and other physical attributes were sampled using procedures being developed for the North Coast Watershed Assessment Project (NCWAP, 2001). Grain size, channel width and channel depth were measured in the field. Channel gradient, sinuosity, and slope angles were estimated using published U.S.G.S. topographic maps.

A field survey of the riparian corridor was conducted to qualitatively describe the native riparian vegetation, identify riparian areas of severe invasion by introduced plant species, and identify potential riparian restoration sites. The field survey entailed hiking the stream channel or viewing it from bridges to compose a woody plant species list for the riparian corridor in each zone. Also, the most common herbaceous species were noted. Other descriptive data collected were: vegetation type (e.g. forest, grassland etc), occurrence of structural layer woody species (e.g. understory, overstory), and an estimate of abundance. In the upper watershed the woody species list, descriptive data, and field notes were used to identify riparian corridor plant series as described by Sawyer and Keeler-Wolfe (1995). They utilize the term series instead of plant community to recognize that vegetation occurs in a continuum with some variation rather than distinct plant communities. A two-way table of riparian woody species was used to confirm the watershed zones.

A description of other plant communities in the watershed is based on field surveys of the riparian corridor, aerial photos, aerial survey, and literature review. Aerial photos of the lower watershed from 1995 were reviewed along with a single flight over the watershed. Here Holland (1986) natural community types were used, as the information does not lend itself to using Sawyer and Keeler-Wolfe (1995) keys to plant series. Riparian areas with severe invasion by introduced plant species were mapped and a list of invasive plant species found in the riparian corridor for each zone was composed.

Potential riparian restoration sites were mapped based on field surveys. Furthermore, riparian habitat was qualitatively evaluated from an ecological viewpoint using the following criteria: plant species composition, structural diversity of vegetation, vegetation canopy condition, stream bank condition, and floodplain connectivity. Structural diversity of vegetation refers to the layers of vegetation: tree canopy, tree subcanopy, shrub canopy and herbaceous plants. Riparian habitat condition was considered good if the vegetation was visually dominated by native plant species, structurally diverse (important to wildlife, especially birds) and the canopy was closed so that the creek was shaded (important for fish); there was little bank erosion (important for water quality) and the creek was still connected to the floodplain (important for hydrologic and ecosystem function). Limited access makes mapping of potential riparian restoration sites and evaluations of riparian habitat within a zone biased to accessible areas.

For fish habitat, the creek was walked using either a hip chain or GPS unit to determine distance from a starting point. The habitat units occurring at predetermined distances from the starting point were evaluated as to type, dimensions, quality and kinds of fish cover and substrate. Fish data were taken from historic records by the CSU, Chico ichthyology class with supplementary sampling in unrepresented areas where trespass permission could be obtained. Fish sampling was done by backpack electrofisher with one or two passes through a representative segment of creek. Fish stunned by the electric field were picked up in dipnets, identified, measured, and released.

Expected species lists for terrestrial vertebrates (amphibians, reptiles, birds and mammals) for the LCC were compiled from field surveys, available literature, and interviews with local people. Information on special status wildlife species expected to occur within the LCC watershed or riparian corridor was obtained from the California Department of Fish and Game website (www.cdfg.ca.gov). Special status species are those that are listed as threatened, endangered, of special concern, and/or fully protected under state or federal law. Species that are threatened or endangered at either the state or federal level have species-specific regulations regarding take or disturbance of these organisms. The U.S. Fish and Wildlife Service and/or the California

Department of Fish and Game develop regulations pertaining to threatened or endangered wildlife species. Species of special concern are species not listed as threatened or endangered, but whose numbers are declining significantly enough that listing may be imminent or whose population(s) historically occurred in low numbers and known threats to their persistence currently exist. Fully protected species are those that, under state law, may not be taken or possessed.

Point-count surveys for birds were conducted between June 8th and June 13th, 2002 along the Little Chico Creek (LCC) riparian corridor. Nineteen listening stations were located opportunistically (where access allowed) along LCC. Ten-minute surveys were conducted at each listening station by an experienced birder. All birds detected (seen or heard) within an approximately 164-ft (50-m) radius "sphere-of-influence" were identified to species (when possible) and counted. Brief searches were conducted after each 10-minute listening period to determine the species of unidentified individuals observed at a given station. Only individuals observed within the 10-minute listening period were included in the survey. Of the 19 stations sampled, 4 were located in the Mountain Zone, 3 in the Canyon Zone, 5 in the Urban Zone, and 7 in the Agricultural Zone (Figures 2.1-2.4).

Point-count stations within a zone were combined to calculate relative abundance for species that occurred more than once and species diversity. The Shannon-Weiner index (H') was used for species diversity. Because bird surveys were conducted during the summer, they tend to emphasize summer breeding season composition of the LCC riparian corridor and *do not reflect composition or diversity of species over the course of the entire year*.

Aquatic benthic macroinvertebrates were sampled as part of the water quality sampling and thus occurred only at water quality sampling sites in the Canyon, Urban and Agricultural Zones (Figure 3.1). Benthic macroinvertebrates are bottom-dwelling animals that do not have a spine but can be seen without the aid of a microscope, although a microscope is often necessary for identification. Some common benthic aquatic macroinvertebrates are insects (e.g. mayflies and dragon fly larvae), clams, and snails.

2.1.3 Surface hydrology

LCC watershed (LCCW) is drained by Little Chico Creek, which is the only natural perennial surface water body. The creek and its tributaries are shown on Figure 2.5. From the headwaters to the valley floor, Little Chico Creek drops approximately 2,675 ft (815 m) over 25.4 mi (40.8 km). The creek is a first-order channel with twenty-one intermittent tributaries shown on USGS maps. Most of these intermittent channels and numerous additional ephemeral channels occur in the Canyon and Mountain Zones (Figure 2.5).

According to the Cohasset 7.5-Minute topographic map (USGS, 1995), the main channel becomes perennial at an elevation of approximately 3,360 ft (1,024 m) and maintains this condition until the vicinity of the downstream urban boundary (elevation of 174 ft or 53 m). Field survey and interviews with residents suggest that perennial flow actually begins somewhat lower, at an elevation of approximately 2,920 ft (890 m). The northwestern tributary shown as intermittent on the Cohasset topographic quadrangle (USGS, 1979) appears to be the uppermost perennial channel of the creek. Below Pomona Avenue on the west edge of the Urban Zone, the creek has been mapped as intermittent out to the lower elevations near the Sacramento River. Field observations and landowner anecdotal reports, however, indicate that the creek is intermittent much further upstream, ceasing perennial flow under normal rainfall years on the upper alluvial fan near Bruce Road. Groundwater pumping in the Chico Urban Area is the primary source of drinking and urban irrigation water. Extraction of groundwater from deeper aquifers can influence and lower water levels in the shallowest unconfined aquifer immediately connected to Little Chico Creek. Although no studies have been performed of surface and groundwater interactions in LCCW, the loss of perennial flow in the urban reaches of Little Chico Creek may be related to groundwater development.

To date, no field surveys have been reported that examine where Little Chico Creek may be gaining or losing flow from or to groundwater. Based on preliminary monitoring in the adjoining Big Chico Creek Watershed, it seems probable that such exchanges do occur. For example, groundwater discharge into the creek may occur where Little Chico Creek crosses the contact between the Lovejoy Basalt and the Chico Formation. Along other reaches, LCC may be losing surface flow to shallow groundwater.

The Groundwater Branch of the DWR Northern District Office is currently investigating creek recharge to groundwater in various strata of the Tuscan Formation (T. Dudley, DWR, personal communication). The conceptual model developed to date is that local creeks such as LCC may recharge aquifers beneath the Sacramento Valley as they cross the Chico Monocline. These creeks have cut down through the upper units of the Tuscan Formation in the lower foothills (LCC Canyon Zone) and are in direct contact with the lower units along certain reaches. Current efforts to quantify creek recharge to the lower Tuscan Formation units are employing stable isotope and geochemical analyses.

Flooding in Chico during the winter of 1932 led to the construction of a flood diversion structure in 1958 approximately 0.4 mi (0.6 km) downstream from the bridge at Stilson Canyon Road (Figure 2.5). As the creek exits the Canyon Zone, this structure routes peak flows to the south into Butte Creek. The 100-year return interval flow in Little Chico Creek above the Urban Zone was estimated to be 6,700 cfs (190 m^3/s) for the diversion structure design (USACOE, 1957). Flows over 2,200 cfs (62 m^3/s) were determined to be damaging in Chico, and thus this was the maximum flow continuing in the main channel. Excess flows are diverted up to a design capacity of 4,500 cfs (127 m^3/s) with zero freeboard within the diversion channel levees during a 100-year event. Normal operation of the diversion structure anticipates approximately 3 ft (1 m) of freeboard below the top of the levees while diverting 3,000 cfs (85 m^3/s) into Butte Creek.

Flows in Little Chico Creek have been gaged at two locations by DWR: just above the diversion structure itself at station A04280 (station name “Near Chico”), and at station A04270 at Taffee Road (Figure 2.5) west of the urban area. Flows in the diversion channel itself are also gaged at station A04910. Peak flows were gaged by the US Geological Survey in a small unnamed tributary above Forest Ranch for the period 1962-1973. Peak flow data for the years of available record are reported in Table 2.1.

Surface water diversions related to flood control and agriculture have made the watershed boundary shown on Figure 2.5 somewhat arbitrary. Reviews of maps in the Butte County Department of Public Works and interviews with several individuals suggest that surface drainage divides have changed over time. Prior to significant modification of the hydrologic system, Little Chico Creek appears to have had a direct connection to the Sacramento River during winter high flow periods when the river spread out over much of the valley floor. Several different maps dating from 1912 to 1949 are on file at the CSU, Chico Map Library depicting topography and historic mining and irrigation in LCCW. Only one of these, a 1912 irrigation map shows LCC connecting directly to the Sacramento River. In contrast, the more detailed 1912 U.S. Geological Survey topographic map shows the LCC channel turning to the south on the flood plain into various channels. There is no topographic indication in the land surface contours of a channel confluence with the Sacramento River. Also, this seasonal confluence may have shifted in location or extent as the Sacramento River migrated laterally within its meander zone.

Under low flow conditions during the drier summer and early fall months, and during below normal precipitation years for the region, Little Chico Creek may have been captured by one of many sloughs and floodplain channels that parallel the main channel of the Sacramento River. If Little Chico Creek did create a perennial channel connection with the Sacramento River, no compelling geomorphic or map evidence has been uncovered. The creek would not have likely maintained sufficient channel-forming flows given its relatively low headwaters elevation, steep slopes, and shallow soils.

The advent of U.S. settlement, flood control, land drainage, and irrigated agriculture added significant complexity to the LCCW. Water is transferred across drainage basins linking flows in Little Chico Creek with those of Butte Creek and the Sacramento River. Channels and canals route water, but are not necessarily connected to the surrounding landscape (Figure 2.5). Thus, for the purposes of this report, the lower watershed boundary shown on Figure 1.1 is not based on fixed drainage divides as is the case in the Mountain and Canyon Zones. Rather, the boundary depicted represents a general area of influence where land surfaces may influence and be influenced by Little Chico Creek.

2.2 MOUNTAIN ZONE

2.2.1 Physical Setting: geology, topography & geomorphology

The Mountain Zone (and upper Canyon Zone) contains the oldest of the three rock units, the underlying Chico Formation. This unit, comprised of fossil-containing marine sedimentary deposits, accumulated during the Cretaceous Period, approximately 75 million years before present. The Chico Formation has been exposed in the upper LCCW, where Little Chico Creek has deeply incised the land surface. The Lovejoy Basalt unconformably overlies the Chico Formation but is only expressed along narrow bands in south-facing cliffs (Harwood et al., 1981). This rock unit is a Tertiary age formation, about 20 million years old, created by volcanic flows from the northeast. Isolated patches of younger formation described as the Olivine Basalt of Paradise occur on ridge tops just to the southwest and southeast of Forest Ranch. The youngest and most extensive rock unit is the Tuscan Formation, Undivided. This and related Tuscan rock units are regionally significant features of surficial bedrock in LCCW. These formations are comprised of lahar deposits, which are volcanically derived mudflows containing volcanic debris of various size classes.

The Mountain Zone is generally the steepest terrain within LCCW. Platte Mountain and other ridge surfaces have relatively low slopes of less than 5% to 10%. Slopes within the canyons are much steeper with a mean of 48% and a range of approximately 25% to 65%, with localized conditions increasing to vertical (100%) on cliff faces. The perennial portion of the creek begins just above the confluence of several intermittent tributaries at approximately the 2,920 ft (890 m) elevation. The distribution of tributary channels entering the creek was roughly symmetric (10 on the north versus 9 on the south) and the number of apparent ephemeral channels is much larger than the USGS-mapped intermittent tributaries. Also notable were the numerous seeps and springs along both sides of the creek. As is expected in steep headwaters streams, bed sediments are the coarsest (largest diameter) in the Mountain Zone. The median (d_{50}) grain diameter is 8.3 inches (210 mm). No significant channel (bank) erosion was noted over the reaches surveyed, nor were mass failures observed in the immediate vicinity of the channel.

From the beginning of the perennial reach, the channel gradient ranges from 2.2% to 10.7% with a mean of 5.5%. Measured channel widths ranged from 24 ft (7.3 m) to 27 ft (8.3 m). Using NCWAP (2001) criteria channel confinement was estimated to be confined in the uppermost portion of the Mountain Zone upstream of Schott Road. Downstream from Schott Road, the creek is moderately confined with confined reaches. Sinuosity for the Mountain Zone was the lowest for all four zones at 1.04 based on USGS topographic map analysis.

2.2.2 Vegetation

Common plant communities of the Mountain Zone are Sierran mixed conifer forest, California black oak forest, canyon and interior live oak forests, white alder riparian forest, montane manzanita chaparral, buck brush chaparral, scrub oak chaparral and blue and valley oak woodlands (Holland 1986). The Sierran mixed conifer forest dominates this zone, especially the ridge tops and north facing slopes. South facing slopes tend to be a mosaic of oak forests and chaparral communities. The oak forests are often the transitional communities found between the mixed conifer forest and the chaparral communities. White alder forest is found along Little Chico Creek along with the other forests. Once the canyon bottom begins to broaden out, just above Crown Point Road, oak woodlands occur in the uplands just above the riparian corridor. General descriptions of these communities follow along with the results for the riparian corridor survey.

Forest communities

Mixed conifer forest is typically composed of ponderosa pine, Douglas-fir, incense cedar, sugar pine, California nutmeg and white fir at higher elevations. Common broadleaf species found in this forest type are California black oak, tan oak and dogwood.

California black oak forest is characterized by even-age stands of California black oak with some canyon live oak and/or emergent ponderosa pines.

Canyon live oak forest is dominated by canyon live oak with incense cedar, tanoak and California bay laurel as other characteristic species.

Interior live oak forest is dominated by interior live oak with canyon live oak, foothill pine, scrub oak and poison oak as other typical species.

White alder riparian forest is a streamside forest dominated by white alder with big-leaf maple, dogwood, Oregon ash, western azalea, various willow species and poison oak as characteristic species.

Chaparral communities

Montane manzanita chaparral is dominated by a mix of manzanita species.

Buck brush chaparral is characterized by buck brush growing mostly with toyon, scrub oak and poison oak.

Scrub oak chaparral is typically composed of scrub oak and birch-leaf mountain-mahogany with deer brush, chaparral whitethorn, toyon, honeysuckle, scrub oak, holly-leaf redberry, and poison oak as other characteristic species.

Woodland communities

Blue oak woodland is characterized by blue oaks with valley oak, interior live oak, California black oak, foothill pine as well as California buckeye, manzanita species, deer brush and buck brush. The understory can vary from dense shrubs to annual grasses.

Valley oak woodland is characterized by valley oaks with some blue oaks and poison oak and alkali ryegrass common in the understory.

The riparian corridor throughout this zone is primarily composed of three Sawyer and Keeler-Wolfe (1995) series: white alder, mixed conifer and mixed oak based on 11 survey samples. Most of these samples keyed out to the same three series, thus only one reach is shown in Table 2.2 as an example of the riparian vegetation found in the mountain zone. Two sample areas lacked ponderosa pine having them key to Douglas-fir series instead of mixed conifer. Since ponderosa pine occurs in all other mountain and canyon samples these two samples may be anomalous, perhaps due to recent logging evident in that area of the field survey. The three series occurred concurrently along the riparian corridor with the mixed conifer series visually decreasing and the mixed oak series increasing as one moved downstream. The white alder series here is visually dominated by white alder and big-leaf maple with a dogwood sub-canopy. The mixed conifer series here is dominated by Douglas-fir, ponderosa pine, incense cedar with California nutmeg and Pacific yew as a sub-canopy. The mixed oak series here is composed mainly of California black oak, interior live oak and canyon live oak. The Douglas-fir series here has Douglas-fir, along with incense cedar, canyon live oak and California nutmeg understory. The 48 woody plant species observed in the riparian corridor survey are listed in Tables B1-B4 in Appendix B. Only three introduced woody species were found in the riparian corridor sampling: black locust, Himalayan blackberry and cut-leaved blackberry (Table 2.3).

The riparian corridor that could be sampled provides good riparian habitat. The riparian corridor is composed of a minimum of 81% native species that visually dominate the corridor. Unknown species were not classified as either native or introduced, thus if the 5 unknown species are native species then the maximum percent of native species could be 94. The native plant species form a closed canopy that is structurally diverse, often having several layers of vegetation. There was little evidence of bank erosion and the main channel is still connected to its floodplain.

2.2.3 Wildlife

The Mountain Zone plant communities provide structurally diverse habitats for wildlife. These habitats range from tall and dense coniferous and oak forests of the headwaters to short, dense chaparral, and then to more open oak woodland and oak savannah as the Mountain Zone transitions to the Canyon Zone. As a result, the expected terrestrial vertebrate community consists of montane, canyon-scrub, canyon-woodland, and riparian species and thus has a relatively high number of species (Table 2.6, and Appendix B Tables B5-B8). Bird diversity in particular has a positive correlation with habitat physical structure—the more diverse the structure the more diverse the bird species (MacArthur & MacArthur 1961; MacArthur, Recher & Cody 1966).

Notable species that have been observed within this zone include northern saw-whet owl (Jean Hubbell and David Wood, pers. comm) and northern flying squirrel (Phil Johnson, pers. comm). Saw-whet owls are notable for their highly unpredictable seasonal distribution, relative rarity, and nomadic nature. A pair of these owls was observed over a two-year period during the breeding season, indicating a probable attempt at breeding by this species within the upper reaches of the LCC drainage. Flying squirrels were observed within the lower mountain/upper canyon zone. Flying squirrels are generally associated with old-growth forests and are a principle prey item of both the California and Northern spotted owl throughout much of their range.

Large trees and stands of large trees in this zone associated with closed forest and/or woodland may periodically harbor species that regularly occur at higher elevations. These old growth stands can provide refugia for higher elevation wildlife species when they face hardship such as wildfire, severe weather, or a poor food year and during times of dispersal. Also, these species may utilize refugia due to competition for better habitat. Among such species with no record of occurrence within the LCC are the California spotted owl and the northern goshawk, both of which may potentially occur periodically within the upper reaches of the LCC watershed in winter. California spotted owls have been detected during the winter in the adjacent Big Chico Creek drainage. Barred owls, not historically occurring in California, are known to be increasing their range into northern California's coniferous forests. For this reason barred owls are considered a species with potential to occur within the upper LCC watershed.

The Mountain and Canyon (see below) Zones provide large tracts of relatively high quality habitat for larger mammals such as black bear and mountain lion, which historically ranged to the valley floor.

2.2.4 Aquatic Habitat

The creek within the Mountain Zone is a small, steep gradient stream dominated by large boulders. Short pools alternate with riffles becoming indistinguishable in many areas from step pools. Habitat units are small, only about 108 ft^2 (10 m^2) in area and usually less than 1 ft (0.3 m) deep. Cover is abundant, mainly in the form of boulders (Figure 2.15).

2.2.5 Fish

The only species of fish found in this zone is the native rainbow trout. Although plentiful, the trout in these small, restricted habitats grow to a maximum length of about 8 inches (200 mm). The small habitat units and dense riparian understory would discourage most anglers from seeking such small rewards.

2.2.6 Aquatic Macroinvertebrates

No data were collected for aquatic macroinvertebrates in the Mountain Zone.

2.2.7 Aquatic fauna

Foothill yellow-legged frogs are found in the lower part of the Mountain Zone. California newts, Pacific tree frogs, and western toads also spawn here.

2.3 CANYON ZONE

2.3.1 Physical Setting: geology, topography & geomorphology

The upper portion of the Canyon Zone contains surface exposures of the Chico Formation along the creek. Surface expressions of the Lovejoy Basalt are limited to the creek bed and adjoining riparian zones over approximately 2.0 mi (3.2 km) in the upper portion of this zone. Downstream from this reach, the creek flows over the Tuscan Formation Unit A until approximately 0.6 mi (1 km) above the Stilson Canyon Bridge. Below the Tuscan, the creek is incised into the upper Modesto Formation, a Quaternary sedimentary unit containing gravel, sand, silt, and clay (Harwood et. al., 1981). These sediments are derived from Tuscan, Lovejoy, and Chico Formations upstream. Small areas of the Red Bluff Formation occur along the creek in the lower Canyon Zone. The Red Bluff alluvial deposits are shallow (approximately 6 ft, or 2 m thick) and very coarse, containing large percentages of gravel.

Very little of the creek through the Canyon Zone was accessible for the field survey. The Canyon Zone is less steep than the Mountain Zone. Hillslopes have a mean of 36% and a range of approximately 21% to 50%. Grain diameter visually appears to decrease with distance downstream through the Canyon Zone; and bed sediments were smaller in diameter than the Mountain Zone. The d_{50} estimate is pending access for sampling. Channel slopes range from 0.5% to 8.5% with a mean of 2.1%. Channel confinement was evaluated only in the uppermost portion of the Canyon Zone, and was unconfined with moderately confined reaches. At the bottom of this zone, in the Stilson Canyon neighborhood, the channel is moderately confined with confined reaches. The flow diversion structure hydraulically confines the flow to the channel in the lowermost portion of the Canyon Zone. Channel sinuosity was estimated to be 1.10.

2.3.2 Vegetation

Common plant communities of the Canyon Zone are valley and blue oak woodlands, California black oak forest, canyon and interior live oak forests, white alder riparian forest, Sierran mixed coniferous forest, montane manzanita chaparral, buck brush chaparral, scrub oak chaparral, and non-native grasslands (Holland 1986). The distribution of these communities is most likely linked to soil depth and drought tolerance. In the upper half of this zone California black oak forest, canyon and interior live oak forests and chaparral communities dominate the ridge tops and upper slopes. The lower slopes and canyon floor tend to be dominated by blue and valley oak woodlands and non-native grasslands. Although non-native grasslands are dominated by non-native grass species, native grass species still occur here. If native grasslands occur here they are likely to be valley wildrye grassland, occasional stands of deer grass in moister areas and valley needlegrass grassland in drier areas. It is more likely that remnant stands of these native grasses may occur than a grassland. Some landowners have been planting wildrye, purple and nodding needlegrass and deer grass in this zone. As one moves down canyon the oak woodlands and grasslands dominate throughout the canyon. White alder riparian forest and the oak forests occur in the riparian corridor. Sierran mixed conifer forest is now seen only in the upstream half (eastern half) of the riparian corridor. General descriptions of these communities follow along with the results for the riparian corridor survey.

Forest communities

For Sierran mixed conifer forest, California black oak forest, canyon live oak, interior live oak forest, white alder riparian forest see descriptions under Mountain Zone Vegetation 2.2.2.

Chaparral communities

For montane manzanita chaparral, buck brush chaparral, scrub oak chaparral see descriptions under Mountain Zone Vegetation 2.2.2.

Woodland communities

For blue and valley oak woodlands see descriptions under Mountain Zone Vegetation in section 2.2.2.

Grassland communities

Non-native grasslands are characterized by introduced annual grasses such as slender wild oat, wild oat, soft chess, ripgut, red brome, and Italian ryegrass as well as native annuals such as foxtail fescue and small fescue. Forbs such as storksbill, gilia, and lupines are associated with this community.

Valley wildrye grassland is dominated by wildrye and is often associated with mugwort and hoary nettle.

Valley needlegrass grassland is characterized by purple needlegrass and nodding needlegrass, California melic, one-sided bluegrass and several forbs such as yarrow, annual agoseris, shooting star, and wavy-leaved soap plant.

The riparian corridor sampled in the upper portion of this zone is primarily composed of five Sawyer Keeler-Wolfe series: white alder, ponderosa pine, blue oak, valley oak, and mixed oak based on 4 survey samples. All of these samples keyed out to the same five series, thus only one reach is shown in Table 2.4 as an example of the riparian vegetation found in the upper Canyon Zone. The five series occurred concurrently along the riparian corridor with the ponderosa pine series visually decreasing and the blue and valley oak series increasing as one moved downstream. Descriptions of white alder and mixed oak series can be found in the Mountain Zone vegetation section (2.2.2). The blue oak series here is visually dominated by blue oaks with valley oak, canyon and interior live oak and foothill pine. The ponderosa pine series here is dominated by ponderosa pine, along with incense cedar and California black oak. In addition, canyon and interior live oaks occur here with a poison oak and Himalayan blackberry understory. The valley oak series here is composed of valley oak and associated with blue oak, California black oak, interior live oak, western sycamore, Oregon ash and wild grape with an understory of poison oak and Himalayan blackberry. As would be expected a shift in woody species occurs with reduction or loss of montane species that are less drought tolerant such as Douglas-fir, pacific yew and California nutmeg. There has been an increase in more drought tolerant species such as valley and blue oak. The 43 woody plant species observed in the riparian corridor survey are listed in Tables B1-B4 in Appendix B. Only four introduced woody species were found in the riparian corridor sampling: black locust, Himalayan blackberry, edible fig and Spanish broom.

The riparian corridor sampled in the upper portion of the canyon zone provides good riparian habitat. The riparian corridor is composed of a minimum of 84% native species that visually dominate the corridor. Unknown species were not classified as either native or introduced, thus if the three unknown species are native species then the maximum percent of native species could be 91. The native species form a closed canopy, with structural diversity, often having several layers of vegetation. However, the introduced Himalayan blackberry dominates the shrubs at times and the grasslands tend to be visually dominated by introduced grasses and /or star thistle. Although these invasive introduced species are problematic, some provide similar structural diversity as their native counterparts. There was little evidence of bank erosion and the main channel is still connected to its floodplain.

2.3.3 Wildlife

Expected wildlife of the Canyon Zone is based upon fauna expected to be associated with deciduous and evergreen woodlands, chaparral, riparian habitat, and open grassland components found in the lower canyon of the Little Chico Creek drainage (Tables B5-B8). Golden eagles (a state species of special concern and a fully protected species) are observed regularly within the Canyon Zone. A pair of golden eagles has been repeatedly observed flying within the Canyon Zone (Jeff Mott, pers. comm.), indicating high potential of a nearby nesting site. Though there is no direct evidence that golden eagles are currently breeding within the LCC watershed, potential breeding sites (e.g. large trees and isolated cliff faces) do occur within this zone. Isolated cliff faces within the canyon offer potential breeding sites for prairie falcons as well. The Canyon Zone, like the Mountain Zone, provides large tracts of relatively high quality habitat for larger mammals such as black bear and mountain lion, which historically ranged to the valley floor.

2.3.4 Aquatic Habitat

In the Canyon Zone, the creek becomes substantially larger, picking up numerous springs and tributaries along the way. Here fish habitat units average much larger, nearly 5,380 ft^2 (500 m^2), and as much as a 3 ft (1 m) deep. Cover is still excellent, again mostly provided by boulders (Figure 2.15).

2.3.5 Fish

Rainbow trout are also resident in the upper part of the Canyon Zone where they grow larger than the Mountain Zone, up to 1 ft (300 mm) in length. These trout are joined by three other species of native fish: the California roach, Sacramento sucker, and riffle sculpin. The sucker in these habitats may grow to 1 ft (300 mm), but the roach and sculpin are both small, less than 5 inches (130 mm). At the downstream end of the Canyon Zone, trout only occur in the colder seasons. Here the introduced green sunfish may also be found in small numbers. Spring run Chinook salmon have been observed in a few high flow years.

2.3.6 Aquatic Macroinvertebrates

The aquatic macroinvertebrate fauna in the Canyon Zone was typical of a diverse community, relatively free from stress (Table 3.10). See Section 3.3.7 and Appendix C Tables C3 through C5.

2.3.7 Aquatic fauna

Foothill yellow-legged frogs are common in the Canyon Zone. California newts, Pacific tree frogs, and western toads also spawn here. Western pond turtles are fairly common.

2.4 URBAN ZONE

2.4.1 Physical Setting: geology, topography & geomorphology

The Red Bluff Formation is present on the alluvial fan formed by Little Chico Creek as it exits the Canyon Zone and enters the Urban Zone. Deposition of Red Bluff sediments occurred during the Pleistocene epoch, roughly one million years before present. However, the creek itself flows through the Modesto Formation through the entire urban area and into the upper portion of the Agricultural Zone. The Modesto Formation was deposited during the Holocene epoch, from 10,000 years ago to the present.

The Urban Zone begins with the alluvial fan created as the creek exits its canyon. Slopes on the fan are approximately 1%. Below the fan, in the main urban area, native ground slopes are approximately 0.5%. However, engineered surfaces create artificial slopes that may be less than the original topography. Channel banks are armored with riprap in various locations and numerous bridges are present throughout this zone. These channel modifications and the upstream flow diversions constrain lateral channel migration from natural processes. Grain diameter further declines with a d_{50} of approximately 2.6 inches (65 mm). Channel slopes range from 0.3% to 0.5% with a mean of 0.4% and measured channel widths ranged from 33 ft (10 m) to 39 ft (12 m). The flow diversion creates a confined channel in which the floodplain is generally restricted to the channel itself. As with the Canyon Zone, the channel sinuosity was estimated to be 1.10.

2.4.2 Vegetation

The Urban Zone is divided into vegetation types rather than natural communities since the high number of introduced species precludes the use of natural community keys and descriptions. Three vegetation types occur here: forest, grassland, and scrubland. The urban forest, composed of native and introduced trees planted in neighborhoods, characterizes much of the Urban Zone (Appendix B Tables B1-B4). The riparian corridor has non-native grassland, riparian forest and riparian scrub with 48% of the species composition being introduced plant species (Table 2.5 and Appendix B Tables B1-B4). There are lengthy reaches of two invasive introduced species here: tree of heaven and giant reed. There are mixed annual non-native grasslands mainly composed of star thistle and introduced annual grasses on the east side of Chico from Bruce Road to just upstream of Forest Avenue. From Forest Avenue to Pomona Avenue, the narrow riparian corridor is best described as a mixture of riparian forest and riparian scrub. The riparian overstory is dominated by large native and non-native sycamores and their hybrids, valley oaks, and California black walnut with lengthy reaches of the invasive introduced tree of heaven. The riparian scrub lands are commonly composed of invasive introduced species such as Himalayan blackberry, edible fig and giant reed along with native willows. A number of other invasive introduced species occur here such as the two species of privet (Table 2.3).

The riparian corridor that could be sampled provides riparian habitat but limited native riparian habitat. As expected in an urban area many more introduced species (48%) occur here than in the Mountain (6%) or Canyon Zones (9%) (Table 2.5). The canopy ranges from non-existent in the grassland area to completely closed in some of the riparian forest. Structural diversity is less than in the Mountain and Canyon Zones with areas often only having one to two layers. For example, even where there is a closed canopy in the riparian forest there is often little understory. There is some bank erosion where trails have been made to access the creek bed. The main channel is disconnected from the floodplain.

2.4.3 Wildlife

The expected wildlife of the Urban Zone is composed of species found regularly within the City of Chico and along the LCC riparian corridor (Appendix B Tables B5-B8). As would be expected in an urban environment, wildlife habitat along the LCC within this zone is limited and disturbed. Residential and commercial development occurs immediately adjacent to the riparian zone (at times overhanging the banks), garbage is regularly found strewn within the stream channel and riparian corridor, and homeless encampments are common under bridges along LCC throughout the City of Chico. Introduced and domestic animals (e.g. rats, cats, and dogs) can be commonly observed within the riparian corridor. These animals can have significant negative impacts on most native wildlife (e.g. amphibians, reptiles, birds, and small to medium sized mammals) through disturbance, competition, predation, and disease transmission (Coleman et. al., 1997; Whisson and Engilis, unpublished). Because of the above-mentioned problems, many native animals periodically encountered within the Urban Zone of the LCCW (e.g. juveniles, dispersing individuals, and/or migratory species) are not expected to establish regular breeding populations here.

During spring and fall migration, many bird species can be encountered utilizing LCC riparian habitat within the Urban Zone. However, as the breeding season progresses into summer, the number of individuals establishing successful nesting territories may be reduced primarily to cavity nesters (e.g. woodpeckers, oak titmice, and European starlings) and cup-nesters that nest higher in the canopy, are more aggressive, and/or are more cosmopolitan in nest site selection (e.g. American robin, western wood peewee, and scrub jay). These bird species are generally more successful at defending their nests against predators. Many cup-nesters breeding elsewhere within the LCCW are not expected to regularly breed successfully within the Urban Zone due to disturbance and high densities of potential nest predators (e.g. crows, jays, rats, cats, dogs, etc.). Birds that nest lower (e.g. in sub-canopy, shrubs, herbs, or on the ground) are expected to be most susceptible to these problems.

2.4.4 Aquatic Habitat

Habitat throughout the Urban Zone is surprisingly good with respect to cover, which is abundantly provided by overhanging vegetation and deep water. However, availability and quality of water are not so dependable. In the upper Urban Zone (Bruce Road to Forest Avenue), Little Chico Creek is seasonal, only providing aquatic habitat in winter and spring. Between Forest Avenue and Pomona Avenue, the stream is intermittent in summer during which time poor water quality (low oxygen, high temperature, and possible pollutants) limits fish communities.

2.4.5 Fish

Being seasonal, the upper Urban Zone supports only migrants or spillovers from upstream populations. The California roach is quite common whenever water is present; and occasional suckers or even trout can be found. Roaches manage to maintain populations in most pools within the lower Urban Zone, being replenished on an annual basis by migrants from the Canyon Zone. Mosquito fish are also common, due to annual reintroduction by Mosquito Abatement personnel. Largemouth bass and bluegills can sometimes be found, particularly after high water events provide connection to California Park Lake or Teichert Pond. According to anecdotal reports, 10 or 15 years ago all species in the Canyon Zone, except trout, were also common in the Urban Zone. If accurate, this would suggest that habitat deterioration has occurred in recent years.

2.4.6 Aquatic Macroinvertebrates

The aquatic macroinvertebrate fauna in the Urban Zone was much less diverse than the Canyon Zone, and was typical of a severely stressed community (Table 3.10). See Section 3.3.7 and Appendix C Tables C3 through C5.

2.4.7 Aquatic fauna

The introduced bullfrog dominates the amphibian fauna of the Urban Zone. Pacific treefrogs and western toad spawn in some pools.

2.5 AGRICULTURAL ZONE

2.5.1 Physical Setting: geology, topography & geomorphology

From the western urban boundary of Chico to Lone Pine Road, the surficial geology is the Modesto Formation as described above. Below Lone Pine Road to the vicinity of Angel Slough, the surface sedimentary deposits have been described as Basin Deposits of Holocene age. These fine-grained (silt and clay) sediments are alluvial deposits derived from both floods on Little

Chico Creek through northern and eastern portions of the unit and from the Sacramento River along the west.

The Agricultural Zone is situated on the floor of the Sacramento Valley with native ground slopes of approximately 0.2%. Many of the orchards have been laser-leveled, thus creating significant areas with essentially zero slope. As in the Urban Zone, channel banks along certain reaches have been stabilized with riprap to prevent loss of agricultural land to lateral channel migration. In the upper Agricultural Zone, the d_{50} was observed to be approximately 0.4 inches (10 mm) and at the Ord Ferry Bridge, the d_{50} is less than 0.1 inches (2 mm) (hand textured to very fine sand – silt). Channel slopes range from 0.1% to 0.3% with a mean of 0.2%, and the channel width varied from 20 ft (6.2 m) to 36 ft (11.0 m). The upstream flow diversion still creates a confined channel due to flow restriction, but in the winter low-lying areas may be fully unconfined during regional flooding. As with the Canyon Zone, the channel sinuosity was estimated to be 1.10.

The Agricultural Zone was the one zone where active erosion problems were encountered (Figure 2.6). At the upstream end of the Agricultural Zone, bank erosion was noted around a storm drain outfall. Isolated cases of bank erosion were noted further downstream. In one case the bank was actively eroding; at the other location it was observed that there were apparent attempts to reinforce the bank with sand bags. Observations reported by local landowners at Steering Committee meetings suggest that the observed erosion may be due to natural bank instability.

2.5.2 Vegetation

The Agricultural Zone like the Urban Zone is best described by vegetation types rather than natural communities since the high number of introduced species precludes the use of natural community keys and descriptions. At least six vegetation types occur here: cultivated lands, grasslands, herblands, wetlands, scrublands, and forest. Orchards dominate cultivated lands near the boundary with the Urban Zone and then are replaced by row crops including rice as one moves downstream. The cultivated lands are interspersed with grasslands, herblands and wetlands (natural and artificial) generally downstream of Alberton Avenue.

The riparian corridor has riparian forest, grasslands, riparian scrublands and herblands with 33% of the species composition being introduced plant species (Table 2.5 and Appendix B Tables B1-B4). Riparian forest with a closed canopy occurs from Pomona Avenue to approximately Lone Pine Avenue. From Lone Pine Avenue to the City of Chico's sewage treatment plant is best described as a more open canopy riparian forest mixed with riparian scrub. The riparian forest includes native species such as valley oak, western sycamore, Fremont cottonwood, box elder, Oregon ash, various willows (e.g. Goodding's black, arroyo) and introduced species such as tree of heaven, privet, silver maple and black locust. The riparian forest native species are typical of the riparian plant communities found along the Sacramento River (e.g. valley oak riparian forest, mixed riparian forest and cottonwood riparian forest). The riparian scrub is made up of long hedges of the introduced species Himalayan blackberry with a few willows punctuated by any one of the tree species listed above. Near the City of Chico's sewage treatment plant the overstory disappears and the riparian corridor is mainly herblands composed of herbaceous weeds or non-native grasslands with an occasional mature tree or large shrub until just above Ord Ferry road. Below Ord Ferry road the riparian corridor is a mixture of all the vegetation types described above. The invasive species of note in this zone are tree of heaven, Himalayan blackberry and giant reed (Table 2.3).

The riparian corridor that could be sampled provides riparian habitat but limited native riparian habitat. As expected in an agricultural area there are relatively fewer introduced species (33%) than the Urban Zone (48%) but relatively more introduced species than in the Mountain (6%) or Canyon Zones (9%) (Table 2.5). The canopy ranges from non-existent in the grasslands and herblands to completely closed in some of the riparian forest. The closed canopy riparian forest structure is similar to the Mountain and Canyon Zones with multiple layers of vegetation. Where the canopy is open or non-existent (e.g. grassland), the structural diversity is less than in the Mountain and Canyon Zones with areas often only having one to two layers. There is some bank erosion and the main channel is disconnected from the floodplain where levees are present.

2.5.3 Wildlife

Expected wildlife of the Agricultural Zone is composed of species found both within the agricultural matrix (predominantly orchard crops), the grassland/wetland complex of Llano Seco (the terminus of the area of consideration), and associated LCC riparian habitat (Appendix B

Tables B5-B8). The City of Chico sewage treatment plant and its associated oxidation ponds also occur within this portion of the LCCW. These oxidation ponds are heavily utilized by a diverse array of wildlife (pers. obs.).

LCC flows into Rancho Llano Seco, which has extensive lands in habitat conservation, with a variety of habitat types (seasonal wetlands, grasslands, and riparian habitat). Thus, many species expected to occur within Llano Seco may not regularly be found elsewhere in the Agricultural Zone.

2.5.4 Aquatic Habitat

Aquatic Habitat in the Agricultural Zone consists mostly of long runs that grade imperceptibly into pools. Cover is poorest here, but still not bad, being provided mostly by overhanging vegetation and woody debris.

2.5.5 Fish

Fish are very scarce in the Agricultural Zone. Its seasonal nature precludes permanent habitation. While most comparable seasonal streams in the Sacramento Valley are heavily used in winter and spring for spawning and rearing by migratory native fish, very few were observed in Little Chico Creek, perhaps due to the long flow path and multiple barriers downstream.

2.5.6 Aquatic Macroinvertebrates

The aquatic macroinvertebrate fauna in the Agricultural Zone, while much less diverse than the Canyon Zone and still typical of a stressed community, was more diverse than that of the Urban Zone (Table 3.10). See Section 3.3.7 and Appendix C Tables C3 through C5.

2.5.7 Aquatic fauna

Pacific treefrogs and western toads spawn in some pools within the Agricultural Zone. Bullfrogs are common wherever water transfers provide permanent pools.

2.6 SUMMARY OF WILDLIFE

Because the LCCW is situated between two major salmon streams (Big Chico Creek and Butte Creek) and flows into a wetlands complex (Rancho Llano Seco) of the Sacramento River National Wildlife Refuge, the LCCW probably provides an essential connectivity to the landscape that has yet to be examined. At least 50 special status wildlife species are expected to be associated with the LCC watershed through the course of an entire year. LCC provides a large amount of quality habitat to over 350 native species of terrestrial vertebrates for breeding, overwintering, and migration despite being degraded in several portions of its length.

During the course of riparian corridor bird surveys (June 2002), approximately 69 bird species (2 species were unidentified) were detected. Data collected reflect the general summer composition of the bird community within the LCC riparian corridor and *do not reflect composition or diversity of species over the course of the entire year for the entire watershed*. A list of all bird species, along with the number of individuals encountered and their relative abundance within the riparian corridor of each zone during the course of the survey is presented in Appendix B Table B9.

The Shannon-Weiner diversity index (H') was calculated for data collected within the riparian corridor of each zone of the LCC watershed and for all stations (Table 2.6). The term "diversity" here refers to both the number of species sampled ("species richness") and the relative abundance of individuals among the species sampled ("evenness"). Differences in diversity are due to differences in species richness, evenness or both. A higher value of the index indicates higher species diversity. The riparian corridor of the Mountain and Canyon Zones had the highest bird diversities for *summer* samples. This was due both to the relatively high species richness in the Mountain and Canyon Zones (28 and 35 species sampled, respectively) and the relatively even distribution of individuals sampled amongst species (Figures 2.7 and 2.8). The Urban and Agriculture Zones' riparian corridor had much lower Shannon-Weiner indices (Table 2.6). The Urban Zone riparian corridor had the lowest Shannon index because of the relatively few number of species detected (17) and the uneven distribution of individuals amongst species (more than 50% of the individuals detected belonged to 3 species – Fig. 2.9). Note also that the Urban Zone riparian corridor had the lowest overall number of individuals detected (Table 2.6).

Riparian corridor samples in the Urban Zone were dominated by European starling, American Crow, and Western scrub-jay. The Agricultural Zone had the second lowest diversity index, but yielded both the largest number of species and number of individuals (Table 2.6). The diversity index of the Agricultural Zone was relatively low because approximately 60% of the individuals detected belonged to approximately 8% of the species (Figure 2.10). Extremely abundant species (red-winged blackbirds, cliff swallows, and yellow-billed magpies) created a skewed distribution of individuals amongst species.

2.6.1 Valley elderberry longhorn beetle

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphicus*) is a federally threatened species that has the potential to occur throughout the LCC watershed wherever its host plant, blue elderberry (*Sambucus mexicana*), is present. Because the valley elderberry longhorn beetle (VELB) larvae develop within the stems of blue elderberry, VELB distribution is directly correlated to the distribution of blue elderberry.

2.6.2 East Tehama Deer Herd

The East Tehama deer herd is the largest migratory deer herd in California (Ramsey, 1981). The LCC watershed is located in the southern portion of the East Tehama deer herd range. The herd ranges from north of Mill Creek in Tehama County to south of Butte Creek, summering above approximately 3000' in montane coniferous forests and wintering in the foothills and valleys of the region. Ponderosa Way approximates the boundary of the herd's winter and summer ranges. In 1981, the "Management Plan for the East Tehama Deer Herd" (Ramsey, 1981) cited rural development as a principle concern affecting the long-term health of the herd. Rural development in the Cohasset, Butte Meadows-Forest Ranch, and Sterling City-Paradise areas are mentioned specifically. Ramsey states, "Should growth occur in other areas of the deer herd's range, the cumulative impact will be significant". At the time of publication, Ramsey estimated the human population of the Paradise-Magalia area at "greater than 30,000". United States census estimates put the current population of Paradise and Magalia at 26,000 and 10,500 respectively, but population growth is also occurring in smaller towns within the greater Paradise-Magalia area (e.g., Concow, Butte Creek Canyon, and Paradise Pines). Also, Ramsey cites a decrease in optimal habitat due to fire suppression and lack of wildfires as a cause for concern. Rural development within the Little Chico Creek watershed and elsewhere will likely increase both habitat fragmentation and the probability of long-term fire suppression throughout this portion of the deer herd's range. Because the LCCW connects two larger watersheds (Big Chico Creek and Butte Creek), affects of potential habitat fragmentation on the East Tehama deer herd are a legitimate management concern.

The report of the Butte County Deer Herd Study Panel (1984) addresses concerns pertaining to the management of deer herds within Butte County. Primary concerns addressed by the deer herd study panel are habitat quality, harassment of deer (e.g. wildlife and livestock) by feral dogs, and development encroaching upon migration corridors and critical wintering range. The Butte County General Plan has adopted several recommendations proposed by the California Department of Fish and Game (see chapter 4). These recommendations include limiting minimum parcel size to 40 acres and limiting fencing in nonresidential areas. Recommendations for fencing in non-residential areas include a maximum of five wires with a minimum above-ground-height of 16" for the lowest wire and a maximum above-ground-height of 48" for the upper wire.

2.6.3 Introduced Vertebrate Species

Approximately 6 introduced fish species and 17 introduced wildlife species are known or expected to occur within the LCCW. Many of these species are known to compete with and prey upon native fish and wildlife. Some introduced wildlife species are also known to transmit disease to native wildlife. Predation, competition, and disease transmission from introduced species potentially precludes many native fish and wildlife species from large portions of the watershed. Little is known about the extent to which these introduced species are impacting native wildlife within the LCC watershed. Management issues pertaining to wildlife within the LCC watershed need to address the impacts of introduced vertebrate species.

2.7 SUMMARY OF FISH SURVEY

Little Chico Creek is fairly typical of small streams in this area. During the wet season, runoff from rain and snowmelt contributes most of the substantial discharge, providing enough water to keep a generous flow throughout the length of the creek. During the dry season, the creek is fed by numerous small springs in the mountains and foothills, keeping a baseflow of about 10% of its wet-season flow in the Mountain and Canyon Zones. After reaching the Great Valley, that small flow is quickly lost to infiltration, evaporation, or human extraction so that the bed within the valley is dry except for local spots where storm drains or irrigation leakage keep water in pools. Upstream reaches provide year-round fish habitat, while the valley reaches provide only seasonal habitat for migratory species. Dams and weirs to create habitat, or divert water for flood control or irrigation can largely exclude the migratory species from this seasonal habitat. The permanent part of Little Chico Creek (from Stilson Canyon Bridge to Headwaters road) supports resident populations of native fishes. The seasonal part provides temporary habitat for strays from upstream and a few hardy migrants, but many of these, being unable to egress before summer dry-down, become food for terrestrial predators. As Little Chico Creek continues to flow through the floodplain of the Sacramento River, it loses its individual character, becoming dominated by agricultural diversions from Butte Creek and the Sacramento River as well as floodwaters from the river. This part of the creek might from time to time contain any of the fish species found in the Sacramento River.

Table B11 in Appendix B summarizes data for fish captured at different sampling sites. Differences in the number captured provide only a general picture of actual differences in fish populations since the number of fish captured is strongly influenced by the physical conditions at the sample site and the experience of the field crew. Additional information can be found in Appendix Table B11. Figure 2.11 shows points where fish data were collected. Figure 2.12 shows the distribution of the more common fish species. Spring Run Chinook were the only salmon species reported for LCC and they were seen only sporadically in high-flow years. Steelhead have also been infrequently observed, but were not distinguished from resident rainbow trout in the study. Smallmouth bass are absent in LCC. Although there is limited smallmouth bass habitat in the canyon zone, they have not colonized it; possibly because of the long reach of warm, still water (i.e. largemouth bass habitat) between the Sacramento River and suitable smallmouth bass habitat.

Figures 2.13 through 2.16 provide a summary of the fish habitat throughout the creek. Since the summary is limited to the available data and many reaches of the creek could not be surveyed, the charts overemphasize characteristics of accessible reaches. Figure 2.13 gives a comparison of fish habitat in the different zones of LCC. Riffles and step pools tend to dominate the upper reaches while pools and runs dominate the Great Valley reaches.

Figure 2.14 shows the percent of habitats having particular substrates in different parts of LCC. Boulders and cobbles decrease in a downstream direction, while other substrates remain fairly constant. In general, a greater variety of substrate types provides more niches for fish and their food organisms than a uniform substrate. Boulders, cobbles, and gravel provide better habitat than sand, silt, or bedrock because there are more spaces for fish and their food organisms. Spawning gravel is present throughout.

Figure 2.15 shows an average rating of cover (expressed as percent of ideal cover) in the different zones of LCC as well as percent of sample sites having each type of cover. Figure 2.16 shows changes in habitat area, habitat depth and water availability throughout LCC. Structure and flushing flows are suitable for fish throughout the creek. Water availability is a problem downstream of the Canyon Zone.

3 WATER QUALITY

Contributors: David L. Brown, Sarah Bidwell, and Ryan Brosius

3.1 INTRODUCTION

The goal of water quality monitoring was to provide baseline data on selected water quality parameters. This monitoring program, hereafter referred to as the Little Chico Creek water quality-monitoring program (LCCWQP), is envisioned as being the start of a long-term (e.g. 20 year) effort to promote the understanding of conditions in the watershed and to assess the relative health of the creek. Future monitoring will likely be a dynamic activity that will change over time as information is accumulated and new information needs are identified. Availability of funding will also likely constrain the frequency and extent of monitoring efforts. It is hoped that water quality data derived through the present and future studies in LCCW will augment and coordinate with a number of other monitoring efforts that are ongoing in the watershed. These programs include: the USGS National Water Quality Assessment Program, the Sacramento Coordinated Water Quality Monitoring Program, the Department of Water Resources, Department of Pesticide Regulation, and US Bureau of Reclamation.

The objective of LCCWQP data collection was to produce data that represent as closely as possible, *in situ* conditions of the watershed. This objective has been achieved by using accepted methods to collect and analyze water quality. This study includes biological, chemical, and physical monitoring elements as described below.

3.2 REVIEW OF EXISTING DATA

The purpose of this review was to identify and review existing water quality data collected within the Little Chico Creek Watershed. A wide range of data sources was consulted, including Federal, State and local agencies, libraries, local consulting firms, and faculty at California State University, Chico. Virtually all of the data gathered to date has been for specific projects at various locations along Little Chico Creek (LCC). Data sources may be broadly grouped into two categories: published data that has undergone varying levels of review, and unpublished data whose review status is unknown or which hasn't been reviewed. Most of the sources described in the following sections present the data in a variety of levels of detail, from mere data listing, to tabulation and interpretation. What follows is a summary of previous and current monitoring efforts that have been identified to date. These studies are presented based with respect to the watershed zone where their data gathering efforts were focused.

3.2.1 Multi-zone Data/Studies

Biology 160 Course Papers 1968-1972. CSU, Chico. Volume 4.

A pilot study produced qualitative data from samples of coliform bacteria taken from LCC near a slaughterhouse at the Dayton Road Bridge, and a public works yard at Broadway and Humboldt Avenue. In the spring of 1971, a study by Janice Wiser et al. reported that the highest concentration of pollutants in the creek during both testing periods was adjacent to a slaughterhouse area. The students allege that soaps, solvents, pesticides, oil, paint, and scraps were also dumped into the creek behind the public works yard on Humboldt Avenue. It was also noted that water is diverted upstream of the city during early summer for irrigation by the Meline family who has water rights to LCC water.

A fall 1971 report by John Skoglund et al. contains an article from the Enterprise Record that alleges that city workers and others have been dumping various materials into the creek. The report includes excerpts from the Butte County Bugle which discuss the dumping of septic tank effluent one hundred feet from LCC (1/6/62), and a ban on septic tank dumping (1/13/62). The students observed oil floating on top of samples collected near the County work garage. Samples taken near the slaughterhouse and at the Broadway Bridge were analyzed for coliform bacteria, pH, alkalinity, nitrate, nitrite, total nitrogen, total phosphates, orthophosphates, metaphosphates, total hardness, $CaCO_3$ hardness, Mg hardness, conductance, iron, sulfate, chloride, turbidity, CO_2, dissolved O_2, and temperature. Results reported for samples collected near the slaughterhouse included elevated levels of coliform bacteria, 19 parts per million (ppm) dissolved oxygen, 12 ppm total phosphates, 5 ppm chloride, 2.5 ppm nitrates, and 8 ppm carbon dioxide. Samples collected at the Broadway location were reported to have similar coliform bacteria levels, 12 ppm carbon dioxide, 11 ppm chloride, 3.5 ppm nitrates, 12.5 ppm dissolved oxygen, 2.4 ppm total phosphates, and increased algal growth in comparison to the slaughterhouse location. A small amount of qualitative macroinvertebrate data was reported.

Biology 160 Course Papers 1968-1972. CSU, Chico. Volume 5.

A spring 1972 report (section 2) on LCC discusses the actions of the Army Corps of Engineers in 1970, which included leveling the creek bed and clearing creek side vegetation for flood protection. The students also included general information on the bacteria, algae, protozoa, insects, birds, and mammals found in and around LCC. A spring 1972 report (section 3) of LCC by Marie Carpenter et al. contains a letter report by the Army Corps of Engineers that recommends an allotment of funds for a project to clear coarse woody debris from Little Chico Creek from September 1969. The students also reported on the parameters discussed in the report from spring 1972, section 2.

Menard, Mark. "An Integrated Environmental Assessment of Little Chico Creek." Term Paper, Biology 259. CSU, Chico, 2000.

The author gathered published information and conducted a field survey to complete an environmental assessment of sites along Little Chico Creek. Topics discussed are biology, topography, geology, soils, vegetation, hydrology, transportation, utilities, and land use. Benthic macroinvertebrate samples were collected using a Surber sampler on November 9, 2000 at four locations on LCC: Schott Road, Wilder Drive, Bruce Road, and Pomona Avenue. Several chemical and physical parameters were measured at these sites on November 9, 2000 and December 1, 2000. Water samples were tested for nitrate, phosphate, and chloride using a Hach DR/3 analogue spectrophotometer and a Hach DR 2000 digital spectrophotometer. Temperature, electrical conductivity (EC), pH, and dissolved oxygen were measured using field meters. Cross-sectional stream areas were determined by integrating the area of a reasonable number of rectangles, and current velocity was measured using a propeller-type mechanical flow probe or by timing a neutrally buoyant object across a measured distance. Results of sampling indicated that chloride concentrations increased from 1.2 to 7.6 mg/L and specific conductance increased from 93.4 to 212 umhos/cm as the stream decreased in elevation. Phosphate concentrations were reported to be uniform throughout the watershed, with values ranging from 0.15 to 0.26 mg/L.

Maslin, Paul. Email. 16 Jan. 2001. Personal Communications

Dr. Paul Maslin provided a summary of fish data collected over several years. Reaches of the stream from its headwaters through the City of Chico were analyzed for fish species. Maslin indicated that some reaches of LCC in town show a decrease in fish diversity and populations, perhaps due to pollution.

3.2.2 Mountain and Canyon Zones

Very little data has been collected for the upper two zones of the watershed. Given the similarity of the physical setting and the rural land-use, these two zones have been combined in the literature review and during this project's monitoring efforts.

Department of Water Resources, Water Quality and Biology Section. Little Chico Creek Fire Monitoring Data, 9/99-3/00.

The Department of Water Resources conducted a fire-related water quality monitoring study above and below the area that burned in the Little Chico Creek Watershed in August 1999. Fifteen Grab samples were taken at Stilson Canyon Rd. and 14 samples at Ten Mile House Trail from September 14, 1999 to March 9, 2000. Parameters measured were temperature, dissolved oxygen, pH, electrical conductivity (field and lab), alkalinity, turbidity, total suspended solids, and total dissolved solids.

Dissolved oxygen concentrations ranged from 9.6 to 12.4 ppm at both the Stilson Canyon Rd. and Ten Mile House Trail locations. Field measured pH values ranged from 7.2 to 8.3 at Stilson Canyon Rd. and from 7.1 to 8.1 at Ten Mile House Rd. Other parameters reported for the Stilson Canyon Rd. location were electrical conductivity values ranging from 63 to 189.6 umhos/cm, alkalinity ranging from 28 to 52 mg/L, turbidity ranging from 0.3 to 26 NTU, and total suspended solids (TSS) at 2 mg/L. Other parameters reported for the Ten Mile House Rd. location were EC values ranging from 58.2 to 180 umhos/cm, alkalinity ranging from 25 to 88 mg/L, turbidity ranging from 0.6 to 24 NTU, and TSS ranging from 4 to 10 mg/L. A report discussing the results of this study has yet to be released.

3.2.3 Urban Zone

The Urban Zone has been the focus of the greatest number of studies that included or focused on water quality monitoring. This focus remains a local priority with LCCWG as the City of Chico is working with local watershed groups to pursue Prop 13 funding for more comprehensive and systematic water quality monitoring.

California Water Resources Control Board. STORET LDC- Detailed Data Report, 1973-1986. http:www.epa.gov/storet

STORET is a national water quality database supported by the EPA, which can be used to store any water quality data gathered by public agencies. A query resulted in 8 water quality data reports for Little Chico Creek submitted by the California Water Resources Control Board. The first data report, collected in November of 1973 at Highway 99E (East) freeway, includes instantaneous stream flow; turbidity; specific conductance (more recently reported as EC); pH; total hardness; dissolved calcium, magnesium, sodium, potassium, chloride, sulfate, and boron; alkalinity; Ca Mg hardness; total filterable residue; and dissolved nitrate nitrogen.

In January of 1974 at the same location, instantaneous stream flow, turbidity, and specific conductance were measured. The same three parameters are reported for a sampling date of May 1977. The report for December of 1977 includes flow, turbidity, specific conductance, pH, total alkalinity, dissolved nitrate nitrogen, nitrogen as ammonia and organic-N, total phosphorus, total hardness, and dissolved sodium, chloride, and boron. The January 1979 report contains measurements of temperature, flow, turbidity, specific conductance, dissolved oxygen, and pH. In January of 1980, temperature, flow, turbidity, and specific conductance were measured. In January of 1983, temperature, flow, turbidity, specific conductance, and pH were measured. In February of 1986, the same parameters were measured except for temperature. Results are discussed in section 3.4.2 below.

Taylor, James Lee. "A Water Quality Analysis of Little Chico Creek." M.S. Thesis, 1974.

Taylor studied the following parameters of Little Chico Creek: Temperature, discharge, pH, NaCl concentrations, alkalinity, electrical conductivity, anions (Cl^-, SO_4^{--}, HCO_3^-, CO_3^{--}), cations (K^+, Na^+, Mg^{++}, Ca^{++}), dissolved oxygen, nitrates, total Kjeldahl nitrogen, total phosphorus, biological oxygen demand, and total coliform bacteria. Temperature, pH, electrical conductivity, and dissolved oxygen were obtained using a field meter. Alkalinity was determined using the potentiometric titration technique. Nitrates were analyzed using a colorimetric test, while SO_4^{--} was analyzed turbidimetrically and Cl^- was analyzed using a mercurimetric method. Total coliform bacteria were determined using the membrane filter technique. Eight sampling stations were located on Little Chico Creek: 33 ft (10 m) east and 33 ft (10 m) west of the confluence of Dead Horse Slough; at the Bruce Street bridge; at the Mill Street bridge; 164 ft (50 m) west of the Olive Street bridge; at the Chestnut Street bridge; 33 ft (10 m) southwest of the southwest end of Nord Avenue; and at the Pomona Avenue bridge. A linear regression was performed on eleven years of annual discharge data and Taylor concluded that discharge is not increasing or decreasing with time.

Taylor's findings include significant increases in nitrate concentration and total ionic concentration indicative of inputs from ground water during periods of low base flow. A decrease in nitrate is evident in residential areas connected to the city sewer system. Increases in anaerobic organic matter, phosphates, and coliform bacteria, and decreases in dissolved oxygen are noted near the Park Avenue Bridge.

Ham, J., R. Syrdahl, and M. Weaver. "Invertebrate Survey of Little Chico Creek Including Some Physical Factors." Term Paper, Biology 259. CSU, Chico, 1991.

This project created a species list of aquatic macroinvertebrates based on sampling at two locations just upstream and downstream of U.S. Highway 99E in Chico. Measurements were also taken for stream temperature, pH, and D.O. Species diversity was judged to be lower than was previously reported in Big Chico Creek.

U.S. Fish and Wildlife Service, Assessment of Urban Water Quality on the Sacramento River National Wildlife Refuge, 1994-1996. Unpublished Agency Data

Concerns about water quality impacts from commercial properties in Chico on downstream wildlife refuge areas prompted a monitoring project that lasted for approximately 2 years. Both storm event and regular (monthly) samples were collected at locations above the Chico urban area, within the urban area, near the Chico Water Treatment Plant, and within the Llano Seco Ranch. Three vernal pools were also sampled on the Sacramento River floodplain. The analytical parameters were priority pollutant metals, oil, and other petroleum hydrocarbons. To date, this data has not been published. A preliminary summary of available analytical results is presented in Tables C1 and C2 in Appendix C.

<u>Metcalf & Eddy, Inc. "Humboldt Road Burn Dump Environmental Restoration Plan." Prepared for City of Chico, May 1998.</u>

Potential restoration objectives described in this plan include re-grading waste-bearing fill materials, consolidating the waste, and capping burn dump materials with a Geosynthetic Clay Liner. Seven surface water samples obtained by the Regional Water quality Control Board were reported along with numerous soil samples. Three surface water samples, taken January 28, 1993 (two at the south fork of Dead Horse Slough and one from flowing seep in the northwest corner of the former dump site), were analyzed for total metals, volatile organic compounds (VOCs), semi-VOCs and pH. EPA methods 8240 and 8270 were used to analyze VOCs and semi-VOCs. It is reported that three surface water samples collected January 5, 1988 and one collected March 13, 1989 were analyzed for total metals.

<u>Metcalf and Eddy, Inc. "Draft Summary Report for Storm Water Monitoring Program City of Chico Locust Street Storm Drain Improvements Project." Prepared for City of Chico, Department of Public Works, Engineering Division, 1998.</u>

To satisfy a regulatory requirement for a stream alteration permit, the City of Chico hired Metcalf and Eddy to perform a storm water runoff-monitoring program. The Locust Street collection basin represents less than .2% of the total watershed area. Outfalls entering Little Chico Creek at Ivy Street and Dayton Road in the Locust Street storm drain tributary basin were sampled and estimated pollutant loads were calculated. Two storm events were monitored before the construction of the Locust Street Storm Drain Improvements Project (Spring '95 and Winter '96), and two storm events were monitored after construction (Spring '97 and Winter '98). For each event, samples were collected from the outfall itself and above and below it. Grab samples were taken during the first flush of the storm water system at the following locations: the 30-inch Dayton Road outfall (pre-construction), the 60-inch Ivy Street outfall (post-construction), LCC at the end of Hazel Street, and under the upstream edge of the Pomona Avenue Bridge. Field duplicate samples were collected and field measurements of temperature, pH, and EC were made. The analytes included in the laboratory analysis were: color, hardness as $CaCO_3$, odor, total dissolved solids, total suspended solids, fecal coliform, total Kjeldahl nitrogen, nitrate plus nitrite nitrogen, total phosphorus, oil and grease, total petroleum hydrocarbons as motor oil/diesel, total petroleum hydrocarbons as gasoline, benzene/toluene/ethylbenzene/xylenes, cadmium (total and/or dissolved), chromium (total and/or dissolved), copper (total and/or dissolved), lead (total and/or dissolved), and zinc (total and/or dissolved). For three of the events the total flow from the storm drain outlet was estimated using the Rational Method, and for one event it was directly measured within the storm drain. Pollutant loads were estimated by multiplying the contaminant concentrations by the total flow from the storm drain system.

Contaminant concentrations measured in outfall samples during the four sampling events were compared to median and mean event mean concentrations reported in the EPA Nationwide Urban Runoff Program. For storm event number one, the total suspended solids, nitrogen, phosphorus, total copper, and total zinc concentrations in samples collected from the Dayton Rd. outfall exceeded the median and mean event mean concentrations reported in the EPA study. For the second storm event, Dayton Rd. outfall sample concentrations for total suspended solids, nitrogen, and phosphorous were higher than the median and mean event mean concentrations reported in the EPA study. Concentrations of total suspended solids, nitrogen, phosphorus, total copper, and total zinc were higher than the median and mean event mean concentrations reported in the EPA urban runoff study for the Ivy Street outfall samples during the third storm event. During the final storm event, Ivy Street outfall samples reported concentrations of total suspended solids, nitrogen, and total zinc as higher than the median and mean event mean concentrations reported in the EPA study.

Dissolved copper and dissolved zinc exceeded the EPA proposed criteria in the Ivy Street outfall samples collected May 23, 1997, and dissolved zinc exceeded proposed criteria in the Ivy Street outfall samples collected March 12, 1998.

Dames & Moore. "Draft Interim Site Characterization Field Investigation Report, Humboldt Road Burn Dump." Prepared for City of Chico, 2000.

Five water samples were collected from Dead Horse Slough in order to assess the potential impacts caused by the flow of water through waste materials along the slough, specifically surface transport of waste materials (sediment) into Dead Horse Slough, and the leaching of constituents from waste piles into surface water. During a rain event on April 17, 2000, samples were collected at five different locations on the slough and sent to a laboratory to be analyzed for semi-volatile organic compounds (EPA method 8270), Title 22 metals, general minerals (major cations and anions), and volatile organic compounds (EPA method 8240). Samples, except those collected for metals analysis, were collected by completely submerging the sample bottles in the creek. Metals samples were collected in a clean container and filtered using a .45 micron filter into bottles supplied by the laboratory. At each site, measurements of pH, electrical conductivity (EC), and temperature were made using a Hydac field meter.

Barium was detected in six of six water samples at concentrations ranging from 0.0124 to 0.0238 mg/L. Calcium was reported in concentrations ranging from 6.08 to 8.97 mg/L. Copper was detected in all six samples at concentrations between 0.00842 and 0.0209 mg/L. Magnesium was detected in all samples at concentrations between 3.95 and 4.91 mg/L. Potassium concentrations ranged from 1.61 to 3.01 mg/L, sodium concentrations were between 2.55 and 3.46 mg/L, and zinc concentrations ranged from 0.0135 to 0.0236 mg/L. Additional maximum concentrations reported include nitrate as nitrogen at 0.28 mg/L, sulfate at 9.8 mg/L, chloride at 4.3mg/L, and alkalinity at 32 mg/L.

Mahnke, Rueben. "A Macro-Invertebrate Assessment of Little Chico Creek accompanied by Water Chemistry Data." Student Paper, Geosciences 350. Fall, 2000.

The author conducted a macroinvertebrate bioassessment and water chemistry study on Little Chico Creek. Four benthic macroinvertebrate samples were collected: one on October 14, 2000 before a period of rain and three on November 2, 2000 after a period of rain. Two samples were taken from each of two pools located approximately ¼-mile west of the Forest Avenue Bridge. During each sampling event, measurements of electrical conductivity, dissolved oxygen, pH, and temperature were taken in the field. Aquatic invertebrates identified in the samples include gastropoda, trichoptera, and oligochaeta. A low number of individual organisms were found in each of the four samples. Dissolved oxygen levels ranged from 8.9 to 9.2 mg/L, pH levels were between 8.4 and 8.54, temperature ranged from 59.8 to 62.1˚F, and electrical conductivity readings ranged from 14.63 to 15.58 umhos/cm.

Emko Environmental, Inc., 2001. Remedial Investigation Report Soil, Waste, And Sediment Humboldt Road Burn Dump, Chico, California.

During the spring of 2000, EMKO Environmental conducted water quality sampling in Dead Horse Slough, which is an intermittent tributary of Little Chico Creek. One sampling station is located at the confluence of Dead Horse Slough and Little Chico Creek. This report was prepared as a Remedial Investigation (RI) Report presenting the investigation results for soils, waste, and sediment at the Humboldt Road Burn Dump (HRBD). The overall purpose of the RI was to characterize the waste material and estimate its extent at the HRBD site. Results of this investigation are summarized in section 3.4.2 below.

David L. Brown, "Preliminary Report on Mass Loading of Diazinon to the Sacramento River in the Vicinity of Chico", Report for the California Department of Pesticide Regulation, September 2001

In February 2001, a study was conducted to investigate the potential for urban organophosphate (OP) pesticide loading in the Sacramento River (above Hamilton City), Stony Creek, and Chico urban creeks. The focus of this investigation was primarily on diazinon. Where detected, estimates were made of diazinon loads. Factors that influence pesticide loading in local creeks were also evaluated, with an emphasis on identifying potential sources. A precipitation event occurred during the period February 8-12 that triggered a larger effort to monitor diazinon and other OP pesticides following dormant season spraying in agricultural settings. Two samples from Little Chico Creek contained detectable diazinon, with concentrations ranging from 0.020 ppb to 0.133 ppb. Creek discharges were relatively low, yielding total load estimates for the storm ranging from 11 g to 55 g. These loads are 2-3 orders of magnitude lower than loads observed in Sacramento Valley agricultural environments during the same storm. Use reporting for strictly urban sources (landscape maintenance and structural pest control) is likewise less than 10% of total diazinon use in Butte County. Consumer use was not quantified, but does not appear to be widespread based on reported consumer sales from retail sources. Further investigation was recommended to evaluate the potential for urban loading during late fall and early winter storms.

3.2.4 Agricultural Zone

Lilburn Corporation and Resource Design and Technology, Inc. "M & T Chico Ranch Mine Draft EIR." Prepared for Butte County, Planning Division, 1998.

This draft EIR presented the possible environmental impacts of the proposed M&T Chico Ranch Mine project. The proposed site lies to the south of Chico River Road, east of River Road, and north of Ord Ferry Road in western Butte County. Little Chico Creek forms the northern boundary of the pit site, separated from the pit by 50 ft (15 m). Comanche Creek is part of an irrigation water supply system up to the eastern boundary of the project site where it reverts to a drain. It flows southward and connects with other agricultural drains and some of this tailwater then flows west to join Little Chico Creek at the southern boundary of the site. The hydrology section of the report provides information about flood issues concerning Little Chico Creek. Existing water quality data already described above was summarized in this EIR.

3.3 PROJECT MONITORING RESULTS MARCH 2001 - MAY 2002

3.3.1 Approach

The following environmental monitoring elements were included in the LCCWQP monitoring effort:

- Nutrients (nitrogen and phosphorus)
- Priority metals
- Pathogens and pathogen indicator organisms in water (fecal and total coliform)
- General constituents in water (pH, electrical conductance, etc.)

Specific individual constituents measured during the LCCWQP are listed in Table 3.1. The purpose for monitoring these parameters is discussed below. Three sites were monitored during the LCCWQP as shown on Figure 3.1. The Mountain and Canyon Zones were monitored at station LCCA located at the Stilson Canyon Bridge upstream of the city of Chico. The Urban Zone station (LCCB) was located at the Pomona Avenue Bridge immediately downstream from the city urban area. And finally, the Agricultural Zone was monitored at the LCCD station located at the Ord Ferry Road Bridge. During the spring of 2001, there was considerable uncertainty as to where flows in Little Chico Creek mixed with diversions from other nearby creeks and the Sacramento River. Thus, an exploratory monitoring station (LCCC) was utilized at the Alberton Avenue Bridge. Sample locations are shown on Figure 3.1.

3.3.2 Sampling Schedule

The sample collection frequency varied by location and the constituent to be tested, as summarized in Table 3.2. Depending on the seasonal flow and precipitation conditions in the watershed, some samples were not possible to obtain. This occurred during the summer and early fall at stations B and C, when the creek went dry. The scheduled monthly sample events were generally conducted on the third Tuesday of each month, and were always conducted on the same day. Rain event-related samples were collected near or just subsequent to the peak of the storm hydrograph. Lacking real-time gaging on Little Chico Creek, rainfall data from the Cohasset rain gage and discharge data from the Rose Avenue stream gage on Big Chico Creek were used to schedule event samples.

3.3.3 Sampling Methods

Samples were collected from Little Chico Creek only. Field-measured parameters (temperature, dissolved oxygen, specific conductivity (EC), and pH) were also measured at each site and event where samples were collected. Temperature, pH and EC were measured using a Hydac 910 Meter. Dissolved oxygen was measured using a Hanna HI-4192 Meter. All water quality samples were collected using clean techniques that attempted to minimize sample contamination. Three different sample collection methods were used for monitoring elements in water: (1) nutrient sampling, (2) metals sampling, and (3) pathogen sampling. Descriptions of specific sampling methods and requirements are provided below.

Sampling methods for all constituents generally conformed to EPA “clean” sampling methodology described in *Method 1669: Sampling Ambient Water for Trace Metals* (USEPA 1995a). Samples were generally mid-depth grab samples and were collected from shore using acid-cleaned polyethylene or glass bottles. Grab samples were collected directly into the sample containers. Samples to be analyzed for dissolved (filtered) metals were filtered at the lab following their respective protocols. After collection, samples were stored at 4°C until arrival at the contract laboratory. Samples analyzed for mercury were preserved using ultrapure hydrochloric or bromochloric acid at Frontier Geosciences laboratory, immediately on arrival. Samples analyzed for other constituents were preserved in the field, as appropriate (Table 3.3). This sample collection method requires that the sample bottle and lid come into contact only with surfaces known to be clean, or with the water sample. If air was present in the sample container for mercury analyses, additional sample were aliquoted into the same sample bottle. If the performance requirements for specific samples were not met, the sample was re-collected. If contamination of the sample container was suspected, a fresh sample container was used.

Pathogen monitoring included sampling for the pathogen indicators fecal and total coliform bacteria. Samplers wore gloves when collecting any pathogen samples. Samples analyzed for coliform bacteria were collected as near-surface grab samples. Sampling for coliform bacteria was performed according to the sampling procedures detailed for Standard Methods 9221B and 9221E (APHA et al. 1998). In brief, the sampling procedures are summarized as follows. Sample containers were cleaned and sterilized by Basic Laboratory using procedures described in Standard Methods 9030 and 9040. For waters suspected to contain a chlorine residual, sample bottles contained a small amount of sodium thiosulfate ($Na_2S_2O_3$) sufficient to neutralize bactericidal activity. Plastic (e.g. polypropylene) sample bottles with a capacity of at least 120 mL were used. After sterilization, sample bottles were kept closed until they were filled. When caps were removed from sample bottles, care was taken to avoid contaminating inner surface of caps or bottles. Using aseptic techniques, sample bottles were filled leaving sufficient air space to facilitate mixing by shaking. Bottles were not rinsed before sampling, and they were recapped tightly after filling.

3.3.4 Mountain/Canyon Zone Sampling Results

Field-measured water quality monitoring results for the upper two zones are presented in Table 3.4. As would be expected, creek water temperature increases from a seasonal low in January to the highest temperatures in the summer. At this station, discharge becomes so low by the end of May that certain reaches appear almost stagnant. The minimum recorded creek temperature was 6.1^{o} C in January 2002 and the maximum temperature was 20.4^{o} C in May 2001. By the third week in June 2001, the creek had gone dry approximately 0.3 mi (0.5 km) above the Stilson Canyon Bridge except for isolated pools. Creek pH showed little change ranging from 7.2 to 8.1.

Observed EC values decline seasonally with highs in the late summer and fall to winter minima as rainfall inputs dilute solute concentrations in the creek. The maximum observed EC value was 167 μS/cm in October 2001 and the minimum observed value was 59 μS/cm during a rain event in February 2002. Dissolved oxygen concentrations are inversely proportional to temperature and thus the highest DO values were observed during the winter months. Overall DO concentrations ranged from the highest value of 12.2 mg/L in January 2002 to the lowest value of 5.8 mg/L during a warm period in April 2002.

Nutrient results are summarized on Table 3.5 for ammonia (NH_4), nitrate (NO_3), nitrite (NO_2), total phosphorus (TP), and ortho-phosphorus (ortho-P). Concentrations of NH_4 and NO_2 were generally below or only slightly above the minimum detection limits. NO_3 concentrations were always less than 0.5 mg/L. TP and ortho-P concentrations were likewise low, never exceeding 1.0 mg/L.

Sampling for metals at the upper sampling station were generally only performed for three rainfall-runoff events (Table 3.6). The purpose of this sampling was to provide background concentrations from which urban runoff could be evaluated for metals as described in the following section. Overall, concentrations of total metals in the creek were relatively low, ranging from below their respective detection limits to the highest concentration of 1.0 μg/L (ppb). Detection limits for total mercury are substantially lower than for other metals (Table 3.7). The final event sample (March) of the 2002 winter runoff season showed a somewhat elevated mercury concentration compared with other samples at this station. One exploratory non-event sample collected in May 2002 showed a very low mercury concentration (0.36 ng/L).

Pathogen analytical results are shown in Table 3.8. Total coliform is consistently high, with bacterial counts ranging from 300 to greater than or equal to 1,600. Of more immediate concern is the fecal coliform, which represents disease-causing organisms. Counts appear to be lower during the winter, presumably due to dilution and reduced aquatic biological activity. The high value (≥1,600) in November 2001 may be due to some form of first flush, or unidentified sources in the upper watershed. These findings are compared with applicable water quality criteria in a subsequent section.

3.3.5 Urban Zone Sampling Results

Urban Zone field-measured water quality monitoring results are presented in Table 3.4. This station and the reaches of the creek it represents are generally the first to go dry. The minimum recorded creek temperature was 7.8^o C in January 2002 and the maximum temperature was 20.0^o C in May 2001. Isolated pools occur throughout the lower portion of the Urban Zone, some of which persist well into or through the summer. The presence of landscape irrigation return flows from surrounding residential areas appears to be a factor in this source of water. Creek pH showed somewhat greater variation than the upstream monitoring station ranging from 6.2 to 8.8. The maximum observed EC value was 193 μS/cm in May 2001 and the minimum observed value was 67 μS/cm during a rain event in February 2002. Overall DO concentrations ranged from the highest value of 11.4 mg/L in February 2002 to the lowest value of 5.3 mg/L during a warm period in April 2002.

Nutrient results were similar in magnitude to the upstream sampling station (Table 3.5). Detectable concentrations of NH_3 and NO_2 occurred somewhat more often, but were still only slightly above the minimum detection limits. NO_3 concentrations were detected during virtually every sampling event, but were always less than 0.5 mg/L. TP and ortho-P concentrations were low, never exceeding 0.5 mg.

Urban Zone concentrations of total metals in the creek were also relatively low overall, although most metals were present in higher concentrations than the upstream results (Table 3.6). Concentrations ranged from below their respective detection limits to the highest concentration of 40.2 μg/L (ppb). As with the upper station results, the non-event sample collected in May 2002 showed a very low mercury concentration (0.51 ng/L) compared with the results from earlier event samples. The May 2002 non-event sample results show very similar concentrations for metals at both the upper (Mountain/Canyon Zone) and middle (Urban Zone) sample locations.

As shown in Table 3.8, total coliform is consistently at or near the maximum reportable count 1,600. The fecal coliform counts don’t appear to follow any apparent seasonal pattern, but they are higher overall than the upstream sampling location.

3.3.6 Agricultural Zone Sampling Results

Field-measured water quality monitoring results for the Agricultural Zone are presented in Table 3.4. The minimum recorded creek temperature was 7.9^{o} C in January 2002 and the maximum temperature was 19.4^{o} C in May 2001. Creek pH showed somewhat less variation than the other two sites, ranging from 6.9 to 8.2. The creek EC values did follow the same trend as the other two sites, but also appear to show variability not directly linked to rainfall patterns. The maximum observed EC value was 176 μS/cm in March 2001 and the minimum observed value was 75 μS/cm during a rain event in March 2002. Overall DO concentrations were the lowest of the three primary stations sampled ranging from the maximum value of 9.8 mg/L in February 2002 to the lowest value of 4.9 mg/L during a warm period in April 2002 (Table 3.4).

Nutrient results were similar in magnitude to the Urban Zone sampling station (Table 3.5). Detectable concentrations of NH_3 and NO_2 occurred fairly frequently, but were only slightly above the minimum detection limits. NO_3 concentrations were detected during virtually every sampling event, but were always less than 0.5 mg/L. TP and ortho-P concentrations were low, never exceeding 0.6 mg/L and 0.3 mg/L, respectively.

Unlike the upper and middle sampling stations, the lowermost station at the Ord Ferry Road Bridge was monitored on a monthly basis to investigate background metals concentrations. Overall, the metals concentrations at this station were higher than those at the two upstream monitoring stations. Of the ten metals monitored, selenium was rarely present above detection limits. Silver and cadmium were detected in virtually all samples, but at concentrations just above detection limits. Arsenic and lead were detected in all samples at concentrations ranging from 0.231 μg/L to 0.649 μg/L and 0.140 μg/L to 0.690 μg/L, respectively (Table 3.6). Chromium concentrations ranged from 0.49 μg/L to 5.5 μg/L; nickel concentrations ranged from 1.13 μg/L to 5.54 μg/L; copper concentrations ranged from 1.13 μg/L to 4.14 μg/L; and zinc concentrations ranged from 1.21 μg/L to 3.57 μg/L. Total mercury concentrations ranged from 1.27 ng/L to 2.97 ng/L. Peak concentrations for all metals except mercury were observed in samples collected in February 2002.

Total coliform at the lower sampling station is consistently at or above the maximum reportable count 1,600 (Table 3.8). The fecal coliform counts don’t appear to follow any apparent pattern, but they are higher overall than the upstream sampling location. The downstream distribution of monthly fecal coliform results shown in Table 3.9 does not suggest consistent inputs of pathogens nor potential dilution that would lower the concentrations. Further sampling would seem needed to investigate both pathogen sources and transport that may control concentrations.

3.3.7 Reconnaissance Bioassessment Sampling Results

Recently, state and federal agencies have expanded water quality monitoring protocols by measuring the integrity of its biological communities. Evaluation of the physical aquatic habitat (channel conditions, sediment size, etc.) as well as indicator species enhances traditional chemical and toxicological water quality assessments. These newer approaches, termed bioassessment, can better assess the effects of point and nonpoint source pollutants. They also provide an effective means of evaluating discharges of non-chemical substances such as sediment, and the effects of habitat alteration. Finally, bioassessment techniques integrate the effects of water quality conditions over time and provide the basis for estimating the overall "health" of surface waters.

Benthic macroinvertebrates are bottom- dwelling aquatic animals lacking backbones and are large enough to be visible to the unaided eye. This term includes aquatic insects, and crayfish, snails, clams and worms. The assemblage of these varied aquatic organisms incorporates a very large number of individual taxonomic categories such as species or genera. Thus, various indicator organisms and multi-species groups of organisms have been developed for bioassessments by state natural resource and water quality agencies. Living in bed sediments of surface waters, they are directly susceptible to degradation of water quality, sediment conditions, and overall aquatic habitat.

Benthic macroinvertebrate samples were collected at the three water quality sampling sites (LCCA, LCCB, and LCC D, respectively) on Little Chico Creek in April of 2002. Three samples were collected at each sampling site using a D-shaped kick net with a 0.02-inch (0.5-mm) mesh. Sample collection and handling methods followed California Stream Bioassessment Procedures (CSBP). CSBP documentation can be obtained through the California Department of Fish and Game (www.dfg.ca.gov/cabw/protocols.html). The CSBP is the California State adaptation of the national Rapid Bioassessment Protocols developed by the U.S. Environmental

Protection Agency (Barbour et al., 1999). A macroinvertebrate taxonomic list was generated, and a standard set of 17 biological metrics was calculated. There were 43 taxa collected. Initial results based on the taxa list and biological metrics suggest that the biotic condition of the upper site (LCCA) on Little Chico Creek was considerably higher than the lower two sites (LCCB and LCCD).

Out of the seventeen metrics calculated, the DFG has determined seven metrics to best differentiate between reference and non reference conditions These are cumulative taxa, percent dominant taxon, sensitive EPT index (%), Shannon Diversity Index, percent intolerant taxa, and percent grazers. These metrics are described below.

Cumulative taxa are representative of the biological diversity (based on number of taxonomic groups observed) of a site, and decreases in response to disturbances. There was a large difference in cumulative taxa between the upper site (31) and the middle (LCCB, 15), and lower (LCCD, 18). The percent dominant taxa for LCCA, LCCB, LCCD were 23, 55, and 31 respectively. This measure shows the percent composition of the single most abundant taxon and increases in response to disturbances.

Cumulative EPT taxa look at the number of taxa in the Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) insect orders. Overall, these three orders contain numerous taxa that are sensitive to disturbance (based on assigned “t-values” ranging from 0 to 10) and pollution stresses. The sensitive EPT index (%) takes this a step further and determines the percent composition of mayfly, stonefly, and caddisfly larvae with intolerant tolerance values (t-values of 0 through 3) for the three taxa combined. With both of these measures the numbers will decrease in response to disturbances. The data showed 44 (LCCA), 6 (LCCB), and 12 (LCCD) in the sensitive EPT index (%) and 14 (LCCA), 2 (LCCB), and 4 (LCCD) in the cumulative EPT taxa. Results of both measurements support the conclusion that the upper site is healthier than the middle (LCCB) and lower sites.

The Shannon diversity index is a general ecological measure of diversity that incorporates species (or taxa) richness and evenness (abundance) and decreases with response to disturbance. This measure was 2.4, 1.3, and 2.1 for the upper, mid, and lower sites, respectively. Taxa were distributed relatively evenly in the upper and lower sites making their Shannon Indices similar. The middle site had the lowest Shannon diversity of the three sites.

Percent intolerant taxa are the percent of organisms in the sample that are highly intolerant to habitat or water quality impairment as indicated by having tolerance values (t-values) of 0, 1, or 2. The upper site value of 46 indicates the presence of a relatively large number of intolerant taxa. The lower two sites had considerably smaller values with 11 and 8 for the middle and lower sites. This measure also decreases in response to disturbance.

Percent grazers is the percent of benthic macroinvertebrates that graze upon periphyton, the algal and cyanobacterial communities that cover streambeds. In healthy systems, the grazers are dominated by insects that are intolerant of disturbance (the mayfly *Epeorus sp*.). In degraded systems, the grazers are dominated by non-insect (i.e. – gastropods) taxa, which are relatively tolerant.

The metrics based on sampling results are shown in Table 3.10. Additional bioassessment data and analytical summaries are presented in Appendix C on Tables C3 to C5. Overall, the biological metrics indicate that the upper site (LCCA) is a much healthier site. The lower two sites (LCCB and LCCD) show a decrease in the health of the stream. There is a trend indicating that the lower site is slightly healthier than the middle site. However, the differences may not be statistically significant. Additional sampling needs to be done for a more complete analysis of the stream's health. With additional sampling, the reduced health rating of the middle site may prove significant, and may point to potential impacts from the City of Chico.

3.4 WATER QUALITY CONDITIONS

3.4.1 Water Quality Goals for LCCW

The Regional Water Quality Control Board Basin set water quality objectives in the Water Quality Control Plan (Basin Plan) for the Sacramento River and its major tributaries (SWRCB, 1998). No beneficial uses specific to the Little Chico Creek have been published to date. For the purposes of this study, beneficial uses for Little Chico Creek are assumed to be consistent with those for the adjoining Big Chico Creek and Butte Creek watersheds, including: agriculture, contact recreation, aquatic habitat, and wildlife habitat. Relevant water quality criteria are summarized in Table 3.11.

3.4.2 Analysis of Historic Monitoring and Water Quality Data

There are only limited surface water quality data available within the LCCW as summarized above. Of the data that do exist, only a subset is directly comparable to data collected during this study. The STORET database current through 2000 contains data for one Urban Zone location at the U.S. Highway 99E Bridge (Table 3.12). Of the eight samples taken over the period of 1973 to 1986, only a limited number of constituents were monitored on a consistent basis (stream discharge, turbidity, and EC). The sporadic constituents monitored overall appear to be consistent with monthly samples collected during the LCCWQP effort. None of the constituents exceed limits set to meet beneficial uses described above.

Limited sampling efforts by the City of Chico were conducted at the Pomona Avenue Bridge, which corresponds to the urban site used in the current study. This sampling was conducted in conjunction with the Locust Street storm drain improvement project (unpub. data, City of Chico). Water quality data obtained from sampling during two storm events are presented in Table 3.13. None of the constituents exceeds limits (Table 3.11) set to meet beneficial uses described above, although some constituents such as copper appear to be elevated.

As part of a Remedial Investigation study of the Humboldt Road Burn Dump (HRBD), sediment samples were collected from Dead Horse Slough in spring 2000 at locations upstream, within, and downstream of the former dumpsite (Dames and Moore, 2000). No detectable concentrations of semi-VOCs, chlorinated pesticides, PCBs, TRPH, or asbestos were detected in any of the sediment samples. Three metals, including antimony, lead, and arsenic were detected at concentrations exceeding their respective screening-level values at several of the sediment sample locations within the HRBD site. Overall, the concentration of these metals appears to decrease with distance downstream. Lead is the metal of greatest concern at this site, but it was not detected at concentrations exceeding 191 mg/kg in sediment samples collected downstream of the HRBD.

3.4.3 Urban Effects on the Creek

One of the major questions in the LCCWQP effort was the extent to which Chico urban area nonpoint source pollution is impairing water quality. Of particular concern is the “first flush” of contaminants that can occur with the first storm(s) of the rainy season in the fall. Over the course of the hot, dry summer and early fall in Northern California, a variety of contaminants may accumulate on ground surfaces, including oil and grease, fertilizers, pesticides, animal waste, and metals. Metals are commonly deposited from automotive sources over the entire urban portion of the watershed served by storm sewers. The first large rain event can flush pollutants into storm drainage systems, creating the potential for impairment of creek water quality and possibly adversely impacting the aquatic ecosystem of LCCW. Sidewalks, parking lots, and streets all channel flow into the storm drain service area in Chico (Figure 3.2). Based on City of Chico estimates, approximately 28% of the Chico Urban Area served by storm sewers discharges storm runoff into Little Chico Creek. Land use in that drainage area is diverse, as previously discussed.

For the water quality constituents monitored through the LCCWQP, nutrients and metals were analyzed for three events: October 30, 2001; February 20, 2002; and March 24, 2002. The first event sampled was the first significant storm of the season, when more than 2.0 inches (50 mm) of rain fell on the headwaters of Little Chico Creek (CDEC data, estimated from Cohasset precipitation gage). Data summarized in Table 3.14 does not show large increases in nutrient concentrations between the monitoring stations above and below the urban area. This may be due to the reduced use of fertilizers on landscaped areas as the winter dormant season approaches.

Metals concentrations, however, did increase by nearly an order of magnitude for most constituents during the October 2001 event (Table 3.15). This appears to be a first flush of metals in terms of concentrations. However, the load (total mass) of metals introduced into Little Chico Creek is likely to have been fairly low. Discharge data is not readily available for the Taffee Road gage for that event due to reported equipment malfunction. Discharge data from

Big Chico Creek indicates that the flows there never exceeded 80 cfs. In the fall, the dry conditions of the watershed and probable seepage of creek water into surrounding shallow aquifers attenuates the amount of creek discharge resulting from early fall storms. This is especially true for the fall of 2001, which followed the 2000-2001 water year with well below normal regional precipitation. Thus, it is not likely that significant discharge volumes resulted from the first event sampled. If the discharge is low, then the mass loading (equal to concentration multiplied by discharge) will also be low. Smaller increases in metals concentrations were observed during the February and March rain events sampled.

The one apparent anomaly in the metals data is the March 2002 event where a higher concentration of mercury was detected upstream of the urban area. No definitive explanation for this finding presents itself at this time. One possible explanation may lie in the fact that metal analyses performed during the LCCWQP were for total constituents only. It is possible that the March 2002 event sample happened to collect some significant solid phase material with sorbed mercury. To examine differences in total versus dissolved metal, the last sampling event of spring 2002 included additional analyses using filtered and unfiltered samples. Table 3.16 shows the results of these analyses for all three sampling stations. For virtually all of constituents with concentrations above detection limits, the majority of the metals were in the dissolved phase at the upper and middle sampling stations. The number of observations is extremely small, but it appears that more metals were in some form of sorbed phase at the lower station. Additional metals sampling and analysis for particulates (clay and organic matter) is needed to evaluate the partitioning of metals into dissolved and solid-phase fractions.

3.5 SUMMARY OF CURRENT WATER QUALITY CONDITIONS

Based on the sampling for the LCCWQP reported above, Little Chico Creek does not seem to be impaired for any of its beneficial uses except contact recreation due to elevated coliform levels. As shown in Table 3.7, fecal coliform levels appear to be highest in the late spring when creek levels are low and water temperatures are increasing. This is true at both the Stilson Canyon and Pomona Avenue sampling stations. The contact recreation count limit (400/100 ml) is exceeded more frequently at the urban station. As air temperatures increase through the summer, there is an increased prospect of individuals using residual pools in the creek for recreation. Assuming the fecal coliform data for the Pomona Avenue station is representative of conditions in the urban area, there seems to be a potential health risk especially for children. Additional sampling of urban pools through the summer and public education efforts seem advisable. If current bacterial pathogen levels are to be reduced below contact recreation levels, future efforts should be made to determine the sources of fecal coliform, and which sources are feasible to control.

Nutrient concentrations were consistently low (Table 3.5) and were always well below established regulatory limits. It appears that the timing of fertilizer use and seasonal rainfall patterns do not currently create a nutrient loading problem for the creek. Metals likewise do not appear to be a significant concern; however future remediation efforts at the Humboldt Road Burn Dump may liberate sediments observed to contain metals such as antimony, lead and arsenic (Emko Environmental, Inc., 2001). Basic water quality constituents such as temperature, pH, EC, and DO do not exceed specified basin objectives or water quality standards at present.

4 LAND USE AND MANAGEMENT PLANS

Contributors: Donald G. Holtgrieve & Bridget Caputo

4.1 PURPOSE

Land use decision-making with regard to watersheds is an important planning tool. Depending upon the decision made, it can enhance or adversely impact human activities within a watershed. Local land use decisions are usually guided by General Plan policies and implemented through enforcement of a zoning ordinance or code. Decision-making in general can be significantly influenced by public input. This input needs to be informed in order to be most effective.

This section of the ECR is designed to inform the general public, public agencies and special interest groups about the current land uses in the Little Chico Creek Watershed (LCCW), along with the City and County goals and policies that may affect the LCCW as well as how these policies are relevant to decision making. This report also addresses recent and current land use issues within the study area.

To determine the land uses, policies, goals and issues pertaining to Little Chico Creek the following documents were reviewed:

- Big Chico Creek Watershed Existing Conditions Report
- Butte Creek Watershed Existing Conditions Report
- County of Butte General Plan
- City of Chico General Plan
- Programmatic Draft EIR for the Oak Valley Conceptual Master Plan and Project Specific Draft EIR for the 43- acre Portion of the Subdivision
- Proposed Husa Ranch Development Flood Mitigation Analysis
- M&T Ranch Rock Quarry EIR

4.2 ENVIRONMENTAL SETTING

The watershed and the creek have been described in detail in Chapters 1 and 2. Little Chico Creek lies within Butte County jurisdiction for land use planning and decision making except for approximately 4.7 miles where it flows through the City of Chico. Population data and predictions for future development in the area are included in both the City of Chico and the County of Butte general plans but not at the watershed boundary level. Note: the Butte County General Plan is currently in the revision process and the City of Chico Housing Element (which predicts future growth) is also being revised at the time of this report's distribution.

4.3 THE GENERAL PLANS

The local governing bodies responsible for land use decision-making are the Butte County Board of Supervisors and the City of Chico City Council. Both the City and the County have adopted comprehensive, long-term general plans, as required by California law, for physical development within their boundaries. Each jurisdiction's general plan has land use policies that can be used to protect the Little Chico Creek watershed from unwise land use practices. At the time of preparation of this document, Butte County is updating its General Plan. The existing land use within the project area is summarized on Figures 4.1a and 4.1b.

A General Plan presents a policy framework within which local agencies review proposals for developing their resources. The policy statements contained in the plan must be brought about or implemented through a series of clear statements concerning the standards which must be met prior to development, and programs for financing, operating, and maintaining facilities that service existing and new development. California law provides local governments with a variety of ways to implement general plans. These implementation tools must, however, be based upon the policies contained in the plan. Implementation measures most commonly used by cities and counties include: zoning regulations, subdivision regulations, specific plans, capital improvement planning, building and housing codes, environmental impact review procedures, and citizen participation in decision making (with the understanding that final decisions will be made by elected bodies).

All discretionary decisions regarding land use, resource management, development approvals, environmental impact assessment and related matters must be considered by the Board of Supervisors or City Council in the context of its respective current General Plan.

4.4 LAND USE POLICIES

4.4.1 Butte County

The County governs land use decision-making for the segment of the Little Chico Creek watershed in Butte County. The policy making body for that agency is the Butte County Board of Supervisors with advisory input from the Butte County Planning Commission. The current Land Use Element of the Butte County General Plan was adopted in 1979 in compliance with Government Code Section 65302.

4.4.2 Butte County General Plan

The Butte County General Plan contains 11 elements that address the County's goals, objectives and policies for decision-making in the County. These elements include Land Use, Circulation, Housing, Conservation, Open Space, Seismic Safety, Safety, Noise, Scenic Highways, Recreation and Agriculture. The elements and relevant goals and policies are described below.

4.4.2.1 Land Use Element

The land use element and its policies can be used by agencies and concerned citizens to assess the County's commitment toward resource protection. The following policies from the land use element of the Butte County General Plan may be significant in future land use decisions:

1.4.a Based upon continuous analysis of population trends, provide plans, which allow reasonable "freedom of choice" of sites and facilities for the population growth of the County, both in the County as a whole and in its various sections.

2.2.a Maintain extensive areas for primary use as livestock grazing land.

2.2.b Allow livestock grazing on all suitable sites not needed for development or crop production.

4.2.a Maintain economic use and value of private property.

4.4.2.2 Related Policies

Below is a list of Butte County land use policies that are relevant to the protection of Little Chico Creek. These policies are used as a basis for decision-making and can be essential to protecting or enhancing the Little Chico Creek watershed. A public agency, citizen group or landowner can use these policies and the coinciding implementation measures to initiate protective actions for preserving and conserving the watershed.

1.7.c Encourage development in and around existing communities with public facilities.

2.4.a Maintain quantity and quality of water resources adequate for all uses in the County.

2.4.c Control development in watershed areas to minimize erosion and water pollution.

5.3.d Direct future urban growth away from flood-plain areas.

6.4.c Encourage compatible land use patterns in scenic corridors and adjacent to scenic waterways, rivers, and creeks.

6.5.b Prevent development and site clearance other than bank protection of marshes and significant riparian habitats.

6.6.a Encourage the creation and expansion of natural and wilderness areas.

7.3.a Limit development in areas with significant drainage and flooding problems until adequate drainage or flood control facilities are provided.

The **Open Space Element** of the Butte County General Plan was adopted on December 21, 1976. The element addresses concerns about the conversion of agricultural lands into urban uses. The following are the *recommendations* listed in the element:

- The County should set large minimum parcel sizes for open space lands outside the urban areas indicated on the Land Use Plan Map. “Urban development” would then be defined as the creation or use of smaller parcels.
- The County should not allow urban development of open space land described in this plan.

- Studies should be conducted to determine the urban development capabilities of the foothill and mountain areas.
- The County should allow urban development only in areas physically suited to such use.
- The County should discourage urban development isolated from existing development and urban centers unless such a need can be determined.
- The County should permit the creation of residential parcels near large numbers of vacant sites of similar characteristics only if such a need can be demonstrated.
- The County should designate, at least once every five years, the land available for urban development.

Policies addressing **agricultural lands** in the county are:

- All “prime agricultural land” (as defined in the Williamson Act) outside designated urban areas (amended December, 1976) should be designated as “Agricultural” on the Land Use Plan Map.
- Agricultural zones should allow only open space uses described in this plan and necessary related structures.
- A minimum parcel size of 5 to 160 acres should be specified for each agricultural zone.
- The County should encourage all agricultural landowners to enter open space agreements.
- The County should support all State and federal legislation designed to preserve soil and agricultural land

Note: A draft Agricultural element for the General Plan is currently under review for adoption by the County Board of Supervisors.

Timberlands in the county are addressed with the following policies:

- Studies should be conducted to determine the multiple-use capabilities of forested areas.
- The County should determine the forest areas which are to remain in the various open space classifications and designate them on the Land Use Plan Map.
- The County should not allow in timber-mountain areas the construction of any roads or buildings which are not necessary to open space uses.
- Logging practices should be studied and regulated to preserve the land’s potential for timber production.

- The County should encourage the owners of timberland to enter open space agreements.
- Studies should be conducted to determine the erosion characteristics of mountain watersheds in the County.
- No urban development should be permitted on highly erodible land.
- Logging, mining, recreational vehicles and other open space uses should be regulated to prevent erosion and protect water resources.
- The County should control land use and water pollution in accordance with State water quality control guidelines.

Wildlife policies in the county general plan are:

- The County should encourage the creation and expansion of conservation and natural wilderness areas.
- The County should regulate residential development in the foothills to facilitate the survival and migration of deer herds.
- The County should not allow any urban development in the Butte Sink area, the marshes near the Sacramento River and the borrow area along Feather River.
- The County should not allow any urban development which would increase sediment loads in prime fishing waters.

Outdoor recreation policies are as follows:

- The County should financially or politically assist the development of recreation facilities commonly used by people outside the City or district.
- The Butte County Association of Governments should coordinate the distribution of State and federal grants to local recreation agencies.
- The County should encourage the State Department of Parks and Recreation to complete their development of recreational facilities in the Lake Oroville State Recreation Area.
- The Recreation Element should be revised by updating the description of existing facilities, by estimating future needs, and by designating suitable sites for future development.
- The County’s scenic corridors should be analyzed and a Scenic Highways Element prepared.

- The County should encourage the development of suitable private and commercial outdoor recreational areas, especially campgrounds and off-road vehicle areas.

- The County should not allow urban development in designated flood plains.

- Areas of unstable soil, earthquake faults and high fire risks should be located, studied and mapped as a guide to the use of such lands.

4.4.3 Chico General Plan

The City of Chico General Plan contains 11 elements that address the County's goals, objectives and policies for decision-making within the city limits. These elements include Land Use, Circulation, Housing, Conservation, Open Space, Seismic Safety, Safety, Noise, Scenic Highways, Recreation and Agriculture. The elements that are relevant to this report are described below.

The City of Chico adopted an updated and revised General Plan on November 16, 1994. The following policies are found in the "**Guiding Policies: Growth and Physical Expansion**" chapter of the Chico General Plan:

- Promote orderly and balanced growth by working with the County and LAFCO to establish long-term growth boundaries for the Planning Area consistent with Plan objectives.

- Promote in-fill development.

- Ensure that new development is at an intensity to ensure a long-term compact urban form.

- Maintain long-term boundaries between urban and agricultural use in the west, and urban uses and the hillside in the east, and limit expansion north and south to maintain compact urban form. Multiple approaches to restrict urbanization outside the City's sphere of influence will be used, including large-lot zoning, and possibly acquisition of land for a greenbelt.

4.4.3.1 Community Design Element (CD)

CD-G-10 Heighten the visual prominence of the creek corridors that help to establish a sense of orientation and identity within the City.

CD-G-11 Open up creeks to public view and access.

CD-G-12 Extend the amenity value of creeks.

CD-G-12 Within the developed core of the city, diminish the barrier effect of the creeks.

D-I-6 Adopt design guidelines for development adjacent to creeks.

4.4.3.2 Parks and Public Facilities and Services

Use the creeks as a framework to provide a network of open space.

4.4.3.3 Open Space (OS) and Environmental Conservation

OS-G-5 Protect habitats that are sensitive, rare, declining, unique, or represent valuable biological resources in the Planning Area. These include Resource Conservation and Resource Management areas identified in Figure 7-1 of the Chico General Plan.

OS-G-7 Minimize impacts to sensitive natural habitats throughout the Planning Area.

OS-G-8 Preserve and protect areas determined to function as regional wildlife corridors, particularly those areas that provide natural connections permitting wildlife movements between sensitive habitats and areas being considered for future conservation because of their high value.

OS-G-9 Provide for no net loss of overall wetland acreage; where such losses may be unavoidable at the project level, require mitigation that meets the no net loss goal.

OS-I-15 Protect and preserve areas identified for Resource Conservation in Figure 7-1, and amend the Zoning Ordinance to include a Resource Conservation zoning district and habitat protection standards, particularly buffering, for sites abutting Resource Conservation Areas. [There are several implementation policies that apply to Resource Conservation Areas and Resource Management Areas. These designated areas on the Chico General Plan Land Use Diagram are generally located adjacent to creeks and the associated riparian habitat area or where known wetlands and/or special status species are present.]

OS-I-18 Explore and implement, where feasible, linking Resource Conservation Areas with interconnecting open space corridors, particularly those which provide access to water sources, and enhance overall biological diversity of the resource area.

OS-I-20 Explore and implement, where feasible, means to minimize or avoid Interference with sensitive wildlife on the urban fringe by domestic pets.

OS-I-21 Ensure that all new developments restrict the use of fencing in locations essential for wildlife movement and place structures so as to minimize interference with wildlife corridors.

OS-I-22 Ensure that open space corridors along creeks include protective buffers (non-development setbacks), preserve existing riparian vegetation through the environmental review process, and continue to require a minimum of 25-foot dedication and acquisition of 75 feet for a total of 100-foot setback from top-of-bank along creeks.

OS-I-35 Work with the California Department of Fish and Game to ensure the preservation and enhancement of species of resident and anadromous fish in creeks in the Planning Area. Maintain hillsides and viable agricultural lands as open space for resource conservation and preservation of views.

OS-G-16 Where feasible, integrate creek-side greenways with the City's open space system and encourage public access to creek corridors.

OS-G-17 Protect aquifer recharge areas needed to maintain adequate groundwater supplies.

OS-G-18 Maintain oak woodlands and habitat for sensitive biological resources as open space for resource conservation/resource management.

4.4.3.4 Water Quality

OS-G10 Enhance the quality of surface water resources of the Planning Area and prevent their contamination.

OS-G-11 Comply with the Regional Water Quality Control Board's regulations and standards to maintain and improve groundwater quality.

OS-G-12 Where feasible, given flood control requirements, maintain the natural condition of waterways and flood plains and protect watersheds to ensure adequate groundwater recharge and water quality.

OS-I-36 Continue to work with the Central Valley Regional Water Quality Control Board and Butte County Environmental Health Department in the implementation of the Nitrate Action Plan and land use controls for the protection of groundwater quality and the foothill primary recharge area.

OS-G-15 Preserve and enhance Chico's creeks and the riparian corridors adjacent to them as open space corridors for the visual amenity, drainage, fisheries, wildlife, habitats, flood control and water quality value.

4.4.3.5 Transportation (T) (reduction of impervious surfaces)

T-I-32 Adopt street standards that provide flexibility in design, especially in residential neighborhoods. Revise right-of-way and pavement standards to reflect adjacent land use and/or anticipated traffic, and permit reduced right-of-way dimensions where necessary to maintain neighborhood character.

T-I-45 Reduce the overall amount of land devoted to parking by encouraging shared parking and examining reduction of parking requirements that apply to individual uses for mixed-use developments.

T-I-52 Investigate opportunities for shared parking facilities whenever possible to reduce the number of new parking stalls required.

4.4.3.6 Safety and Safety Services (S) - Flooding and Dam Inundation

S-G-1 Minimize threat to life and property from flooding and dam inundation.

S-I-1 As part of project review, ensure that structures subject to the 100-year flood provide adequate protection from flood hazards.

When considering areas for future urban expansion ensure that impacts for flooding are adequately analyzed. In designing flood control facilities, consider the need to protect anadromous fisheries and allow for adequate water passage to ensure the survival of downstream riparian ecosystems.

4.5 ZONING AND SUBDIVISION REGULATION

4.5.1 Planning and Permit Procedures

Most land use changes within the county usually are in the form of development proposals. If the proposed development or land use change is in conformance with the County General Plan and the County zoning code the proposal is evaluated by county staff and administratively approved or reviewed by the planning commission. The reviews include an environmental assessment that may be in the form of an Initial Study or an Environmental Impact Report. This environmental review of a proposed land use change is the most common and most effective way of assessing effects on the creek, the watershed or its related resources.

Two major considerations in local project review, particularly in the Little Chico Creek watershed are compliance with County policy regarding the East Tehama Deer Herd and the proposed USFWS designation for vernal pool critical habitat. The East Tehama Deer Herd was discussed earlier in Section 2.6.2. The Butte County General Plan includes a policy proposed by the California Department of Fish and Game which basically requires a development density of one housing unit per 40 acres (and in some cases, 20 acres).

The Butte County Planning Division, GIS Section, has created Critical Habitat Maps from data prepared by the State Department of Water Resources. Of the 15 critical habitats, Butte County has nine. They are available through the Planning Division. Also available are maps prepared by the California Department of Fish and Game. The Little Chico Creek Watershed is included in this map set. The Butte County Agricultural Commissioner’s Office also has a Pesticide Regulations Endangered Species Map that can be reviewed by the public.

The US Fish and Wildlife (USFWS) Service has developed maps of a Proposed Vernal Pool Critical Habitat. The LCCW intersects a portion of this critical habitat occurring within Butte County. Under the Federal Endangered Species Act, the USFWS is the agency responsible for designation of critical habitat, which “refers to specific geographic areas that are essential for the conservation of threatened or endangered species and may require special management considerations” (http://sacramento.fws.gov). This designation requires all agencies to “consult with the (USFWS) before taking actions, issuing permits or providing funding for activities that might affect critical habitat” (http://sacramento.fws.gov).

“The listed species for which critical habitat is being proposed include four types of freshwater shrimp -- the Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool tadpole shrimp and vernal pool fairy shrimp; and 11 plants -- the Butte County meadowfoam, hairy orcutt, slender orcutt, San Joaquin Valley orcutt, Sacramento orcutt, Solano grass, Greene's tuctoria, Colusa grass, succulent (or fleshy) owl's clover, Hoover's spurge and Contra Costa goldfields.” (http://sacramento.fws.gov).

All proposed land use changes within the mapped critical habitat areas will likely be required to include a field based biological study of the area as part of the project environmental assessment (NEPA/ CEQA) process. Raptor surveys, wetlands delineations, and cultural resources studies may also be required by City and County development procedures.

According to the Butte County General Plan, it is likely that the Little Chico Creek watershed contains sensitive archeological and cultural resources. The General Plan contains policies to protect these sites and contains a large scale map which depicts areas that may contain “low,” “medium” or “highly” sensitive archeological and cultural resources. The Planning Division’s GIS data base contains information on specific parcels. Development projects located in “high” or “medium” sensitivity areas are referred to professional archaeologists for study and review. Protective measures (usually avoidance) are incorporated into the project.

As stated earlier, the general plan is the primary basis for making major land use decisions. If an area of Little Chico Creek is being considered for development, for increased resource protection, or for a land use change, the landowner or the county can initiate a zoning amendment and/or a general plan amendment to include the appropriate action. A property owner or citizen group can initiate a general plan amendment by petitioning the governing body. In lieu of a general plan amendment, a specific plan may be prepared by the lead agency which usually includes a detailed land use program along with an appropriate environmental review of the program. Use of a Planned Development zoning designation within the zoning ordinance is also a way to initiate planned land use changes into the decision-making system. All project approvals normally also include requirements to conform to local development standards and Best Management Practices when working near streams.

After the proposed land use change (usually in the form of a development proposal, a general plan amendment or a zoning action) has been initiated a public hearing is held by the planning commission on the proposed action and notice is given to the public. Environmental impact review of the project usually takes place concurrently with the project approval process. The planning commission then submits a report of its findings, a summary of the administrative record and recommendations to the governing body. The Board of Supervisors then makes a decision based on the planning commission’s recommendations and the policies and implementation measures detailed in the General Plan.

The land use decision-making process for areas within the City’s jurisdiction are similar to those in the County. All proposals for land use changes are reviewed by City staff, particularly for environmental compliance, and then are given to the Planning Commission and/or the City

Council for evaluation and a decision for or against the proposed project. Both City and County zoning ordinances and development standards and Best Management Practices include creek protection measures such as setbacks from the banks, provisions for erosion control and limitations of some activities within stream corridors.

4.5.2 Agency Permits

In addition to local agency "entitlements" for land use changes there are state and regional agencies that regulate California resources on a local project-by-project basis. For example, the **Regional Water Quality Control Board** is responsible for the protection of beneficial uses of water resources within the Central Valley Region. It uses planning, permitting and enforcement authorities to meet this responsibility. RWQB administers a storm water permitting program in the Central Valley region. Construction activities of five acres or more are subject to the permitting requirements. The project applicant must submit a Notice of Intent to the RWQCB to be covered by the *General Construction Permit* prior to the beginning of construction. Issuance of the permit requires the preparation and implementation of a Storm Water Pollution Prevention Plan which must be approved before construction begins. Further, The California *Water Code* provides the basis for water quality regulation within California. The law requires that a *Report of Waste Discharge* be filed with the RWQCB for any discharge of liquid or solid waste to land or surface waters that may impair a beneficial use of surface or ground water of the state. The RWQCB then issues *Waste Discharge Requirements* for that discharge.

The **California Department of Fish and Game** regulates work that will substantially affect resources associated with rivers, streams, and lakes in California pursuant to the *Fish and Game Code.* Authorization, known as a *Lake or Streambed Alteration Agreement*, is required for projects prior to any action that substantially diverts, obstructs, or changes the natural flow of the river, stream or lake or uses material from a streambed.

Section 404 of the federal *Clean Water Act* requires that a permit be obtained from the **U.S. Army Corps of Engineers** for the discharge of dredged or fill material into "waters of the United States" including wetlands. Section 10 of the *Rivers and Harbors Act* prohibits the unauthorized obstruction or alteration of any navigable waters of the United States without a permit from the Corps. Where applicable, the Corps combines the permit requirements of

Section 10 with those of Section 404 under one permit application. Section 401 of the *Clean Water Act* requires that state water quality standards not be violated by the discharge of fill or dredged material into the waters of the United States. The U.S. Army Corps of Engineers will not issue a Section 404 permit until the state, through the **California State Water Resources Control Board** and RWQCB has issued a *Certification (or waiver of certification) of Compliance* with state water quality standards.

Section 7 of the federal *Endangered Species Act* requires federal agencies in consultation with the **U.S. Fish and Wildlife Service** and **National Marine Fisheries Service**, to insure that their actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of these species. Section 10 of the *ESA* applies to those projects with no federal involvement that require an “incidental take” permit. An example of this process is the USFWS’s necessity for a Section 7 consultation and a Habitat Conservation Plan for dealing with the occurrence of blue elderberry (*Sambucus mexicana*) shrubs on lands considered for development.

The **Federal Emergency Management Agency** among other responsibilities prepares maps of potential flooding in local areas including the LCCW. Information on floodplain mapping can be obtained at the FEMA web-site (www.fema.gov). Revised floodplain maps for Butte County were issued by FEMA for most of Butte County in 1998. Four updated maps in the vicinity of Chico were later released in 2000. With these updates, the 100-year flood boundary changed in the City of Chico. The boundary expansion caused residents in some neighborhoods to be required to pay for flood insurance for the first time. Digital floodplain map data is not yet available on-line for Butte County. FEMA floodplain maps for the Chico Urban Area are available for public review at the City of Chico Community Development Department. Note that this is a change from the map repository agency listed on the FEMA web-site.
For unincorporated areas, FEMA floodplain maps are available for public review at the Land Development Division in the Butte County Public Works Department. These maps are updated periodically as new data becomes available or conditions in the water change that could influence flood phenomena. Both the City and County require special consideration of flood hazards in their project review and approval processes.

Finally, the **State Reclamation Board** issues encroachment permits to maintain the integrity and safety of flood control project levees and floodways that were constructed according to the flood control plans adopted by the Board or the California Legislature.

4.6 RECENT AND CURRENT LAND USE ISSUES

Stakeholders and decision makers in the Little Chico Creek watershed should be aware of the following land use matters that may have effects on the creek or its environs.

4.6.1 Humboldt Road Burn Dump

The Humboldt Road Burn Dump is located within the City of Chico's city limits, east of Bruce Road and South of State Highway 32 near Stilson Canyon Road. Land uses immediately surrounding the burn dump are primarily open rangeland, with low density residential and public services in the distance. The principle drainage of the site, Dead Horse Slough, runs into Little Chico Creek and on through the Chico Urban Area.

An early study of the site was the Humboldt Road Restoration Project Draft Environmental Impact Report prepared for the City of Chico in 1997 by EDAW Inc. In May 1998 Metcalf and Eddy Inc. prepared an updated environmental restoration plan for the Humboldt Road Burn Dump. The findings of this study are summarized in section 3.2.3 of this document.

A *Draft Environment Impact Report (EIR) for the Oak Valley Conceptual Master Plan* for the 43-acre portion of the subdivision in the Humboldt Road Burn Dump vicinity was conducted in April 2000. The project proposal is to develop a 43-acre into mixed density residential use and a conceptual development plan for the future development of 340 acres. The Draft EIR identified the following impacts as unavoidably significant after mitigation measures have been incorporated into the project:

- 4.4-1 Construction of the project would generate criteria air pollutants, which exceed the Butte County Air Quality Management District (BCAQMD) ambient air quality standards.

- 4.4-2 The project‘s total long-term operational activities would violate state and BCAQMD's adopted air quality standards.

- 4.4-6 The project, in combination with build-out of the General Plan, would contribute to cumulative demand on existing water supply sources.

- 4.8-7 The project would contribute to the cumulative loss and degradation of foothill woodland, grassland, and riparian habitat supporting native plants and wildlife

- 4.9-1 The project would convert undeveloped landscape to urban development

- 4.9-2 The project would alter views visible from surrounding areas, including State Route 32, Humboldt Road, and the bike trail along Little Chico Creek.

- 4.9-4 Development of the project, in combination with other cumulative development, would alter existing views and the visual character of the City of Chico.

In January 2002 EMKO Environment Inc. completed a feasibility study report for the Humboldt Road Burn Dump. This study examined alternatives for clean up measures. The recommended alternative was excavation with disposal in an onsite, Title 27 of the Hazardous Waste Disposal Guidelines, equivalent disposal cell.

A *Health Risk Assessment*, published by the City of Chico in October 2002, analyzes how chemicals in the dump might be dispersed in dust raised by clean up activities. The State Department of Toxic Substances Control and Regional Water Quality Control Board recommend consolidation of contaminated material on 20 acres of the dump site, then sealing it with an impermeable cap. (*Enterprise Record* (October 20, 2002 pp A1 and A11). The City of Chico is considering clean up options at the time of publication of this existing conditions report (*Enterprise Record*, October 29, 2002 pp. 1A and 10 A).

4.6.2 Husa Ranch

Hignell & Hignell Inc. is currently developing the Husa Ranch into Sky Creek Research Park. All required environmental studies were completed and approved by the City of Chico. Borcalli and Associates conducted a *Flood Mitigation Analysis* which was also accepted by the City and will be used to guide development of the project area flood plain which is also located within County jurisdiction and is within the 50 year FEMA flood zone for Little Chico Creek.

4.6.3 M&T Ranch Gravel Mine

The 23.5-acre project is a proposed long-term off-channel mining operation located between Little Chico Creek and Comanche Creek. The land under consideration is 1 ½ miles east of the Sacramento River and about 5 miles southwest of Chico on the M & T Ranch. Baldwin Contracting Company is proposing the mining operation. After the gravel is removed over a 20-year period, the depression in the landscape will be made into aquatic habitat. Potential significant and unavoidable environmental impacts identified in the September 2002 Draft EIR are in the areas of traffic and air quality. The document also includes an extensive assessment of the project's impact on water quality and flooding. The updated Draft EIR for this project is on the County's website at: www.buttecounty.net/dds.

4.6.4 Deer Creek Rock Gravel Mine

A small five-acre gravel mining operation near Highway 32 at Old Humbolt Road was approved for the Deer Creek Rock Company in 2002. It has not yet commenced operation. County environmental review of the project indicated that all potential significant adverse impacts would be mitigated to a less than significant level.

4.6.5 Teichert Pond

Teichert Pond is described in section 2.1,3 of this document. It has been of some concern to the City of Chico because drainage from surrounding land development has added to the groundwater filled basin and outfall into Little Chico Creek has been hampered by inefficient drain pipes and the work of local beavers. Over the past three years, the City of Chico has focused increasing attention on these management issues. Concerns over urban stormwater management have prompted the City of Chico to begin development of a management plan for water quality and aquatic habitat. During the Summer 2002, the City hired a consulting firm, Jones and Stokes, to monitor pond water levels and various water quality constituents, including nitrates, phosphates, dissolved oxygen, pH, and temperature. The resident flora and fauna will also be surveyed. Following this monitoring plan, a restoration management plan will be developed to guide future use of the area.

4.7 EXISTING LAND USE

The Land Use Maps (Figure 4.1a and 4.1b) were created by California State University, Chico's Geographic Information Center. The map illustrates the diversity of land uses in the watershed. These uses include commercial, dry farming, industrial, misc. agriculture, field and row crops, forestry, orchards, grazing, irrigated pasture, rice farming, residential and unknown.

The three largest land uses are grazing, orchards and residential uses (Table 4.1). The primary land use within the Little Chico Creek watershed is agricultural. The watershed consists of 54,774.1 acres of various agriculture uses. Orchards occupy the largest amount of land within the Little Chico Creek watershed (approximately 18%). Residential uses contribute to approximately 17% and grazing land contributes to approximately 10 % of the land uses within the watershed.

The landowners both private and public are fragmented along Little Chico Creek. Tables 4.2 and 4.3 list the 10 largest landowners along Little Chico Creek. Parrott Investments Co. is the largest private property owner within the watershed.

5 FINDINGS

5.1 FUTURE NEEDS, MONITORING AND POTENTIAL RESTORATION

Mapping of potential restoration areas in the watershed is limited in two ways. First, the watershed encompasses a significantly larger area than has been evaluated during the stream survey, which focused on the creek itself and its riparian vegetation. Second, limited access to survey in the upper watershed (Mountain and Canyon Zones) and the lower watershed, (Agriculture Zone) has resulted in an incomplete survey of the entire watershed. Given the above limitations, the Urban Zone and its gradation into the Agriculture Zone have the greatest known need for restoration. This is due to the domination by exotic vegetation, lack of riparian overstory vegetation, and copious amounts of in-stream trash (Figure 2.17). For the purposes of this project, the term "restoration" will be used to refer to any level of restoration from simply cleaning the creek of trash to actively removing exotic vegetation and replanting with native species.

In the Mountain and Canyon Zones, fire was formerly a regular occurrence, keeping the vegetation relatively open. Fire suppression and logging have resulted in both an increase and a redistribution of fuel that greatly raise the potential for large, destructive fires. Construction of many homes in these zones has further exacerbated the problem. Some form of fuel control program is essential.

Roads constructed for logging, ranch or homesite access have altered the drainage pattern of the creek, generally moving precipitation to the creek faster and increasing erosion, siltation, and flood potential while decreasing summer base flow for fish habitat. Future road construction should minimize cutting hillslopes and incorporate outslopes and rolling dips to return water to the undisturbed land surface. Existing roads could be retrofitted with waterbars. Water movement through eroding gullies could be slowed with rock checkdams and addition of woody debris.

Additionally, the Canyon Zone has potential effects from grazing and grazers in the riparian vegetation. A review of these lands and their grazing program(s) to share creek and riparian friendly practices, could be beneficial.

In the Urban Zone, a major problem is pollution and litter accumulation from material carried by storm drains. A campaign to educate citizens about the value of creeks and the function of storm drains as tributaries might be helpful. A great deal of litter also accumulates from homeless people using the riparian area for campsites. Providing a year-round shelter would be a humane approach to lessening this problem. There are likely several other sources of litter in the creek. LCC Watershed Group (LCCWG) continues to work with Butte Environmental Council on creek cleanups. LCCWG is part of Chico Urban Streams Alliance (CUSA), which has submitted a grant titled the Chico USA Clean Creeks Project. The five elements of the project are: public education and outreach, Best Management Practice effectiveness evaluation, stream monitoring, and a water quality data website. Should this program be funded it could go a long way to helping LCC and other Chico waterways.

Introduced plant species have been noted due to their significant effect on the ecology of a watershed. Each species will differ on its specific effect but the range of effects result in the out-competing of native plants. Invasive introduced plants are a serious problem in all but the Mountain Zone (Table 5.1). Removal of these introduced plants will take well-planned comprehensive programs involving willing landowners and agencies from all levels of government.

It is not surprising that the Aquatic Macroinvertebrate Assessment showed impaired water quality in the Urban and Agricultural Zones even though chemical analysis found no significant problems. The aquatic macroinvertebrate bioassessment integrates all the events that have happened to the creek within the lifetime of the surviving fauna. Occurrence of any detrimental conditions within that time will have depressed or eliminated populations of sensitive organisms, reducing competition for the tolerant species and depressing diversity. Fish, being more mobile, are not as easily related to impaired water quality as invertebrates, but the fish data show a similar loss in diversity through the City of Chico. Chemical water quality assessment looks at a few parameters at a few points in time and can easily miss short term peaks of pollutants or unusual pollutants. However, one must keep in mind that the natural stressors of decreased permanence of flow and increased temperature become more severe as the creek flows from the canyon across the valley floor so some decrease in diversity is to be expected even in the absence of pollution. Still, if these natural stressors were the only forces at work, conditions would have continued to deteriorate in a downstream direction rather than slightly improving as the data indicate.

5.2 FUTURE WATER QUALITY MONITORING NEEDS

The relevant water quality constituents that should be addressed in future monitoring are:

- bacterial (total and fecal coliform) sources
- other pathogens including *Cryptosporidium* and *Giardia*
- pesticides
- suspended sediment and turbidity
- total petroleum hydrocarbons (including oil and grease)
- priority gasoline oxygenates,
- volatile and semi-volatile organic compounds
- biological and chemical oxygen demand
- toxicity bioassays and fish tissue analysis for toxic substances

Rapid Bioassessment Protocols consistent with methods developed by the California Department of Fish and Game (CDFG) should also be employed with laboratory identification to the genus level. Periodic monitoring on a three to five-year schedule should be conducted for potential changes in metals, nutrients, dissolved oxygen, pH, and temperature. The Surface Water Ambient Monitoring Program (SWAMP) recently initiated by the California State Water Resources Control Board should provide an opportunity for regular systematic sampling of Little Chico Creek. Urban water quality sampling by the City of Chico will also likely become more frequent as the city grows and new regulatory requirements are imposed by State and/or Federal agencies. The City of Chico is currently applying for funding to conduct systematic sampling of all Chico urban creeks.

5.3 INTEGRATION OF THIS REPORT IN FUTURE LAND USE PLANNING

It is recommended that future environmental impact studies carried out by Butte County or the City of Chico for development projects contain reference to watershed existing conditions reports, such as this document, and watershed management strategies developed by citizen groups and agencies.

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http:// www.dfg.ca.gov/cabw/protocols.html - California Stream Bioassessment Procedures (CSBP) documentation available from the California Department of Fish and Game

http://www.fws.gov - US Fish and Wildlife Service website

http://sacramento.fws.gov – Sacramento office of the US Fish and Wildlife Service website

Table 1.1 Results of the Stakeholder Survey of Issues and Concerns

	IMPORTANCE		
Issue or Concern	***High***	***Moderate***	***Low***
Water pollution sources and effects	50	13	1
Urban pesticides	41	20	5
Agricultural pesticides	33	26	7
Teichert Ponds	25	26	13
Humboldt dump site	30	23	8
Possible restrictions on farming practices	19	26	22
Dumping of garbage in the watershed	46	14	3
Trespassing	12	20	36
Non-native plants	19	30	16
Proposed gravel pit/aggregate mines	39	12	12
Homeless encampments and water pollution	28	25	13
FEMA mapping of flood zones in Chico	17	21	28
Little Chico Creek flood capacity and diversions	20	28	20
Fish	32	28	6
LCC watershed boundaries	13	32	17
Year-round flow status of LCC	16	28	15
Organization issues: "Stakeholder" definition; voting by stakeholders	16	24	22

NOTE: There were 69 Surveys returned

Table 2.1 Peak flows at Little Chico Creek gage sites

	Station			
Year	**Taffee Road (A04270)**	**Near Chico (A04280)**	**Diversion (A04910)**	**Total (A04280 + A04910)**
1959	NR	DU	DU	DU
1960	NR	DU	DU	DU
1961	NR	DU	DU	DU
1962	NR	1,150	233	1,383
1963	NR	DU	DU	DU
1964	NR	DU	DU	DU
1965	NR	1,790	1,204	2,994
1966	NR	915	-	915
1968	NR	908	-	908
1969	NR	1,450	ID	1,450
1970	NR	1,570	ID	1,570
1971	NR	DU	DU	DU
1972	NR	DU	DU	DU
1973	NR	DU	DU	DU
1974	NR	DU	DU	DU
1975	NR	DU	DU	DU
1976	NR	DU	DU	DU
1977	NR	DU	DU	DU
1978	NR	1,730	1,460	3,190
1979	NR	1,050	108	1,158
1980	NR	1,280	950	2,230
1981	NR	764	-	764
1982	NR	1,300	556	1,856
1983	NR	1,330	649	1,979
1984	NR	1,220	664	1,884
1985	NR	478	-	478
1986	NR	1,230	**733**	1,963
1987	NR	1,090	**485**	1,575
1988	NR	418	-	418
1989	NR	1,380	**943**	2,323
1990	NR	231	-	231
1991	968	660	-	660
1992	1,230	669	-	669
1993	1,690	1,050	**925**	1,975
1994	587	545	-	545
1995	2,330	1,640	**1,030**	2,670
1996	1,260	1,160	**595**	1,755
1997	2,400	NR	**1,410**	NE
1998	2,670	NR	NR	NE
1999	1,350	NR	NR	NE
2000	1,650	NR	NR	NE

NOTES: Flows in cubic feet per second (cfs)
NR - No flow records available
DU - Data currently unavailable
ID - Insufficient data to estimate flow
Flows in bold were estimated due to debris accumulation at diversion
NE - Total flow not estimated due to missing data at main channel gage

Table 2.2. Vegetation data collected approximately 2 kilometers upstream of the end of Blackberry road as an example of Mountain Zone vegetation. Native species are in **bold.** Species with an asterisk (*) were obvious in the understory as well. Nomenclature follows the Jepson Manual (1993).

Common Name	Scientific Name	Estimated Abundance
Canopy species		
big-leaf maple*	***Acer macrophyllum***	common
white alder	***Alnus rhombifolia***	less common
Pacific madrone	***Arbutus menziesii***	less common
Douglas-fir	***Pseudotsuga menziesii***	less common
canyon live oak	***Quercus chrysolepis***	less common
interior live oak	***Quercus wislizenii***	less common
incense cedar*	***Calocedrus decurrens***	less common
hazelnut	***Corylus cornuta***	uncommon
Pacific ponderosa pine	***Pinus ponderosa***	uncommon
Sub-canopy species		
dogwood*	***Cornus sessilis***	common
Oregon ash*	***Fraxinus latifolia***	less common
California bay	***Umbellularia californica***	less common
pacific yew*	***Taxus brevifolia***	less common
California nutmeg*	***Torreya californica***	less common
Understory woody species		
spicebush	***Calycanthus occidentalis***	less common
Himalyan blackberry	*Rubus discolor*	less common
red elderberry	***Sambucus racemosa***	less common
vine maple	***Acer circinatum***	less common
cut-leaved blackberry	*Rubus laciniatus*	uncommon
California blackberry	***Rubus ursinus***	uncommon
western poison oak	***Toxicodendron diversilobum***	uncommon

Table 2.3. Occurrence of introduced plant species (predominantly woody) identified in survey samples by zone. Nomenclature follows the Jepson Manual (1993).

Common Name			**Zone**			
Trees	**Scientific Name**	**Family**	**Mountain**	**Canyon**	**Urban**	**Agriculture**
silver maple	*Acer saccharinum*	Aceraceae			x	x
pistachio	*Pistacia atlantica*	Anacardiaceae			x	
date palm	*Phoenix* species	Arecaceae			x	
northern catalpa	*Catalpa speciosa*	Bignoniaceae			x	x
black locust	*Robinia pseudoacacia*	Fabaceae	x	x	x	x
honey-locust	*Gleditsia triacanthos*	Fabaceae			x	x
pecan	*Carya illinoinensis*	Juglandaceae			x	
English walnut	*Juglans regia*	Junglandaceae			x	x
white mulberry	*Morus alba*	Moraceae			x	x
eucalyptus species	*Eucalyptus* species	Myrtaceae			x	x
olive	*Olea europaea*	Oleaceae			x	
privet species 1	*Ligustrum* species1	Oleaceae			x	x
privet species 2	*Ligustrum* species2	Oleaceae			x	
American sycamore	*Platanus occidentalis*	Platanaceae			x	
London planetree	*Platanus x acerifolia*	Platanaceae			x	
sycamore hybrid	*Platanus* hybrid	Platanaceae			x	x
almond	*Prunus dulcis*	Rosaceae			x	x
tree of heaven	*Ailanthus altissima*	Simaroubaceae			x	x
elm	*Ulmus* species	Ulmaceae			x	
persimmon	*Diospyros* species	Ebenaceae			x	
goldenrain tree	*Koelreuteria paniculata*	Sapindaceae			x	
Shrubs						
oleander	*Oleander* species	Apocynaceae			x	
heavenly bamboo	*Nandina domestica*	Berberidaceae			x	
manzanita species (horticultural var.)	*Arctostaphylos* species	Ericaceae			x	
spanish broom	*Spartium junceum*	Fabaceae		x		
edible fig	*Ficus carica*	Moraceae		x	x	x
lilac	*Syringa vulgaris*	Oleaceae			x	
Himalyan blackberry	*Rubus discolor*	Rosaceae	x	x	x	x
cut-leaved blackberry	*Rubus laciniatus*	Rosaceae	x			
firethorn	*Pyracantha angustifolia*	Rosaceae			x	
Vines						
English ivy	*Hedera helix*	Araliaceae			x	
Herbs					x	
giant reed	*Arundo donax*	Poaceae			x	x
star thistle	*Centaurea solstitialis*	Asteraceae			x	x

Table 2.4. Vegetation data collected at the end of Ten Mile House Trail as an example of upper canyon zone vegetation. Native species are in bold. Species with an asterisk (*) were obvious in the understory as well. Nomenclature follows the Jepson Manual (1993).

Common Name	**Scientific Name**	**Estimated Abundance**
Canopy species		
big-leaf maple*	***Acer macrophyllum***	common
blue oak*	***Quercus douglasii***	common
canyon live oak*	***Quercus chrysolepis***	common
interior live oak*	***Quercus wislizenii***	common
Oregon ash*	***Fraxinus latifolia***	common
white alder*	***Alnus rhombifolia***	common
foothill pine	***Pinus sabiniana***	less common
valley oak	***Quercus lobata***	less common
black locust*	*Robinia pseudoacacia*	less common
California black oak*	***Quercus kelloggii***	less common
Goodding's black willow*	***Salix gooddingii***	less common
incense cedar*	***Calocedrus decurrens***	less common
Pacific ponderosa pine*	***Pinus ponderosa***	less common
western sycamore*	***Platanus racemosa***	less common
California black walnut*	***Juglans californica* var.*hindsii***	uncommon
Sub-canopy species		
California bay	***Umbellularia californica***	common
California buckeye	***Aesculus californica***	common
dogwood*	***Cornus sessilis***	less common
plum/cherry species*	*Prunus* species	uncommon
Understory woody species		
Himalyan blackberry	*Rubus discolor*	common
honey suckle	*Lonicera* species	common
western poison oak	***Toxicodendron diversilobum***	common
hoary coffeeberry	***Rhamnus tomentella***	less common
spicebush	***Calycanthus occidentalis***	less common
toyon, Christmas berry	***Heteromeles arbutifolia***	less common
willow species 1	*Salix* species 1	less common
red elderberry	***Sambucus racemosa***	uncommon
red willow	***Salix laevigata***	uncommon
wild mock orange	***Philadelphus lewisii***	uncommon
California rose	***Rosa californica***	uncommon
Vines		
California wild grape	***Vitis californica***	less common
pipevine	***Aristolochia californica***	less common
virgin's bower	***Clematis ligusticifolia***	uncommon

Table 2.5. The total number of woody species (species richness) sampled in the riparian corridor of each zone. Native and introduced species richness are shown as well. Note that the later two do not sum to the total as any unknown species could not be classified as native or introduced.

	Species richness		
Zone	**Total**	**Native**	**Introduced**
Mountain	47	38	3
Canyon	43	36	4
Urban	61	29	29
Agricultural	40	26	13

Table 2.6. Bird species abundance, richness, and diversity in the Little Chico Creek riparian corridor of each zone. Data were collected at 19 point count stations in June 2002, Little Chico Creek, Butte County, CA.

Zone	**No. of Point Count Stations**	**Total No. of Individuals**	**Species Richness**	**Shannon-Weiner Species Diversity Index**
Mountain	4	118	28	1.49
Canyon	3	127	35	1.63
Urban	5	73	17	1.11
Agriculture	7	326	40	1.19
LCC Riparian Corridor	19	644	69	1.69

Table 3.1. Constituents measured for the LCCWQP monitoring program

Parameter
Fecal Coliform
Total Coliform
Trace Metals
Arsenic (As)
Cadmium (Cd)
Chromium (Cr)
Copper (Cu)
Lead (Pb)
Mercury (Hg)
Nickel (Ni)
Selenium (Se)
Silver (Ag)
Zinc (Zn)
Nutrients
Nitrite as NO_2_N
Nitrate as NO_3_N
Ammonia as NH_3
Orthophosphate as PO_4
Total phosphorus as P

Table 3.2. Water quality sampling schedule

Pollutant type	Sampling schedule	Station		
		Stilson Canyon: Above Chico urban area (LCCA)	Pomona Avenue: Below Chico urban area (LCCB)	Ord Ferry Bridge: End of LCC main channel (LCCD)[a]
Pathogens	monthly	x	x	x
Trace metals	event	x	x	
	monthly			x
Nutrients	monthly + event	x	x	x

[a] Lowermost sampling access above significant inflows or mixing with other surface waters.

Table 3.3. Sample handling protocols

Parameter	Sample Container	Sample Volume (1)	Immediate Processing and Storage	Holding Time (2)
Metals				
Mercury, Total	Teflon™	250mL	Store at 4° C; Preserve to ≤ pH 2 with HCl	28 days
Total Metals	Glass	500 mL	Store at 4° C; Preserve to ≤ pH 2 with HNO_3	6 months
Nutrients				
Nitrate, Nitrite, Ammonia	Polyethylene	2 L	Store at 4° C; Preserve to ≤ pH 2 with H_2SO_4	28 days
Ortho-Phosphate	Polyethylene	125 mL	Filtered; Store at 4° C	
Total Phosphate	Polyethylene	125 mL	Unfiltered; Store at 4° C; Preserve to ≤ pH 2 with H_2SO_4	
Pathogens				
Fecal Coliform	Polyethylene	100 mL	Store at 4° C	24 hours
Total Coliform	Polyethylene	100 mL	Store at 4° C	24 hours

(1) Additional volumes may be required for QC analyses
(2) Holding time after initial preservation

Table 3.4. Field Water Quality Monitoring Data by Station

site		date	time	Temp. °C	EC μS/cm	pH	DO mg/L
Schott Rd.		3/21/2002	942	8.0	43	7.71	na
Crown Point Rd.		3/21/2002	1000	10.9	77	7.74	8.02
10-mile House Trail		3/21/2002	1040	10.6	70	7.91	8.23
Stilson Canyon		3/28/2001	1020	15.9	116	8.0	9.6
LCCA		4/24/2001	930	16.2	99	7.8	9.7
		5/18/2001	940	20.4	142	7.9	8.3
	event	10/30/2001	1300	14.9	167	7.9	na
		11/29/2001	1250	9.1	106	7.5	9.4
		12/18/2001	1030	10.6	82	7.4	10.8
		1/15/2002	945	6.1	85	7.3	12.2
	event	2/20/2002	740	10.9	59	7.3	na
		2/28/2002	1130	11.0	70	7.2	10.0
		3/21/2002	1120	12.2	85	8.1	8.3
	event	3/24/2002	1040	10.8	78	8.0	7.8
		4/9/2002	m	14.8	92	7.9	5.8
		5/2/2002	850	13.2	113	7.6	8.9
Pomona Ave.		3/28/2001	1140	18.7	165	8.0	10.8
LCCB		4/24/2001	1015	17.1	128	7.5	9.3
		5/18/2001	1030	20.0	193	7.7	8.6
	event	10/30/2001	1400	15.7	71	7.0	na
		11/29/2001	1220	9.3	131	7.6	9.2
		12/18/2001	1110	10.3	94	6.2	10.3
		1/15/2002	1020	7.8	123	7.1	11.1
	event	2/20/2002	830	11.1	67	7.3	na
		2/28/2002	1230	11.4	85	8.2	11.4
		3/21/2002	1245	13.7	104	8.8	10.7
	event	3/24/2002	1100	11.3	88	8.2	7.9
		4/9/2002	m	14.8	125	7.5	5.3
		5/2/2002	945	16.3	152	6.9	8.0
Alberton Ave.		5/18/2001			dry		
LCCC		10/30/2001			dry		
		11/29/2001	1145	9.4	133.4	8.02	9.15
Ord Ferry Rd.		3/28/2001	1240	18.3	176	7.3	8.5
LCCD		4/24/2001	1100	19.4	129	7.2	7.8
		5/18/2001	ns	ns	ns	ns	ns
	event	10/30/2001	1600	14.9	145	7.1	na
		11/29/2001	1045	8.8	173	7.2	8.0
		12/18/2001	1145	9.6	92	6.9	9.1
		1/15/2002	1110	7.9	146	7.0	9.8
	event	2/20/2002	900	11.5	89	7.2	na
		2/28/2002	1245	13.6	101	8.2	8.9
		3/21/2002	115	14.3	111	8.0	8.2
	event	3/24/2002	1200	12.2	75	7.6	6.5
		4/9/2002	m	16.5	135	7.5	4.9
		5/2/2002	1020	15.6	143	7.3	6.4

NOTES: na - not analyzed
ns - not sampled (dry)
m - missing

Table 3.5. Nutrient Sampling Results

Station		Ammonia @ N mg/L	Nitrate @ N mg/L	Nitrite @ N mg/L	Total Phosphorus @ P mg/L	Ortho Phosphorus @ P mg/L
	MDL	0.05	0.05	0.01	0.02	0.01
Stilson Canyon	3/28/2001	n	n	0.01	n	n
LCCA	4/24/2001	n	n	n	n	n
	5/18/2001	n	0.1	n	n	n
event	10/30/2001	0.09	n	n	0.65	n
	11/29/2001	n	0.29	0.01	0.26	n
	12/18/2001	n	0.17	n	0.18	n
	1/15/2002	n	0.2	n	0.2	n
event	2/20/2002	n	0.08	n	0.27	0.2
	2/28/2002	n	n	n	0.62	0.25
	3/21/2002	n	n	n	0.1	0.32
event	3/24/2002	n	n	n	0.34	0.19
	5/2/2002	0.08	0.05	n	0.26	0.14
Pomona Ave.	3/28/2001	n	0.15	0.01	n	n
LCCB	4/24/2001	n	0.09	n	n	n
	5/18/2001	n	0.25	n	n	n
event	10/30/2001	0.33	0.39	n	0.45	0.26
	11/29/2001	0.05	0.44	0.01	0.17	0.05
	12/18/2001	n	0.27	n	0.09	0.05
	1/15/2002	n	0.43	n	0.14	n
event	2/20/2002	0.05	0.11	n	0.26	0.29
	2/28/2002	n	0.08	n	0.26	0.18
	3/21/2002	n	0.08	n	0.07	0.3
event	3/24/2002	0.07	n	n	0.28	0.24
	5/2/2002	0.06	0.2	0.01	0.13	0.18
Alberton Ave. LCCC	11/29/2001	0.05	0.4	0.01	0.25	0.07
Ord Ferry Rd.	3/28/2001	n	0.06	0.01	n	n
LCCD	4/24/2001	n	n	0.01	n	n
	5/18/2001	ns	ns	ns	ns	ns
event	10/30/2001	0.06	n	n	0.57	0.14
	11/29/2001	0.05	0.41	0.02	0.18	0.08
	12/18/2001	n	0.25	0.01	0.13	0.05
	1/15/2002	0.06	0.48	n	n	n
event	2/20/2002	0.06	0.14	n	0.28	0.22
	2/28/2002	n	0.05	n	0.23	0.26
	3/21/2002	0.05	0.06	n	0.14	0.24
event	3/24/2002	n	0.14	n	0.33	0.25
	5/2/2002	0.05	0.08	n	0.24	0.12

n: not detected at the reporting limit
ns: not sampled/not analyzed

Table 3.6. Metals data by station

Station	Date	Total Cr ug/L	Total Ni ug/L	Total Cu ug/L	Total Zn ug/L	Total Hg ng/L	Total As ug/L	Total Se ug/L	Total Ag ug/L	Total Cd ug/L	Total Pb ug/L
Stilson Canyon	3/28/2001										
LCCA	4/24/2001										
	5/18/2001										
event	10/30/2001	<0.02	0.53	0.94	0.61	3.47	0.639	<0.13	0.002	<0.004	0.082
	11/29/2001										
	12/18/2001										
	1/15/2002										
event	2/20/2002	0.9	0.74	1.02	0.79	2.85	0.173	<0.10	0.003	0.004	0.188
	2/28/2002										
	3/21/2002										
event	3/24/2002	1	0.68	0.75	0.85	62.7	0.039	<0.07	<0.006	<0.003	0.128
	5/2/2002	0.19	0.22	0.25	0.11	0.36	0.241	<0.15	<0.006	<0.003	0.006
Pomona Ave.	3/28/2001										
LCCB	4/24/2001										
	5/18/2001										
event	10/30/2001	2.39	4.05	8.47	40.2	21.3	0.76	0.21	0.017	0.103	5.33
	11/29/2001										
	12/18/2001										
	1/15/2002										
event	2/20/2002	1.23	1.06	1.53	2.55	3.23	0.189	<0.10	0.004	0.009	0.657
	2/28/2002										
	3/21/2002										
event	3/24/2002	1.31	0.945	1.35	2.22	24.7	0.042	0.14	<0.006	0.006	0.431
	5/2/2002	0.2	0.29	0.51	1.09	0.51	0.235	<0.15	<0.006	0.004	0.051
Ord Ferry Rd.	3/28/2001	0.98	1.54	1.62	1.66	1.62	0.394	0.21	0.003	0.008	0.257
LCCD	4/24/2001	1.45	1.5	2.04	2.89	2.12	0.317	<0.09	0.002	0.02	0.638
	5/18/2001					dry					
event	10/30/2001										
	11/29/2001	2.6	3.09	3.81	3.57	2.97	0.475	<0.06	0.005	0.009	0.409
	12/18/2001	1.06	1.13	2.08	1.8	2.78	0.231	<0.12	0.004	0.004	0.215
	1/15/2002	0.49	1.23	1.13	1.21	1.27	0.332	<0.19	0.003	0.007	0.14
event	2/20/2002										
	2/28/2002	5.5	5.54	4.14	9.8	2.07	0.649	0.06	0.008	0.018	0.69
	3/21/2002	1.35	1.44	1.32	1.58	1.27	0.259	<0.18	0.003	0.007	0.317
event	3/24/2002										
	5/2/2002	2.4	2.38	2.34	3.05	2.18	0.482	<0.15	0.013	0.011	0.583

Table 3.7. Laboratory analytical performance requirements for trace metals

Analyte	Method[1]	EPA #[2]	MDL[3], µg/L	RL[4], µg/L	Accuracy[5], *X*	Precision[6], *s*	MS Rec[7]	MS/MSD RPD[8]
Arsenic	HGFAA	1632	0.002	0.005	59-134%	< 42%	55-146%	20%
Cadmium	GFAA	1639	0.0024	0.01	64-125	23	64-145	20
Chromium	GFAA	1639	0.1	0.2	74-131	26	74-131	20
Copper	GFAA	1639	0.024	0.1	67-154	43	63-159	20
Lead	GFAA	1639	0.0081	0.02	56-144	44	52-144	20
Mercury	CVAFS	1631	0.00005	0.0002	70-130	21	70-130	24
Nickel	GFAA	1639	0.029	0.1	65-145	27	65-145	20
Selenium	GFAA	1639	0.83	2	56-131	31	56-131	20
Silver	GFAA	1639	0.029	0.1	55-142	19	55-142	20
Zinc	GFAA	1639	0.14	0.5	67-142	43	46-146	20

(1) HGFAA- Hydride Generation Flame Atomic Absorption;
GFAA- Graphite Furnace Atomic Absorption
CVAFS – Cold Vapor Atomic Fluorescence Spectrometry
(2) EPA Method number
(3) Method Detection Limit: minimum concentration that can be reported with 99% confidence that the analyte is greater than zero.
(4) Target Project Reporting Limit: MDL multiplied by 3.18 and rounded to the nearest multiple of 1, 2, 5, 10, 20, 50, etc.,
(5) *X* = Average recovery for demonstration of initial performance
(6) *s* = standard deviation of recovery for demonstration of initial performance
(7) Percent recovery of matrix spike
(8) Relative percent difference of matrix spike duplicates
(9) Sample collection, cleaning procedures, and evapo-concentration methods differ from EPA 1639

Table 3.8. Pathogen data by station

Station	Date	Total Coliform MPN/100mL	Fecal Coliform MPN/100mL
Stilson Canyon	3/28/2001	300	23
LCCA	4/24/2001	300	300
	5/18/2001	900	240
	11/29/2001	≥ 1600	≥ 1600
	12/18/2001	≥ 1600	130
	1/15/2002	1600	50
	2/28/2002	500	30
	3/21/2002	≥ 1600	23
	5/2/2002	900	500
Pomona Ave.	3/28/2001	≥ 1600	240
LCCB	4/24/2001	≥ 1600	500
	5/18/2001	≥ 1600	1600
	11/29/2001	≥ 1600	900
	12/18/2001	≥ 1600	30
	1/15/2002	≥ 1600	170
	2/28/2002	1600	130
	3/21/2002	1600	130
	5/2/2002	900	900
Alberton Ave.	11/29/2001	≥ 1600	≥ 1600
LCCC			
Ord Ferry Rd.	3/28/2001	≥ 1600	30
LCCD	4/24/2001	≥ 1600	900
dry	5/18/2001	ns	ns
	11/29/2001	≥ 1600	240
	12/18/2001	≥ 1600	500
	1/15/2002	≥ 1600	170
	2/28/2002	≥ 1600	50
	3/21/2002	≥ 1600	23
	5/2/2002	≥ 1600	130

MDL: Minimum Detection Limit (2/100mL)
n: not detected at the reporting limit
ns: not sampled/not analyzed - dry channel

Table 3.9. Pathogen data by sampling date

Total Coliform

	Sampling Date								
Station	**3/28/2001**	**4/24/2001**	**5/18/2001**	**11/29/2001**	**12/18/2001**	**1/15/2002**	**2/28/2002**	**3/21/2002**	**5/2/2002**
LCCA	300	300	900	≥ 1600	≥ 1600	1600	500	≥ 1600	900
LCCB	≥ 1600	≥ 1600	≥ 1600	≥ 1600	≥ 1600	≥ 1600	1600	1600	900
LCCD	≥ 1600	≥ 1600	ns	≥ 1600	≥ 1600	≥ 1600	≥ 1600	≥ 1600	≥ 1600

Fecal Coliform

	Sampling Date								
Station	**3/28/2001**	**4/24/2001**	**5/18/2001**	**11/29/2001**	**12/18/2001**	**1/15/2002**	**2/28/2002**	**3/21/2002**	**5/2/2002**
LCCA	23	300	240	≥ 1600	130	50	30	23	500
LCCB	240	500	1600	900	30	170	130	130	900
LCCD	30	900	ns	240	500	170	50	23	130

Table 3.10. Summary bioassessment metrics and ranking score by reach for macroinvertebrates sampled from Little Chico Creek April 2002

Bioassessment metric	LCCA4/02	StationID LCCB4/02	LCCD4/02
Taxonomic Richness	24	11	15
stdev	4	1	0
Cumulative Taxa	31	15	18
Percent Dominant Taxon	23	55	31
stdev	8	7	11
EPT Taxa	11	2	2
stdev	3	1	1
EPT Index (%)	64	6	13
stdev	9	2	3
Sensitive EPT Index (%)	44	6	12
stdev	10	2	2
Cumulative EPT Taxa	14	2	4
Percent Chironomidae	31	85	43
stdev	11	2	18
Shannon Diversity	2.4	1.3	2.1
stdev	0.2	0.1	0.1
Tolerance Value	2.8	5.2	5.4
stdev	0.5	0.2	0.1
Percent Intolerant Taxa (0-2)	46	11	8
stdev	10	5	7
Percent Tolerant Taxa (8-10)	1	12	20
stdev	0	3	13
Percent Collectors	42	93	67
stdev	5	3	12
Percent Filterers	16	5	15
stdev	3	4	16
Percent Grazers	39	2	17
stdev	8	1	15
Percent Predators	1	1	1
stdev	1	1	0
Percent Shredders	2	0	0
stdev	1	0	0

NOTE: Each of the metrics above represents a mean of three samples at each station.
stdev: Sample standard deviation

TABLE 3.11. Surface Water Quality Criteria for Selected Constituents

Constituent	Objective
Temperature (^oF)	< 5 ^oF increase over background
pH	6.5-8.5
Electrical Conductivity (µmhos/cm)	<230
Turbidity (NTU)	< 20% increase over background
Dissolved Oxygen, % of Saturation	85%
Total Phosphorus (mg/l as P)	nc(1)
ortho-Phosphate (mg/L)	nc(1)
Total Kjeldahl Nitrogen (mg/l as N)	nc(1)
Nitrate (mg/l as N)	10(2)
Total Arsenic	nc(1)
Dissolved Arsenic (µg/l)	10
Total Cadmium (µg/l)	nc(1)
Dissolved Cadmium (µg/l)	0.22(2)
Total Chromium (µg/l)	50(2)
Dissolved Chromium (µg/l)	50(2)
Total Copper (µg/l)	nc(1)
Dissolved Copper (µg/l)	10(2)
Total Lead (µg/l)	nc(1)
Dissolved Lead (µg/l)	15(2)
Total Mercury (µg/l)	nc(1)
Dissolved Mercury (µg/l)	2(2)
Total Nickel (µg/l)	nc(1)
Dissolved Nickel (µg/l)	100(2)
Total Selenium (µg/l)	nc(1)
Dissolved Selenium (µg/l)	50(2)
Total Silver (µg/l)	nc(1)
Dissolved Silver (µg/l)	10
Total Zinc (µg/l)	nc(1)
Dissolved Zinc (µg/l)	100(2)
Fecal coliform (per 100 ml)	400
Total coliform	nc(3)

NOTES:

nc(1) No criteria, Water Quality Objective or Maximum Contaminant Level (MCL) for municipal/domestic use has not been established.

(2) Where Basin Plan does not specifically establish a Water Quality Objective, DHS primary, or secondary (as applicable), drinking water MCL used.

nc(3) No criteria, Water Quality Objective or Maximum Contaminant Level (MCL) for contact recreation use not established.

SOURCES:

Sacramento River Basin Water Quality Control Plan, 1995, Central Valley RWQCB.
Calif. Dept. Health Services, Drinking Water Standards.

Table 3.12. STORET Data for Little Chico Creek at the Highway 99 E Bridge

	Sample Date							
Constituent	**11/30/1973**	**1/16/74**	**5/11/77**	**12/23/77**	**01/12/79**	**01/14/80**	**01/24/83**	**02/18/86**
Streamflow (cubic feet/second)	50	175	25	60	45	250	75	60
pH	7.7			8	7.5		7.2	7.4
Dissolved Oxygen (mg/l)					9.1			
Temperature (^oC)					12.5	13.5	11	
Conductivity (µmhos/cm)	94	75	198	133	119	78	70	68
Turbidity (FTU)	11	25	2	18	12	20	33	24
Nitrate (mg/l as N)	1.6			0.22				
Total Kjeldahl Nitrogen (mg/l as N)				0.3				
Total Phosphorus (mg/l as P)				0.02				
Hardness (mg/l as CaCO3)	38			53				
Alkalinity (mg/l as CaCO3)	39			52				
Boron, Dissolved (µg/l) as B)	200			0				
Calcium, Dissolved (mg/l as Ca)	7.9							
Chloride (mg/l)	0			1.1				
Magnesium, Dissolved (mg/l as Mg)	4.5							
Potassium, Dissolved (mg/l as K)	1.5							
Sodium, Dissolved (mg/l as Na)	3.5			5				
Sulfate, Dissolved (mg/l as SO4)	3.3							

Table 3.13. Historic water quality data for Station LCCB Pomona St. Bridge

Constituent	05/24/95	01/15/96
Temperature (EF)	68.8	50
PH	7.5	6.9
Electrical Conductivity (µmhos)	214	110
Turbidity (NTU)	15	44
Hardness (mg/l as $CaCO_3$)	NA	42
Total Suspended Solids (mg/l)	45	71
Total Dissolved Solids (mg/l)	NA	82
Total Phosphorus (mg/l as P)	0.98	0.44
Total Kjeldahl Nitrogen (mg/l as N)	16.8	1.35
Nitrite + Nitrate (mg/l as N)	0.31	0.46
Oil and Grease (mg/l)	ND	ND
MBAS (surfactants, mg/l)	0.07	NA
Motor Oil (mg/l)	NA	ND
Diesel (mg/l)	NA	ND
Gasoline (mg/l)	ND	ND
Benzene (µg/l)	ND	ND
Toluene (µg/l)	0.5	ND
Ethyl-benzene (µg/l)	ND	ND
Total Xylenes (µg/l)	ND	ND
Total Cadmium (µg/l)	ND	ND
Dissolved Cadmium (µg/l)	NA	ND
Total Chromium (µg/l)	8	5
Dissolved Chromium (µg/l)	NA	ND
Total Copper (µg/l)	17	10
Dissolved Copper (µg/l)	NA	ND
Total Lead (µg/l)	18	19
Dissolved Lead (µg/l)	NA	ND
Total Zinc (µg/l)	85	83
Dissolved Zinc (µg/l)	NA	11

NOTES:
NA not analyzed
ND not detected at or above minimum practical laboratory reporting limit

SOURCE: Correspondence to Mr. Matt Thompson, City of Chico, from Metcalf & Eddy, Inc., dated November 22, 1995, and March 25, 1996.

Table 3.14. Nutrient data by sampling date

Station	Nutrient (mg/L)	3/28/01	4/24/01	5/18/01	event 10/30/01	11/29/01	12/18/01	1/15/02	event 2/20/02	2/28/02	3/21/02	event 3/24/02	5/2/02
LCCA	Ammonia @ N	n	n	n	0.09	n	n	n	n	n	n	n	0.08
LCCB		n	n	n	0.33	0.05	n	n	0.05	n	n	0.07	0.06
LCCD		n	n	ns	0.06	0.05	n	0.06	0.06	n	0.05	n	0.05
LCCA	Nitrate @ N	n	n	0.1	n	0.29	0.17	0.2	0.08	n	n	n	0.05
LCCB		0.15	0.09	0.25	0.39	0.44	0.27	0.43	0.11	0.08	0.08	n	0.2
LCCD		0.06	n	ns	n	0.41	0.25	0.48	0.14	0.05	0.06	0.14	0.08
LCCA	Nitrite @ N	0.01	n	n	n	0.01	n	n	n	n	n	n	n
LCCB		0.01	n	n	n	0.01	n	n	n	n	n	n	0.01
LCCD		0.01	0.01	ns	n	0.02	0.01	n	n	n	n	n	n
LCCA	Total Phosphorus	n	n	n	0.65	0.26	0.18	0.2	0.27	0.62	0.1	0.34	0.26
LCCB		n	n	n	0.45	0.17	0.09	0.14	0.26	0.26	0.07	0.28	0.13
LCCD		n	n	ns	0.57	0.18	0.13	n	0.28	0.23	0.14	0.33	0.24
LCCA	Ortho Phosphate	n	n	n	n	n	n	n	0.2	0.25	0.32	0.19	0.14
LCCB		n	n	n	0.26	0.05	0.05	n	0.29	0.18	0.3	0.24	0.18
LCCD		n	n	ns	0.14	0.08	0.05	n	0.22	0.26	0.24	0.25	0.12

NOTE:

Nutrient	MDL (mg/L)
Ammonia @ N	0.05
Nitrate @ N	0.05
Nitrite @ N	0.01
Total Phosphorus	0.02
Ortho Phosphate	0.01

Table 3.15. Metals data by rain event sampling date

Station	Date	Total Cr ug/L	Total Ni ug/L	Total Cu ug/L	Total Zn ug/L	Total Hg ng/L	Total As ug/L	Total Se ug/L	Total Ag ug/L	Total Cd ug/L	Total Pb ug/L
	10/30/2001										
Above Urban		<0.02	0.53	0.94	0.61	3.47	0.639	<0.13	0.002	<0.004	0.082
Below Urban		2.39	4.05	8.47	40.2	21.3	0.76	0.21	0.017	0.103	5.33
	2/20/2002										
Above Urban		0.9	0.74	1.02	0.79	2.85	0.173	<0.10	0.003	0.004	0.188
Below Urban		1.23	1.06	1.53	2.55	3.23	0.189	<0.10	0.004	0.009	0.657
	3/24/2002										
Above Urban		1	0.68	0.75	0.85	62.7	0.039	<0.07	<0.006	<0.003	0.128
Below Urban		1.31	0.945	1.35	2.22	24.7	0.042	0.14	<0.006	0.006	0.431

Table 3.16. Metals sampling results for May 2, 2002

	Station LCCA		Station LCCB		Station LCCD	
Metal (μg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Cr	0.19	0.12	0.2	0.13	2.4	0.07
Ni	0.22	0.16	0.29	0.29	2.38	0.85
Cu	0.25	0.24	0.51	0.46	2.34	0.94
Zn	0.11	0.13a	1.09	0.94	3.05	0.31
As	0.241	0.223	0.235	0.231	0.482	0.379
Se	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Ag	<0.006	<0.006	<0.006	0.012a	0.013	<0.006
Cd	<0.003	<0.003	0.004	<0.003	0.011	0.003
Pb	0.006	<0.002	0.051	0.017	0.583	0.055
Hg (ng/L)	0.36	0.27	0.51	0.34	2.18	0.58
MHg (ng/L)	0.03	-	0.03	-	0.177	-

Table 4.1. Existing Land Use in LCCW Project Area

Land Use	Number of Acres	Percentage of Total
Misc. Agriculture	15,803	18.6%
Orchards	15,461	18.2%
Residential	14,356	16.9%
Rice	12,082	14.3%
Grazing	8,921	10.5%
Field and Row Crops	5,162	6.1%
Unknown	4,538	5.4%
Refuge	3,740	4.4%
Commercial	1,827	2.2%
Dry Farming	1,011	1.2%
Forestry	945	1.1%
Industrial	860	1.0%
Irrigated Pasture	74	0.1%
TOTAL	**84,780**	

NOTE: *Due to rounding, percentages don't add up to 100%

Table 4.2. The 10 largest private land owners

Owner	Acreage	Zone
MELINE EDW R & CHARLENE MIRR	3,530.9	Canyon
SIMMONS FAMILY TRUST	2,690.2	Canyon
HALL & ISOM INVESTMENT COMPANY	1,998.8	Canyon
GEMSTONE PROPERTIES INC	1,275.2	Canyon
INTERPACIFIC PROPERTIES INC	1,146.5	Canyon
PARROTT INVESTMENT CO INC	11,821.6	Agricultural
PACIFIC REALTY ASSOCIATES	5,483.0	Agricultural
FENN EUGENE	1,463.2	Agricultural
JOHNSON C WILLIAM & CAROLE R	1,272.3	Agricultural
ORD BEND FARMS INC	1,219.1	Agricultural
TOTAL	**31,900.8**	

Table 4.3. Public land owners. The following are the largest public landowners within the Little Chico Creek Watershed. The two largest public landowners are United States Fish and Wildlife and California Department of Fish and Game.

Owner	Acreage	Zone
BLM	671.7	Mountain
U S PLANT INTRODUCTION GARDENS	205.8	Canyon
CITY OF CHICO	461.1	Urban
CALIFORNIA STATE UNIVERSITY CHICO	0.4	Urban
U S F&WS	2,632.5	Agricultural
STATE DF&G	1,805.1	Agricultural
STATE OF CALIFORNIA (other)	860.2	Agricultural
UNIVERSITY FOUNDATION CSUC THE	118.4	Agricultural
TOTAL	**6,755.2**	

Table 5.1. Invasive introduced plant species problematic within the riparian corridor. Nomenclature follows the Jepson Manual (1993).

Common Name	**Scientific Name**	**Zones where a problem**
Himalayan blackberry	*Rubus discolor*	All
Spanish broom	*Spartium junceum*	Canyon
black locust	*Robinia pseudoacacia*	Urban, Agricultural
privet species 1	*Ligustrum* species1	Urban, Agricultural
privet species 2	*Ligustrum* species2	Urban, Agricultural
giant reed	*Arundo donax*	Urban, Agricultural
tree of heaven	*Ailanthus altissima*	Urban, Agricultural

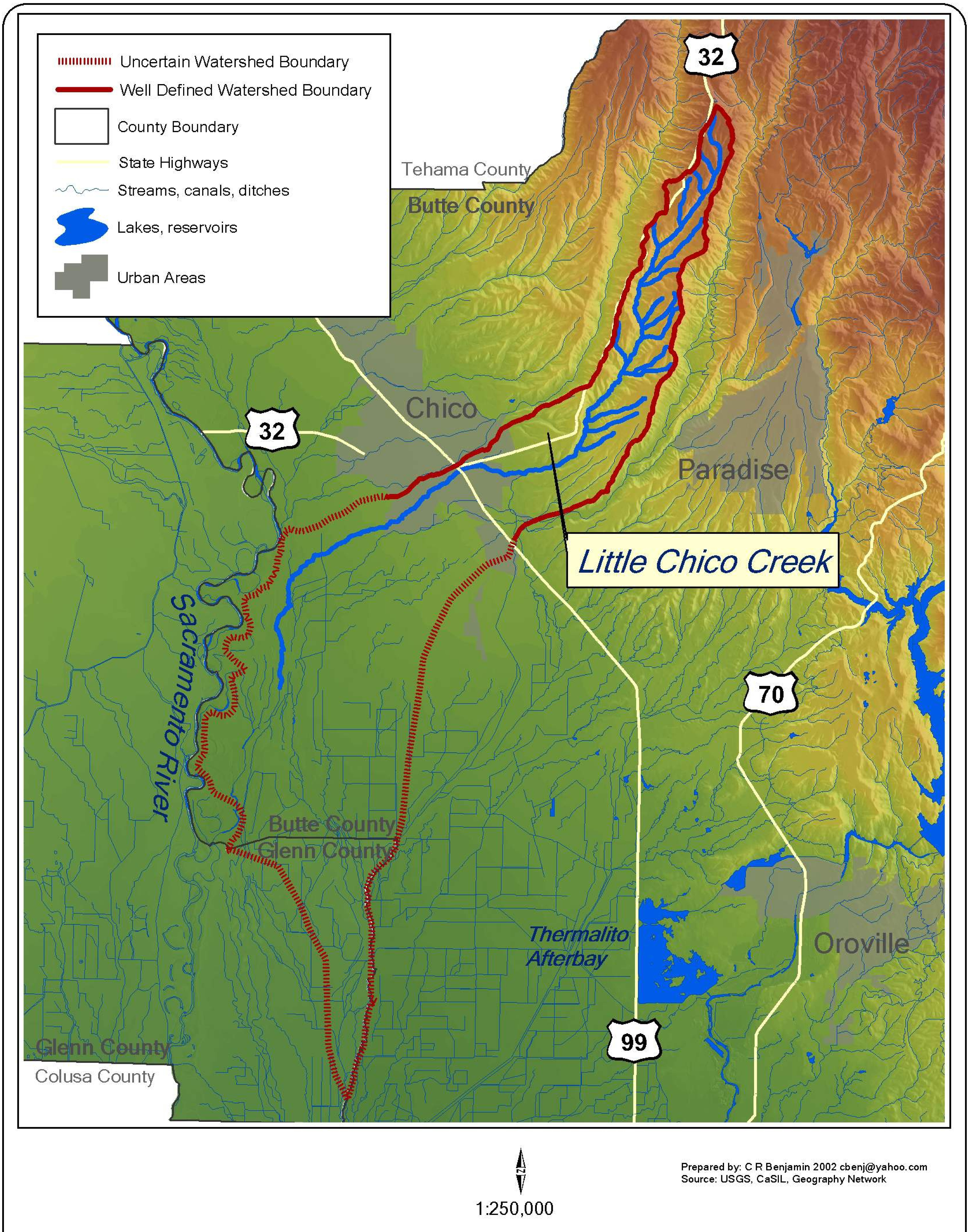


Figure 1.1. Little Chico Creek Watershed Boundary

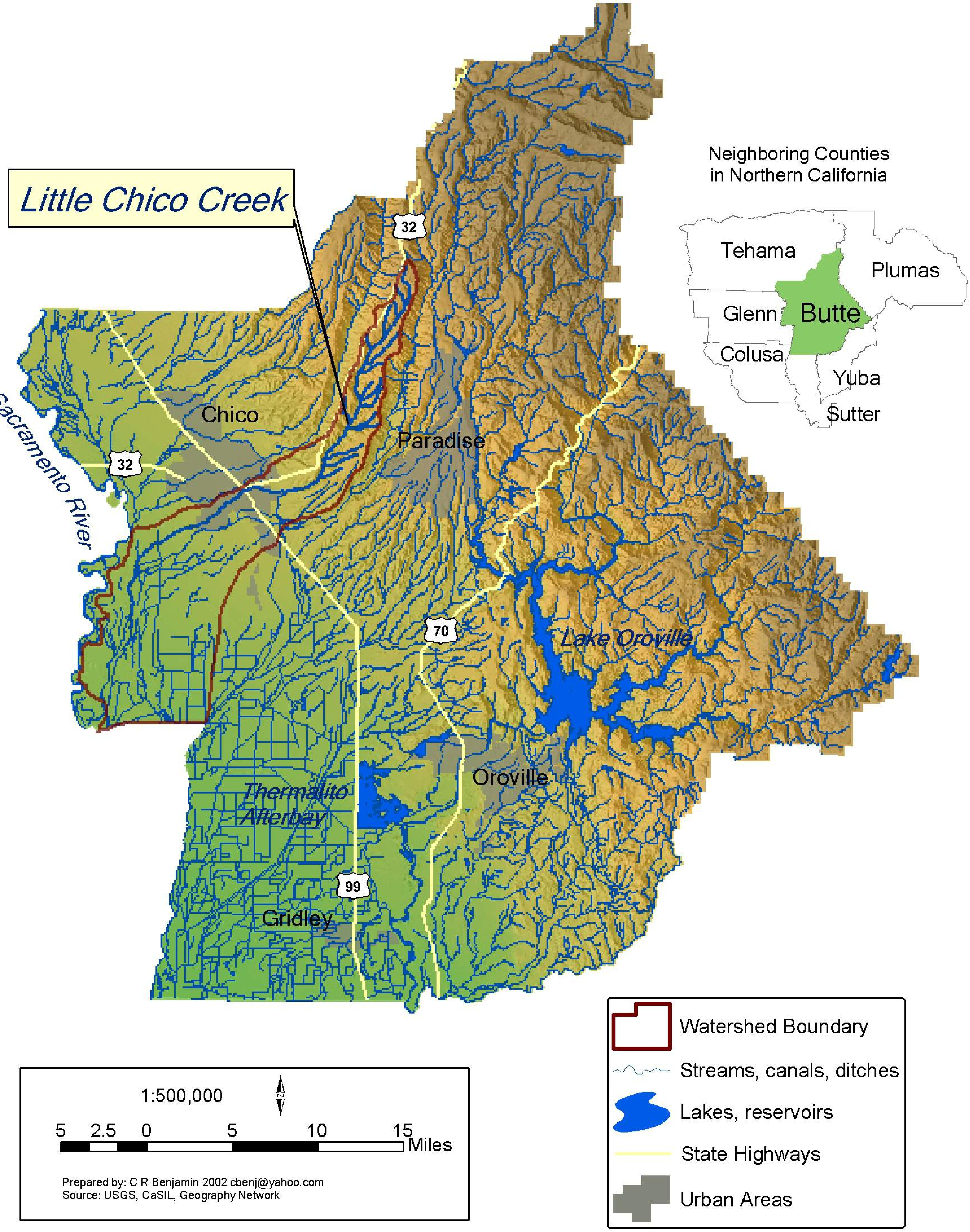


Figure 1.2. Project Location Map

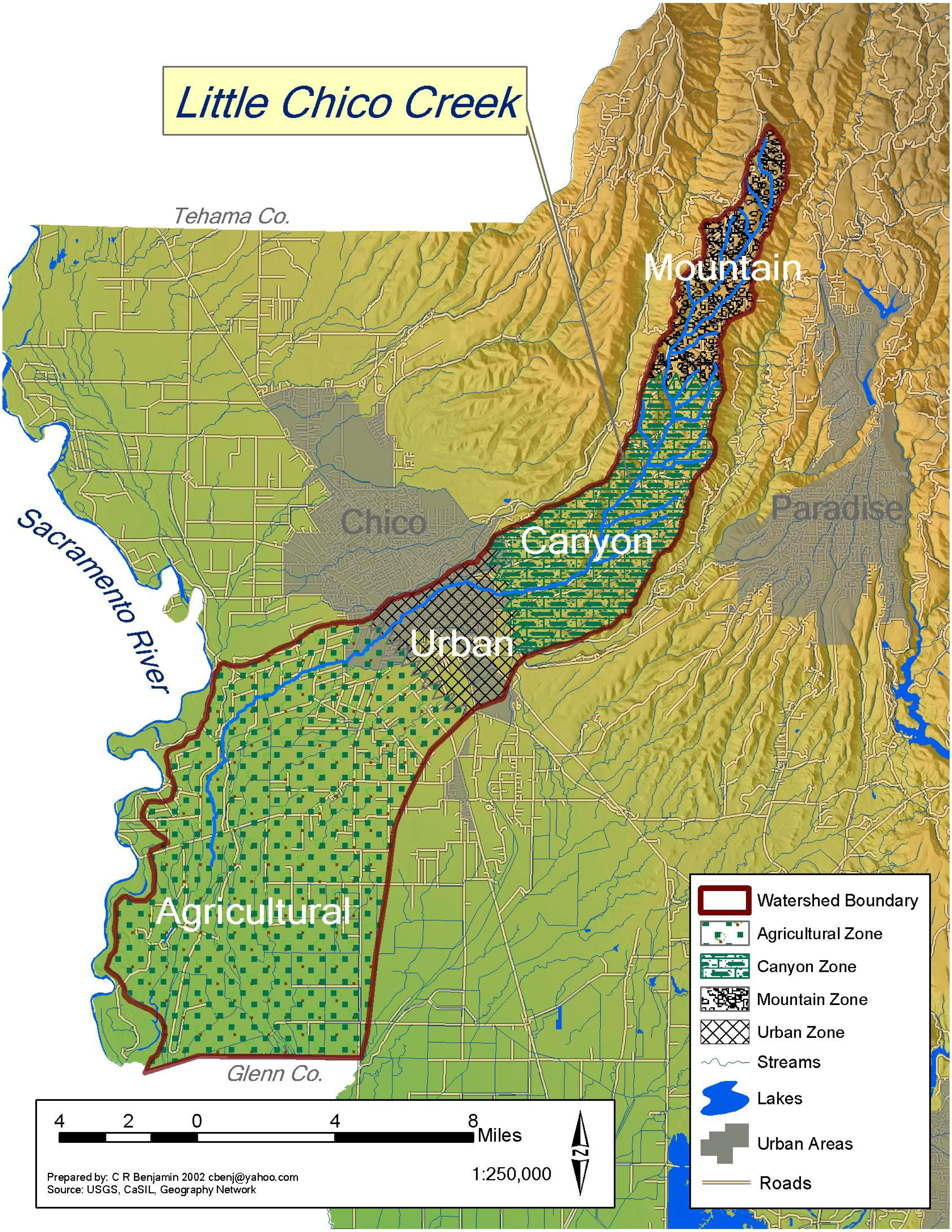


Figure 1.3. Four Zones of Little Chico Creek Watershed

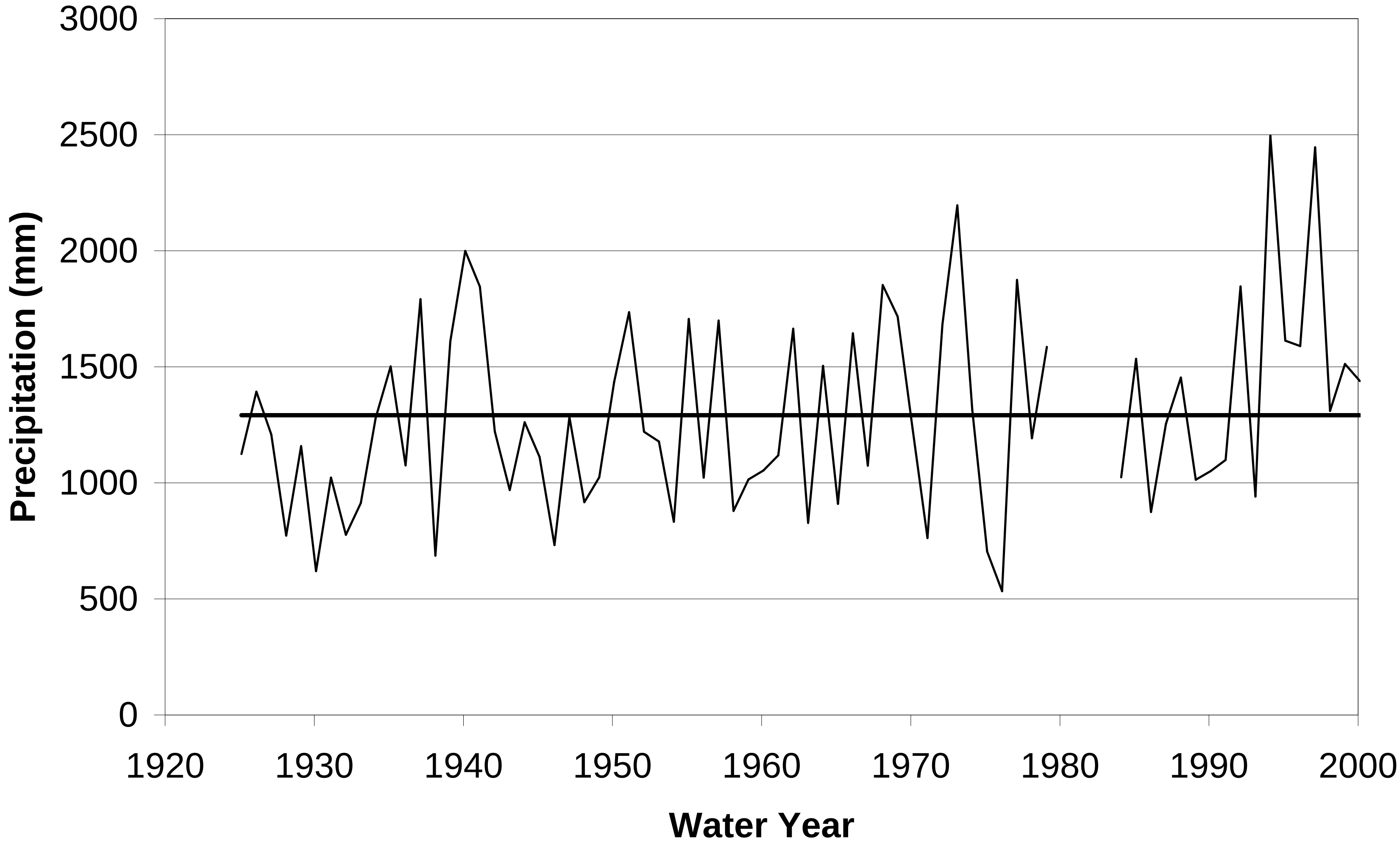


Figure 1.4. Precipitation Record for Paradise Rain Gage

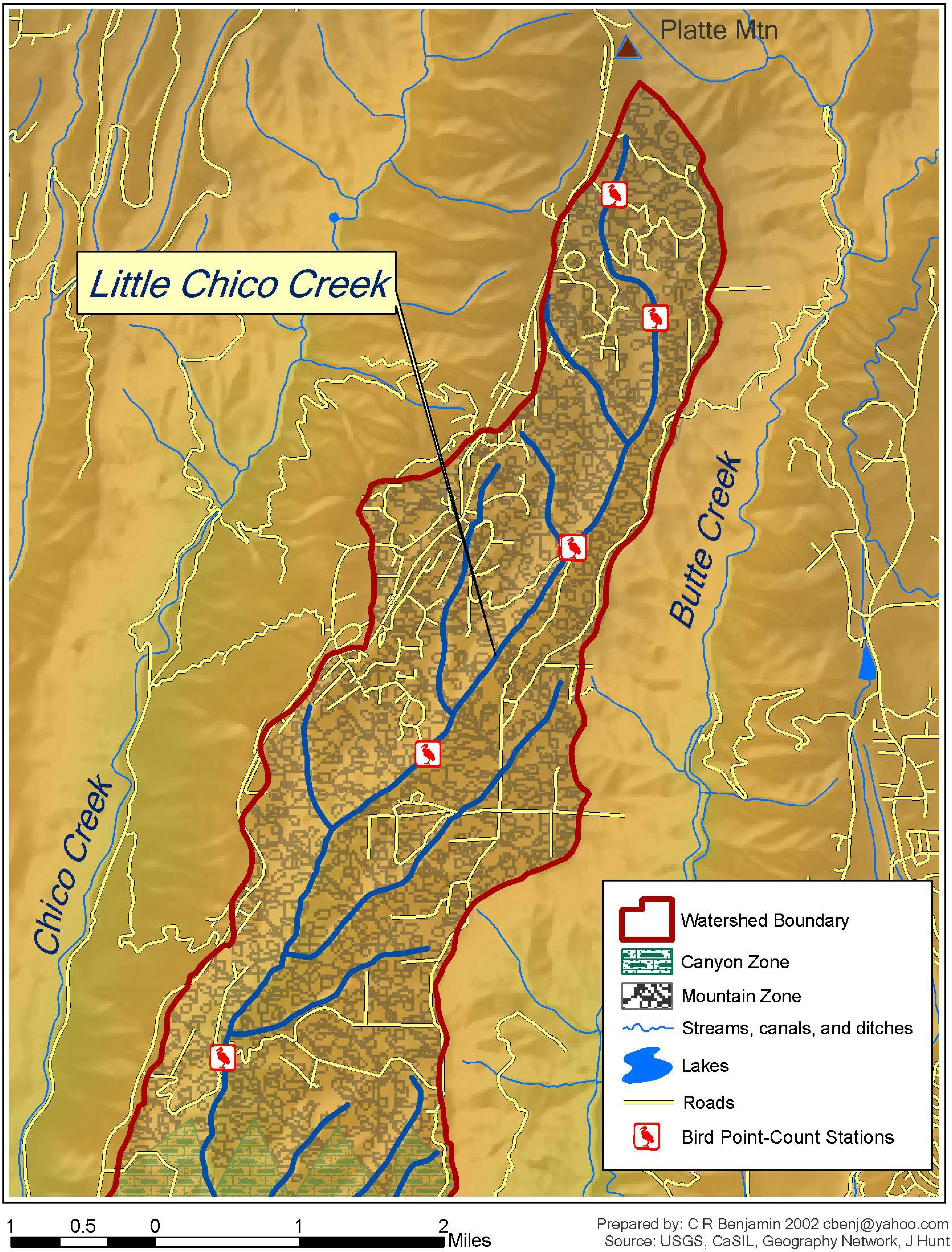
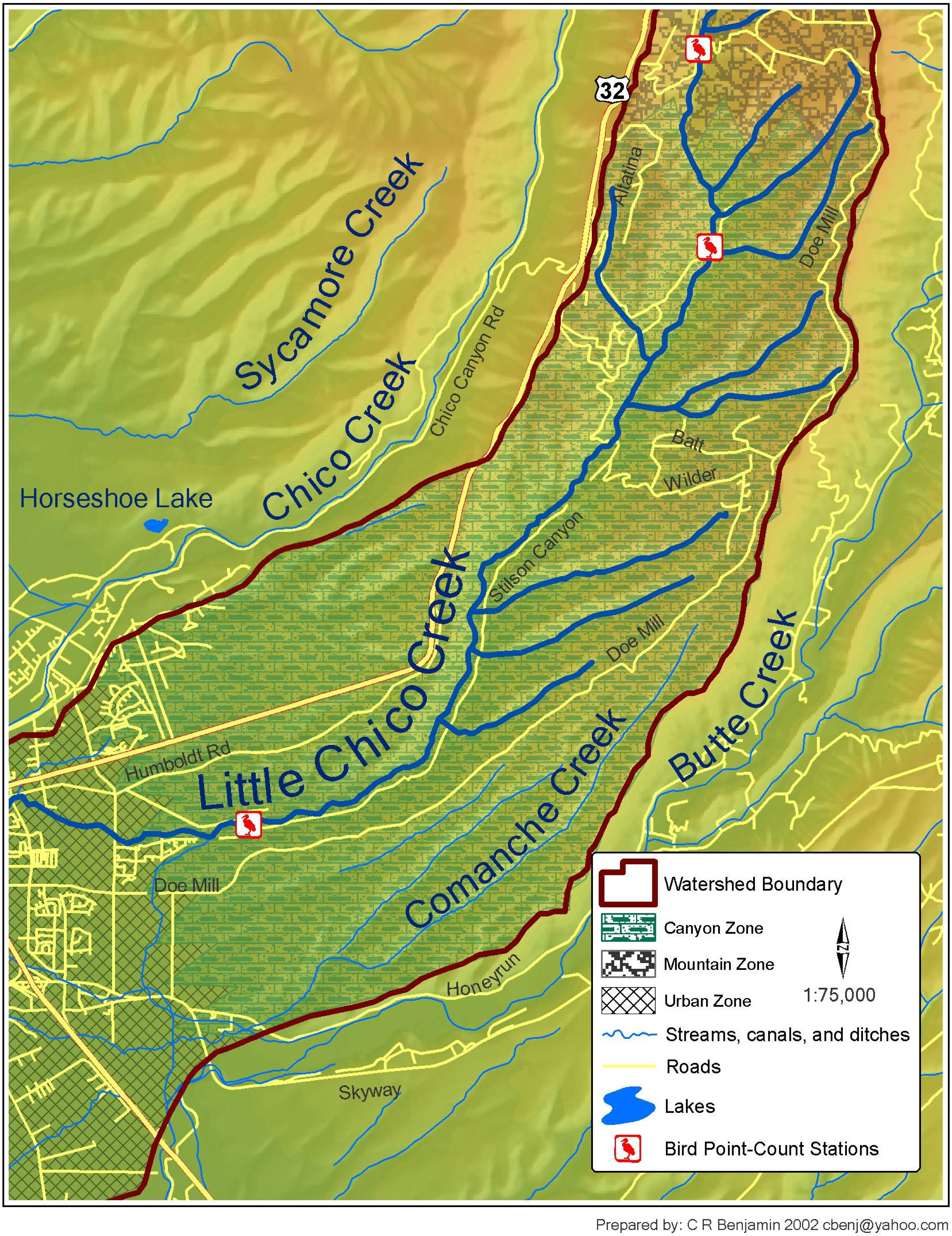
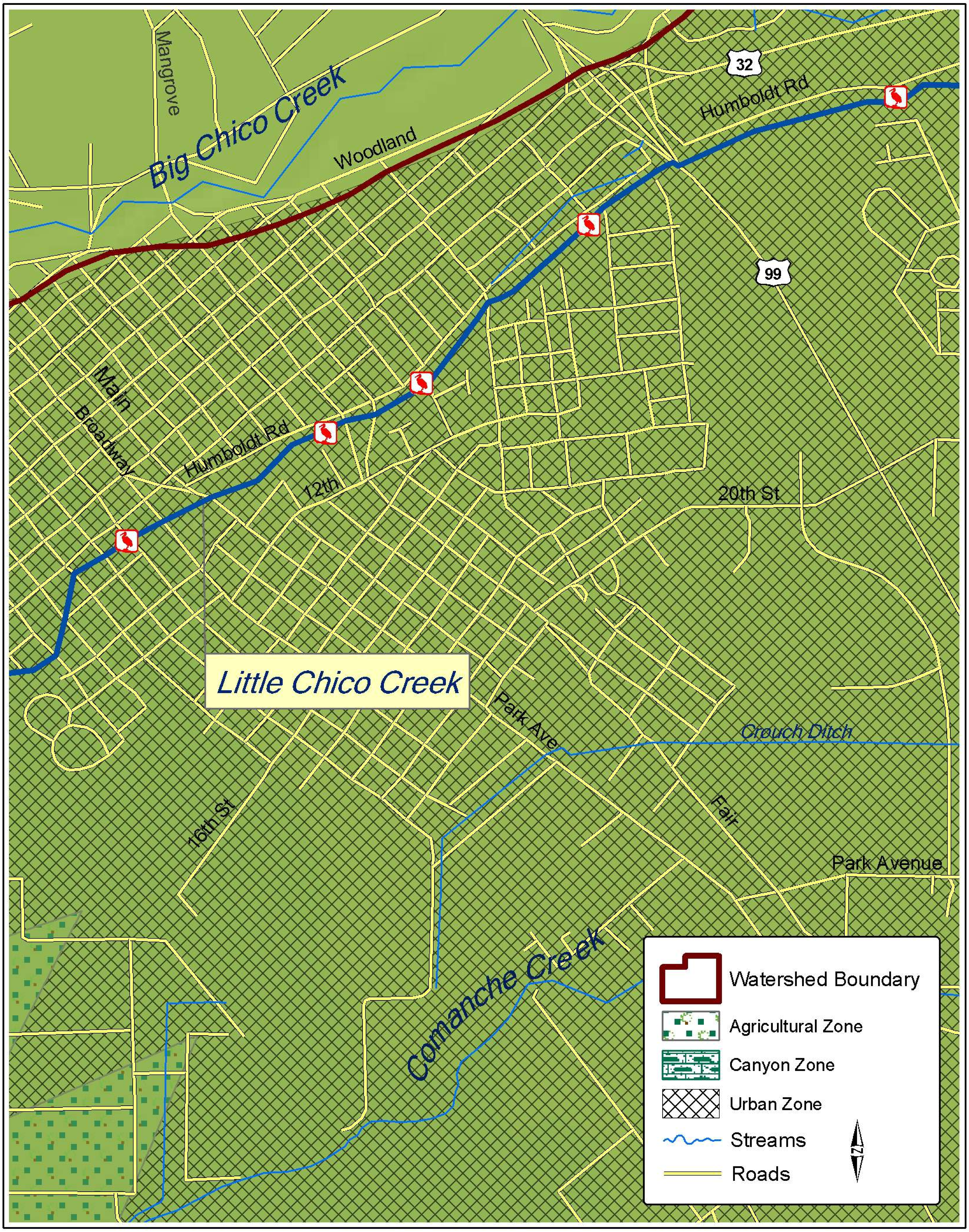


Figure 2.1. Location of June 2002 Bird Point-Count Stations
Little Chico Creek Watershed: Mountain Zone



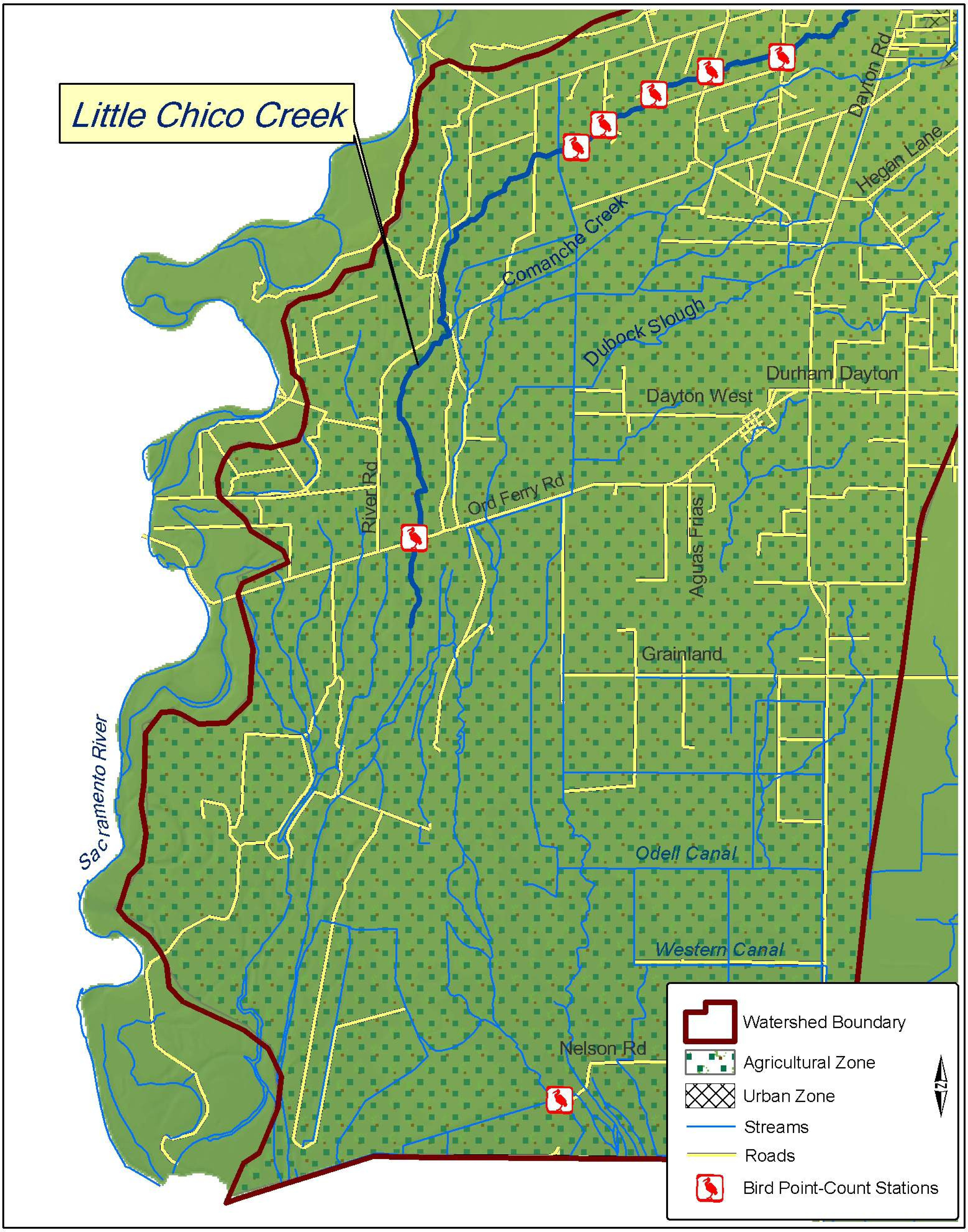
Prepared by: C R Benjamin 2002 cbenj@yahoo.com
Source: USGS, CaSIL, Geography Network, J Hunt

Figure 2.2. Location of June 2002 Bird Point-Count Stations
Little Chico Creek Watershed: Canyon Zone



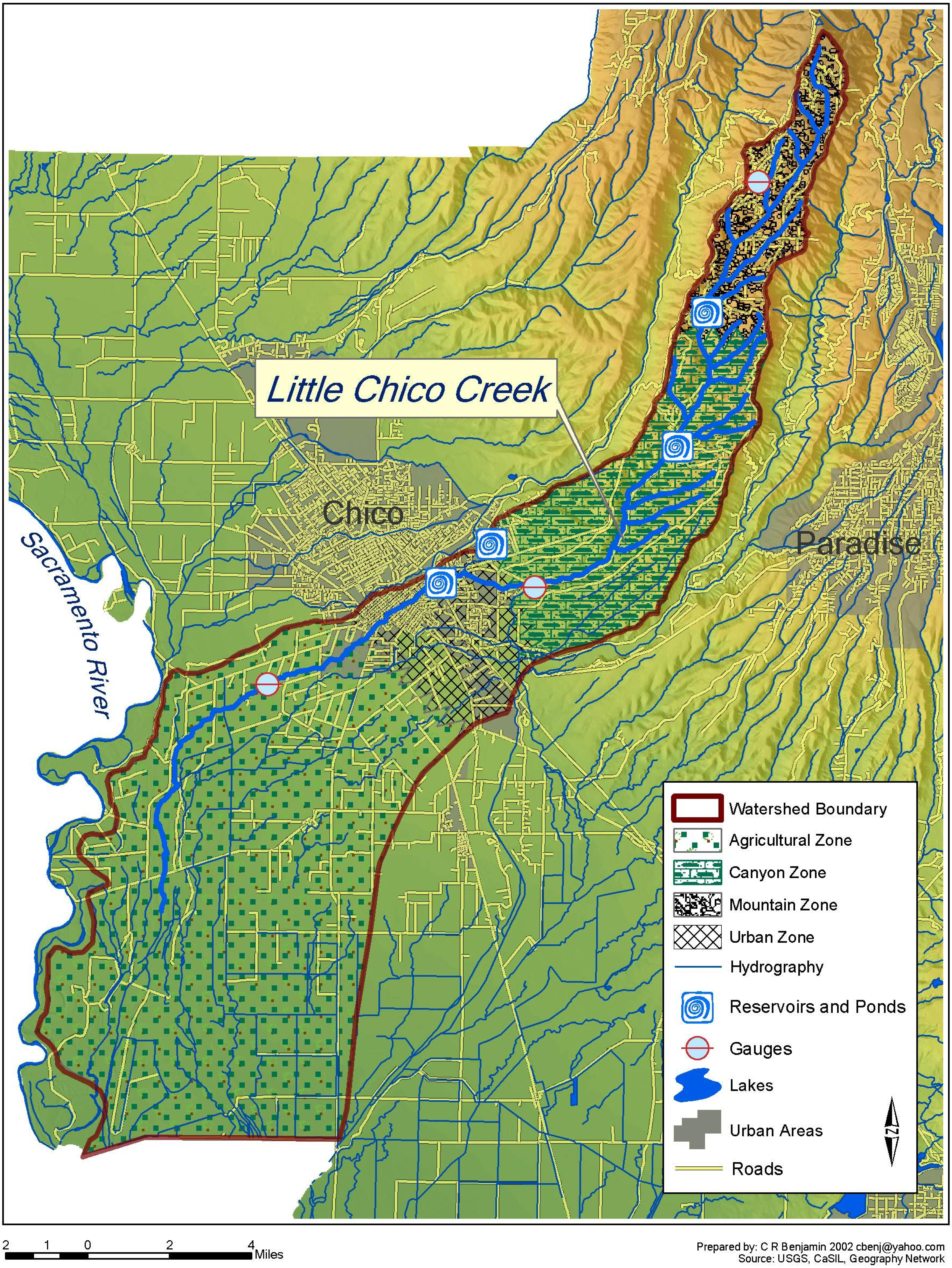
Prepared by: C R Benjamin 2002 cbenj@yahoo.com
Source: USGS, CaSIL, Geography Network, J Hunt

Figure 2.3. Location of June 2002 Bird Point-Count Stations
Little Chico Creek Watershed: Urban Zone



Prepared by: C R Benjamin 2002 cbenj@yahoo.com
Source: USGS, CaSIL, Geography Network, J Hunt

Figure 2.4. Location of June 2002 Bird Point-Count Stations
Little Chico Creek Watershed: Agricultural Zone



Prepared by: C R Benjamin 2002 cbenj@yahoo.com
Source: USGS, CaSIL, Geography Network

Figure 2.5. Surface Hydrography of Little Chico Creek Watershed

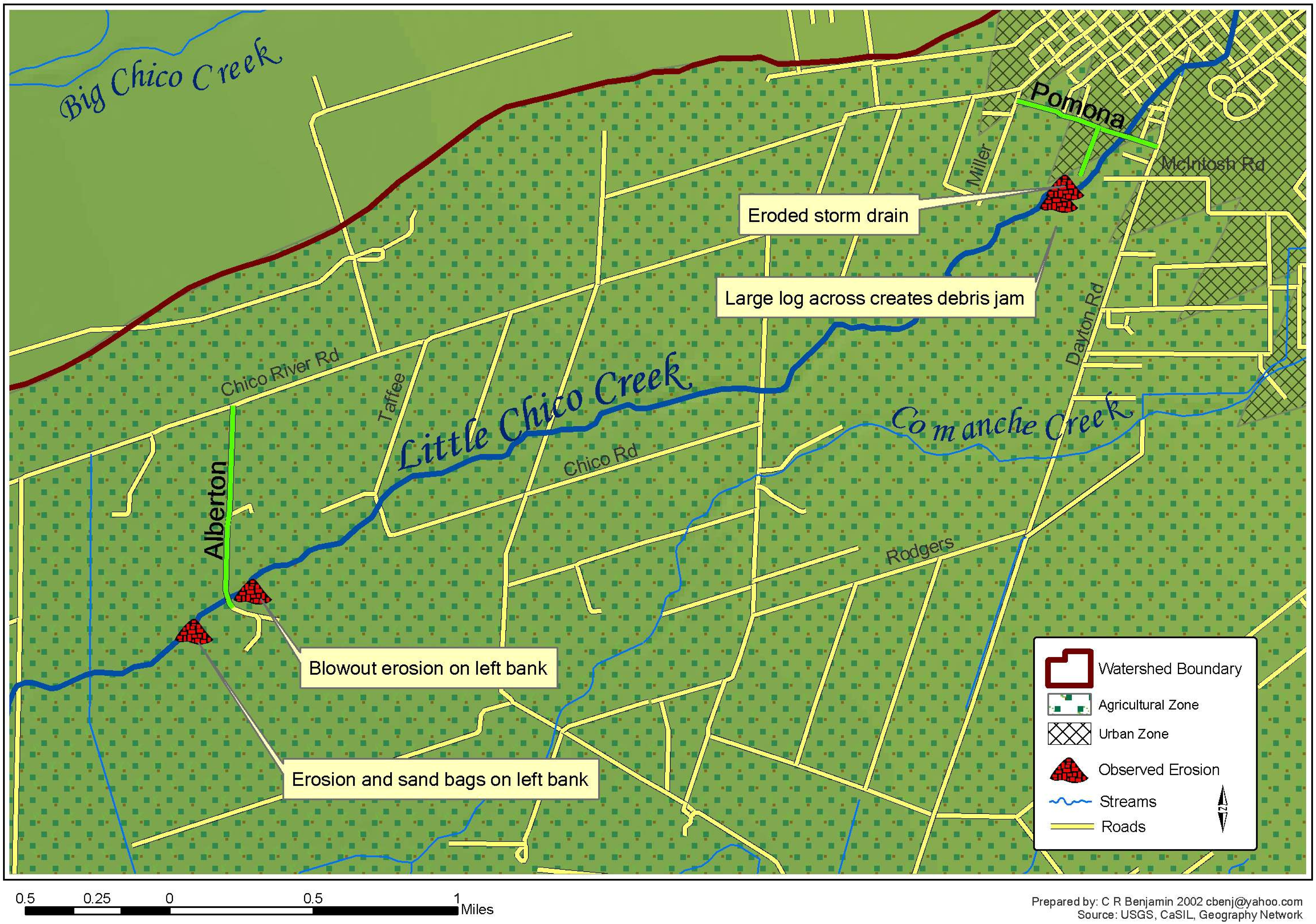


Figure 2.6. Observed Erosion Problems in Little Chico Creek Watershed

Fig 2.7. Relative abundance of observed bird species – Mountain Zone. Percentage of total individuals detected for species recorded more than once during point count surveys conducted in June 2002 at 4 stations within the Mountain Zone of the Little Chico Creek watershed, Butte Co., Ca.

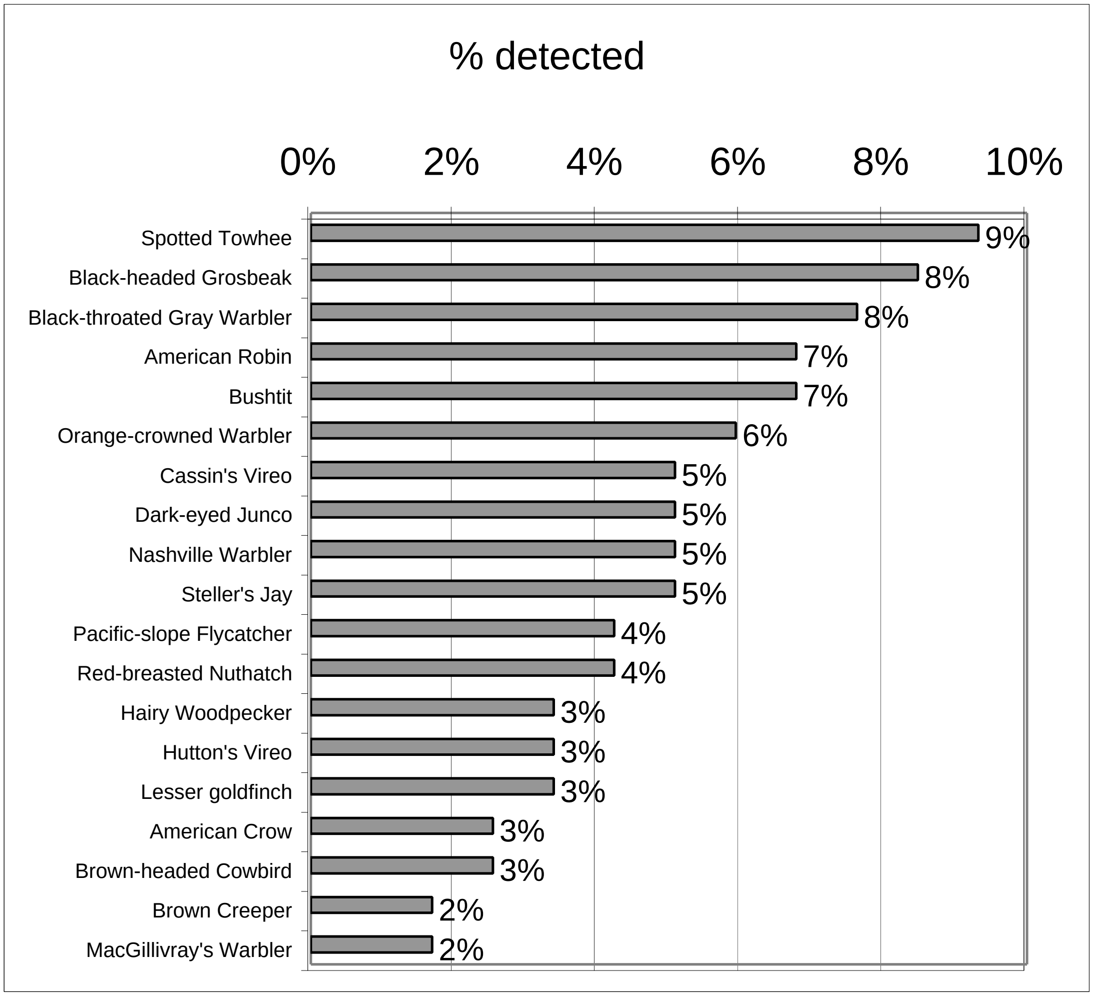


Fig 2.8. Relative abundance of observed bird species – Canyon Zone. Percentage of total individuals detected for species recorded more than once during point count surveys conducted in June 2002 at 3 stations within the Canyon Zone of the Little Chico Creek watershed, Butte Co., Ca.

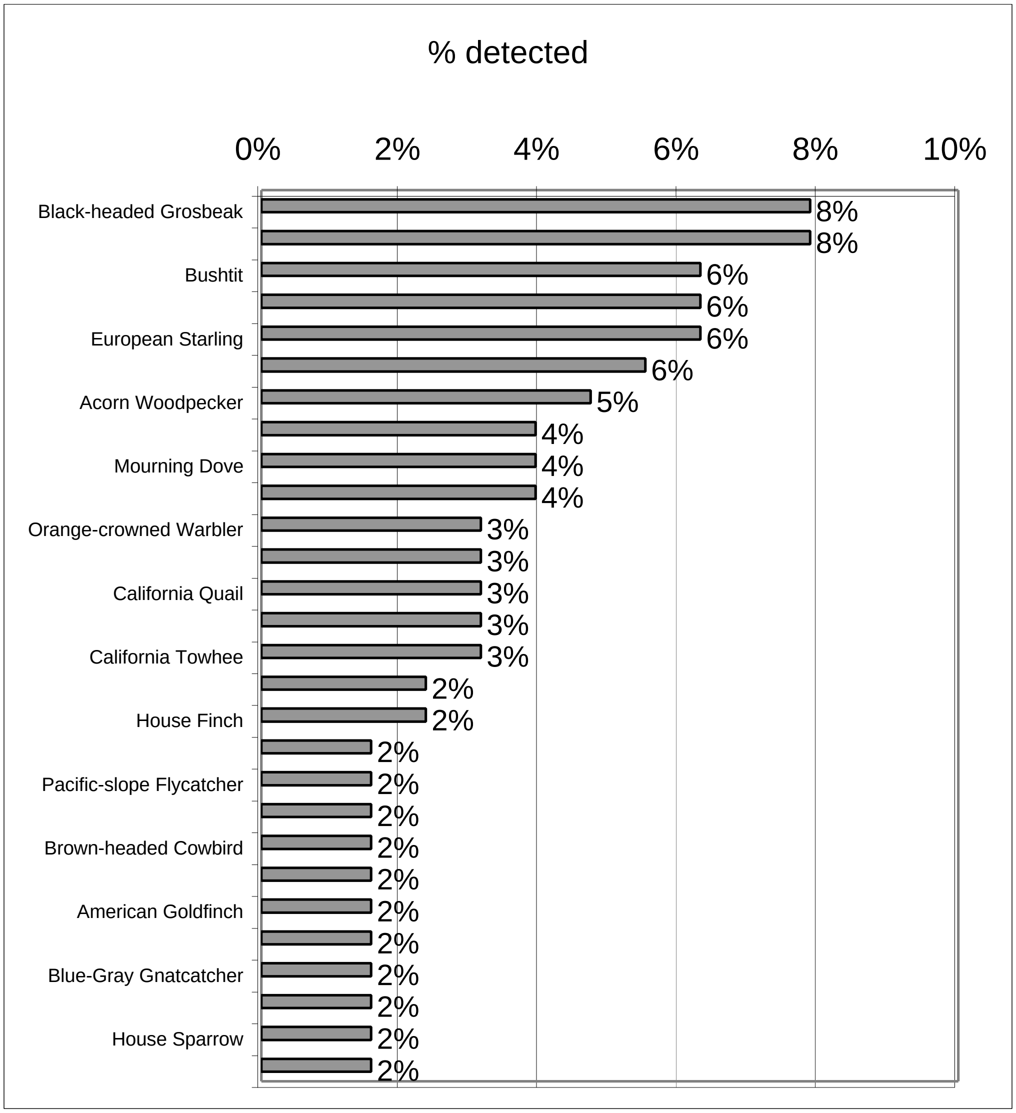


Fig 2.9. Relative abundance of observed bird species – Urban Zone. Percent of total individuals detected for species recorded more than once during point count surveys conducted in June 2002 at 5 stations within the Urban Zone of the Little Chico Creek watershed, Butte Co., Ca.

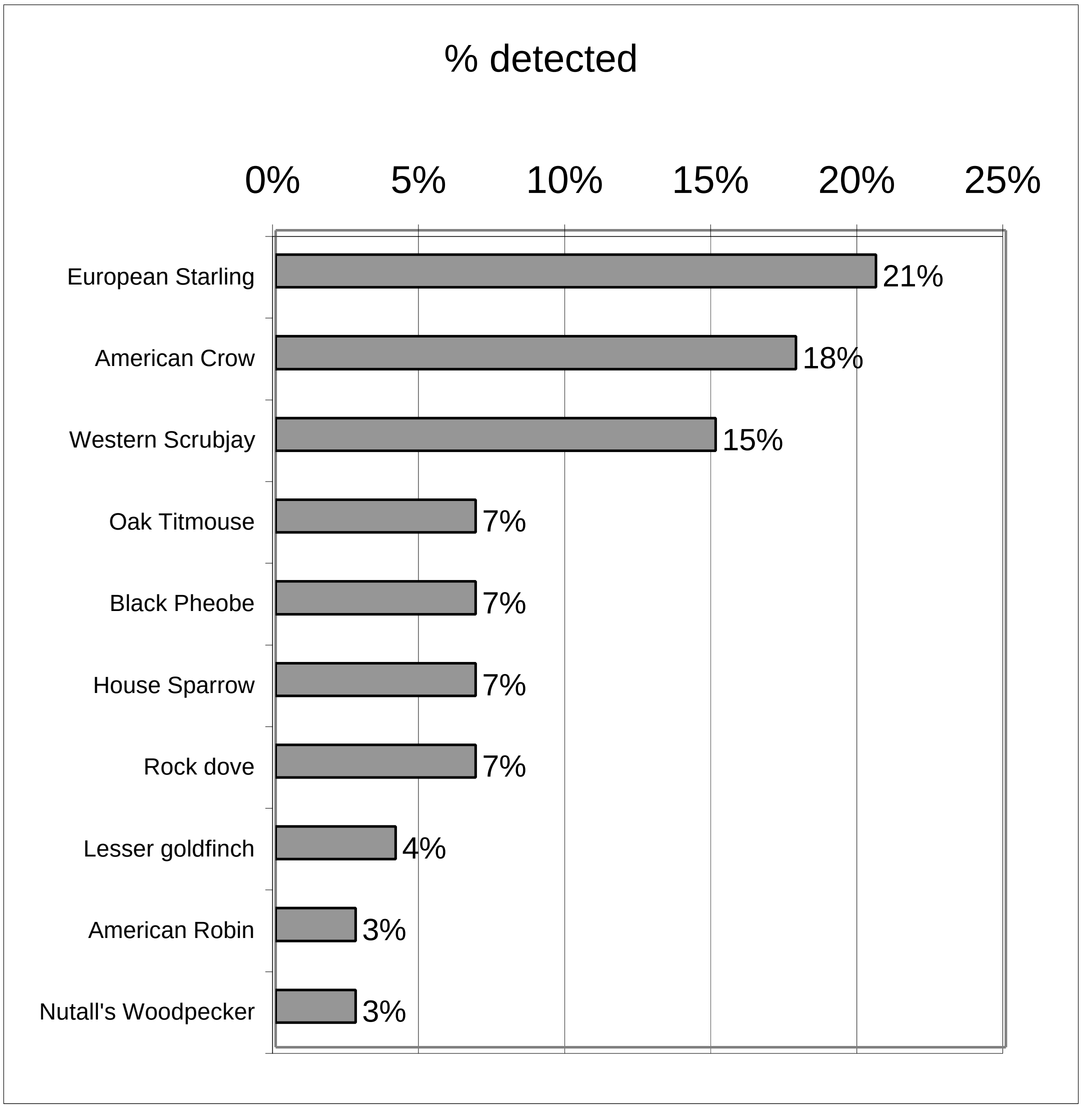
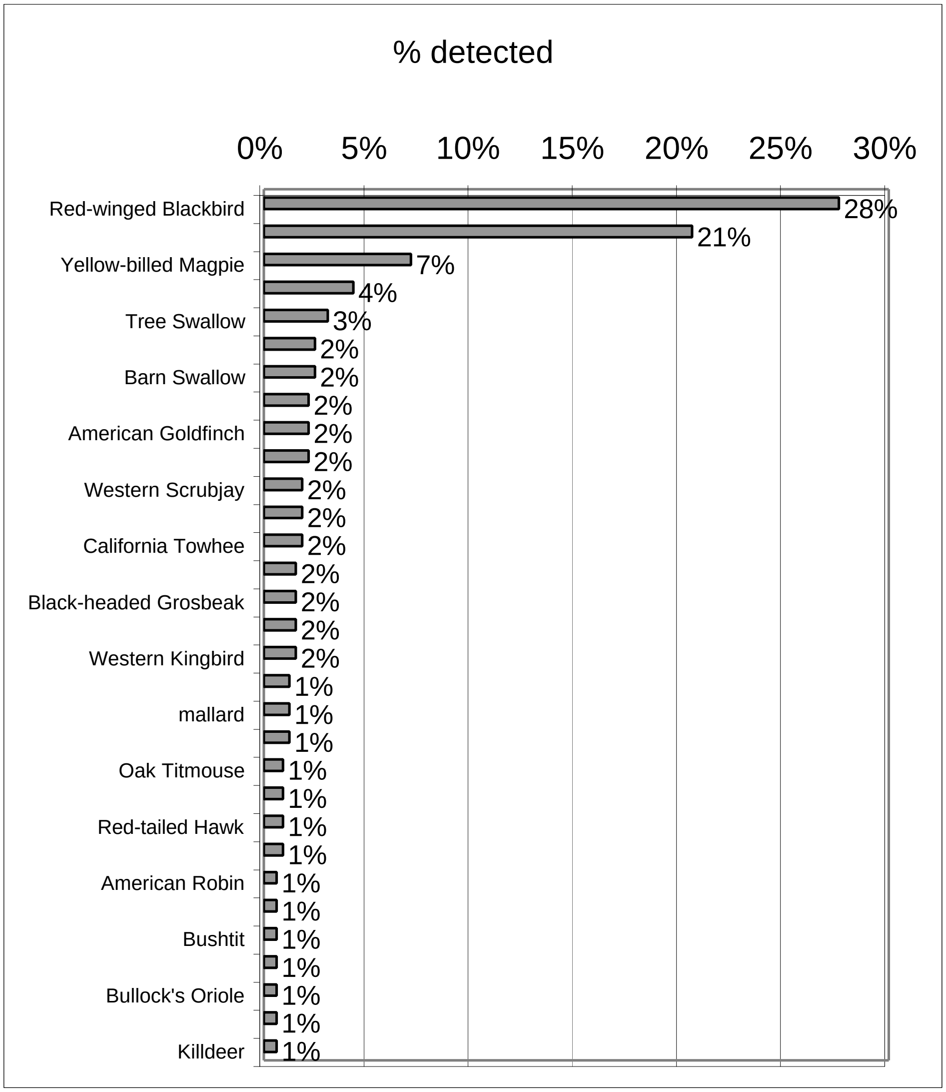
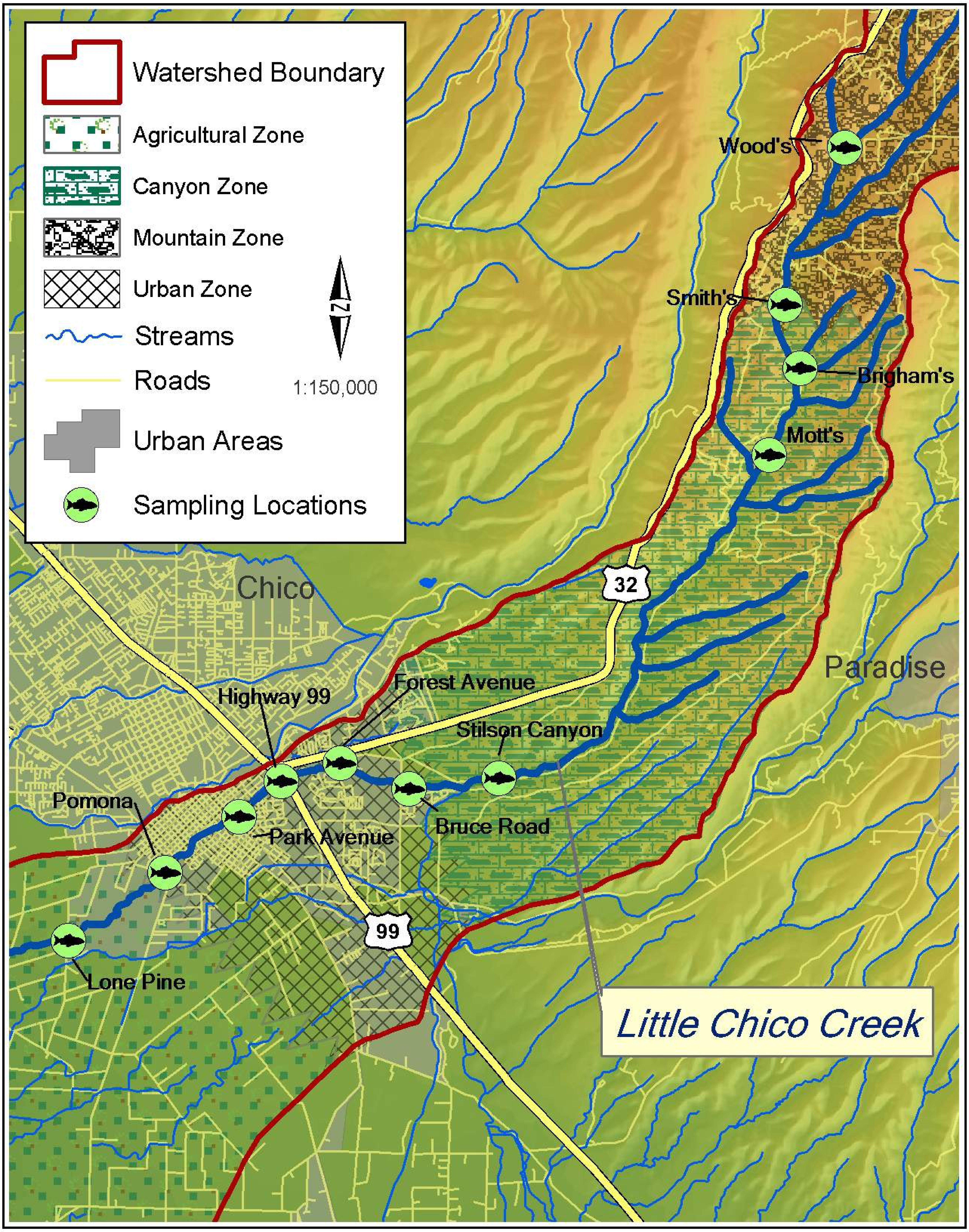


Fig 2.10 Relative abundance of observed bird species – Agricultural Zone. Percent of total individuals detected for species recorded more than once during point count surveys conducted in June 2002 at 7 stations within the Agricultural Zone of the Little Chico Creek watershed, Butte Co., Ca.





Prepared by: C R Benjamin 2002 cbenj@yahoo.com
Source: USGS, CaSIL, Geography Network, P Maslin

Figure 2.11. Fish Survey Sampling Locations

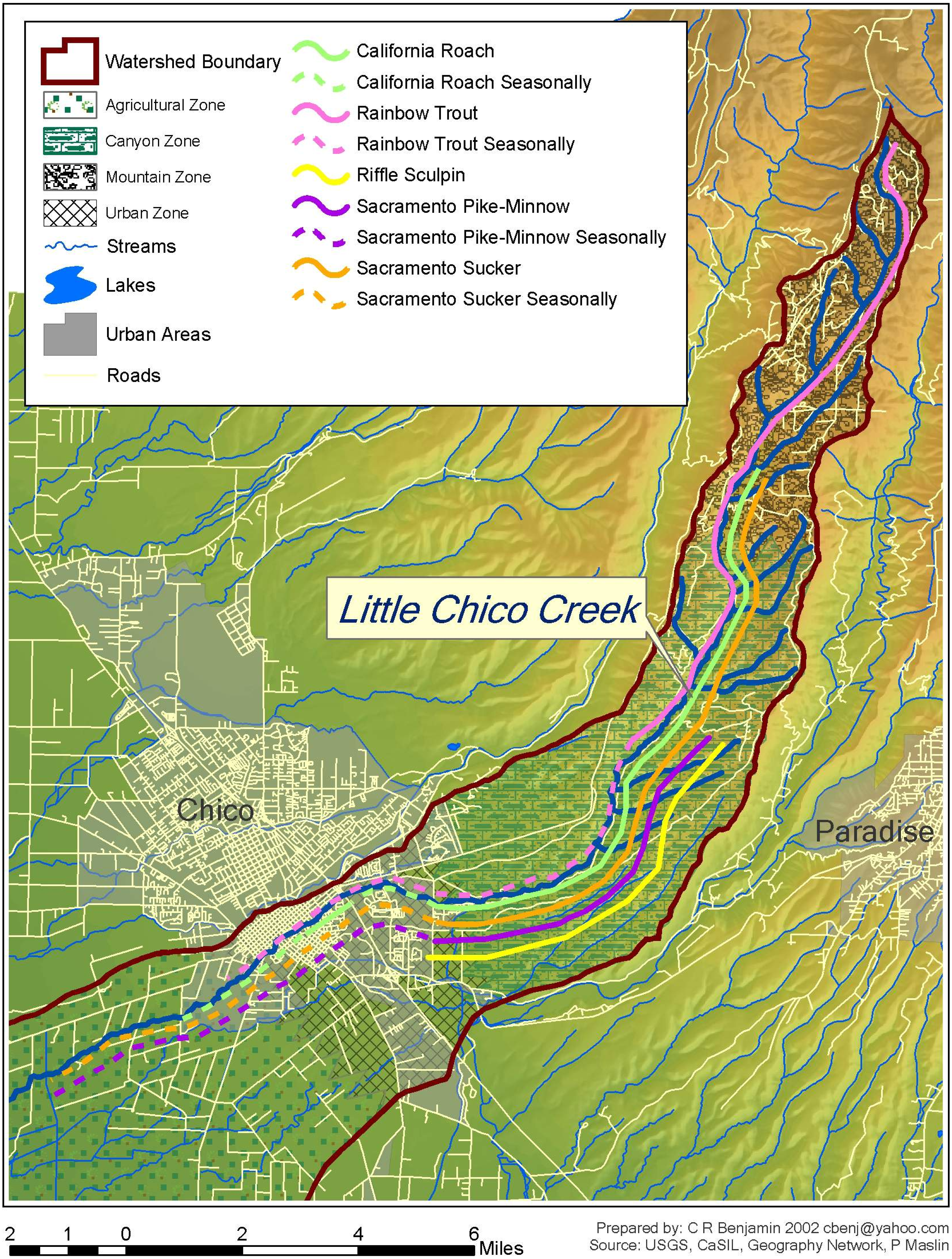


Figure 2.12. Fish Distribution in Little Chico Creek

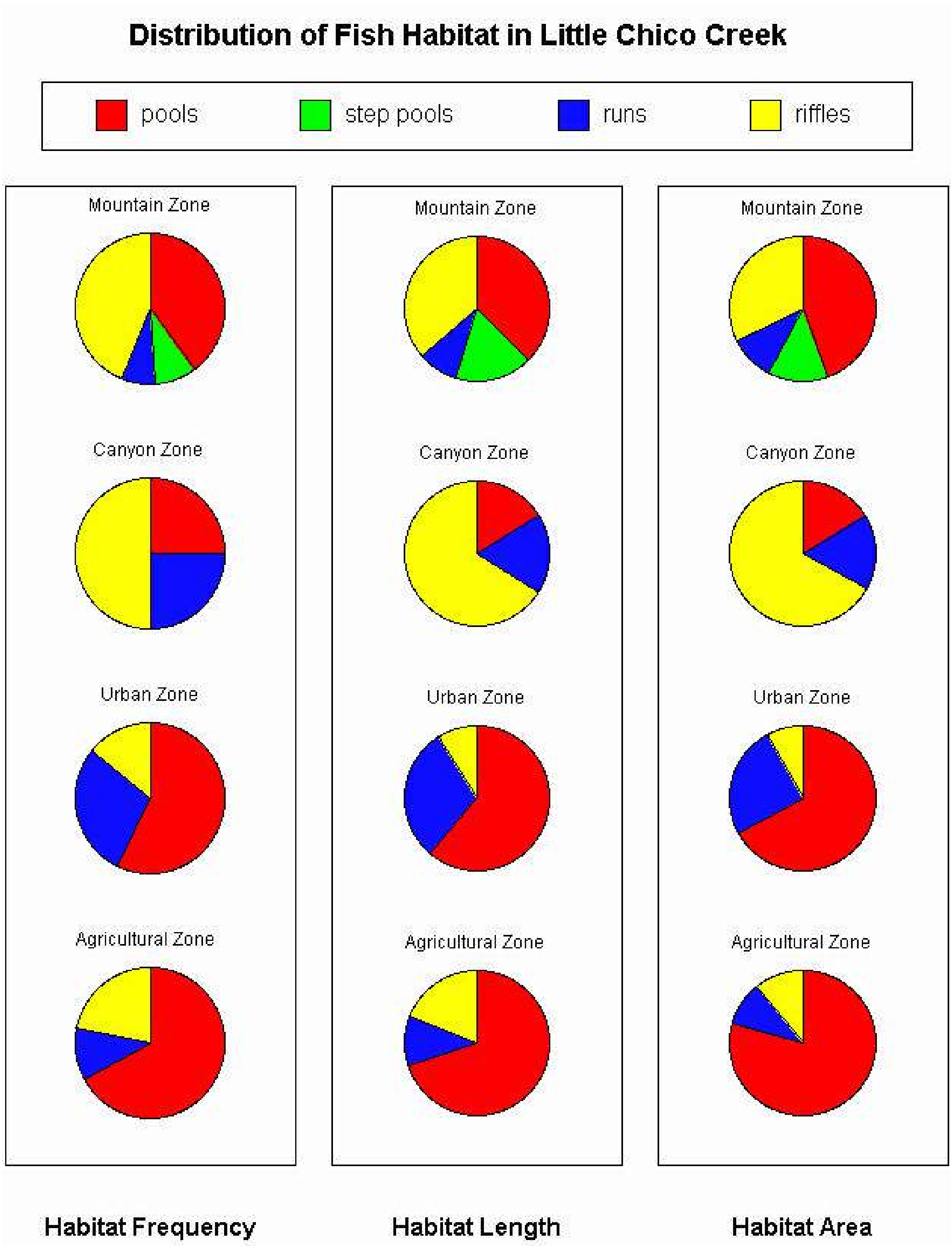


Figure 2.13. Distribution of fish habitat in Little Chico Creek

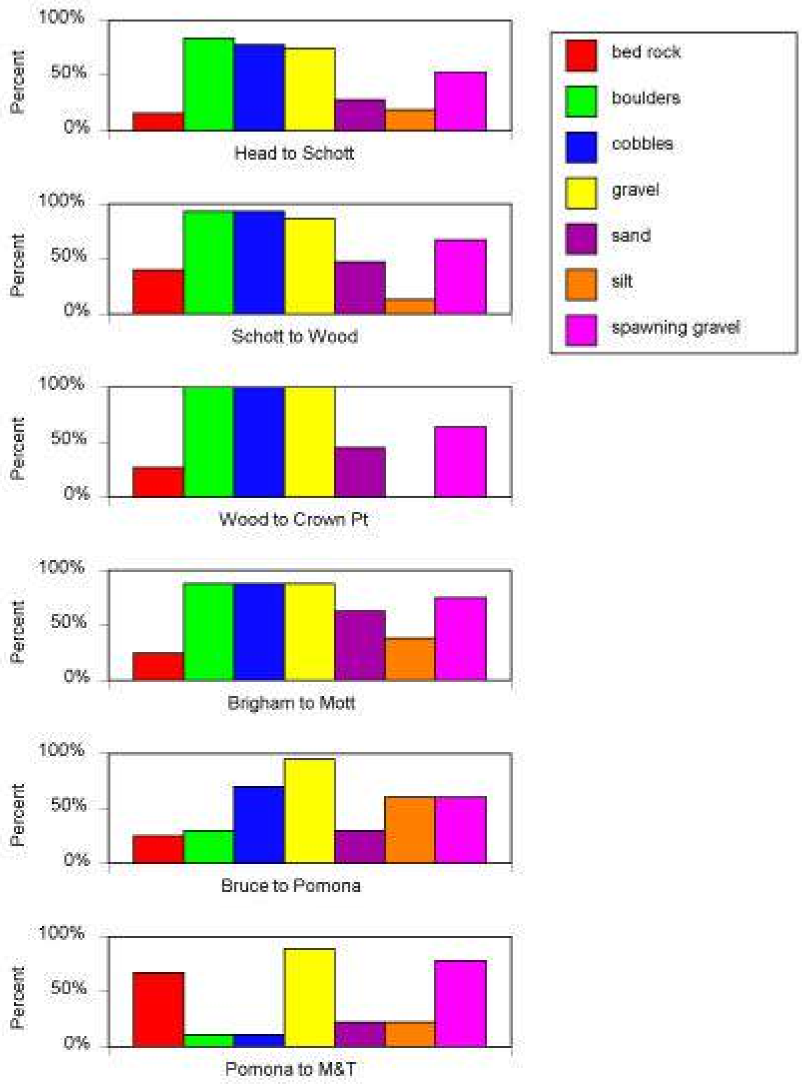


Figure 2.14. Substrate in various reaches of Little Chico Creek

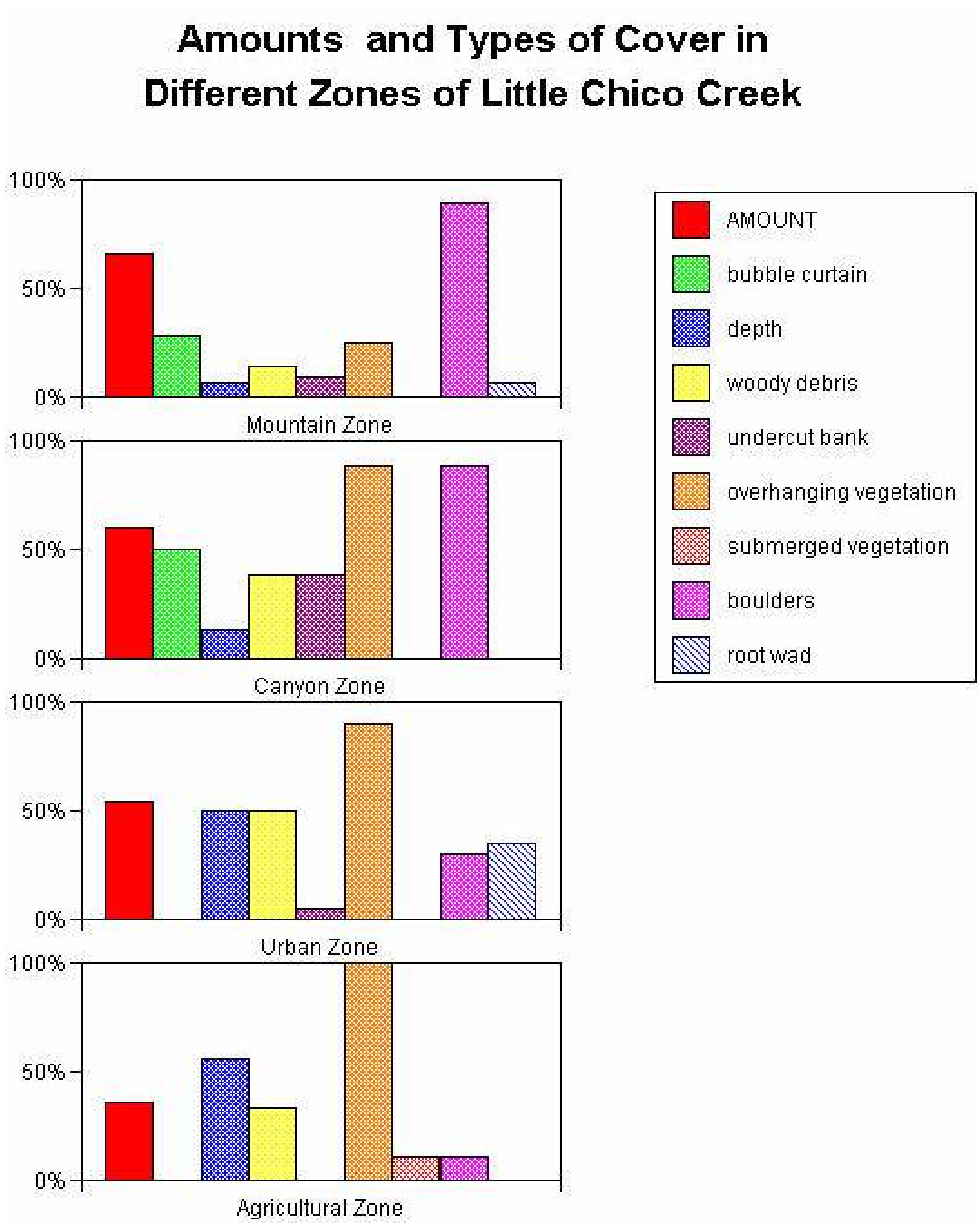


Figure 2.15. Amounts and types of cover in different reaches of Little Chico Creek

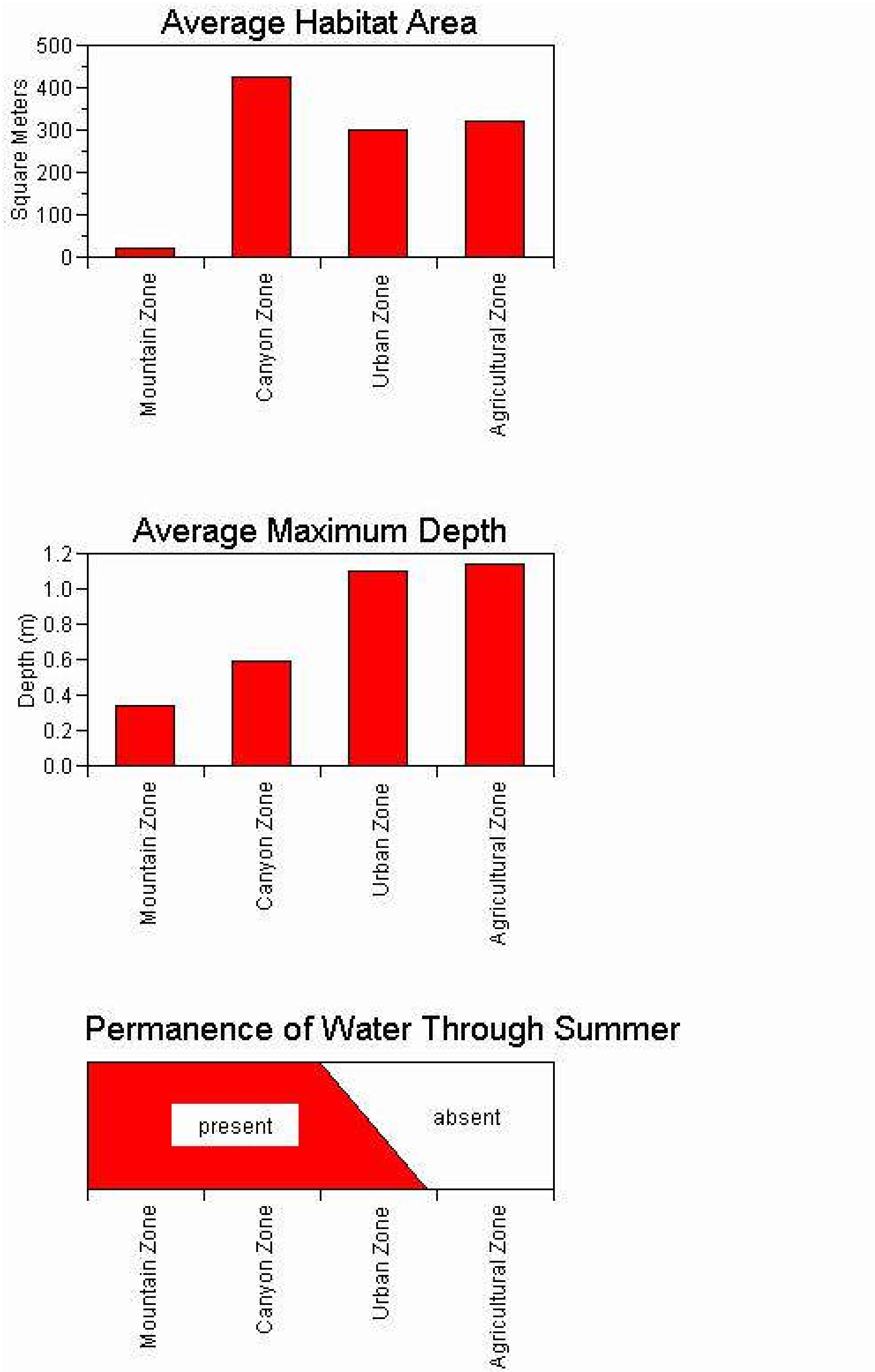


Figure 2.16. Selected habitat characteristics

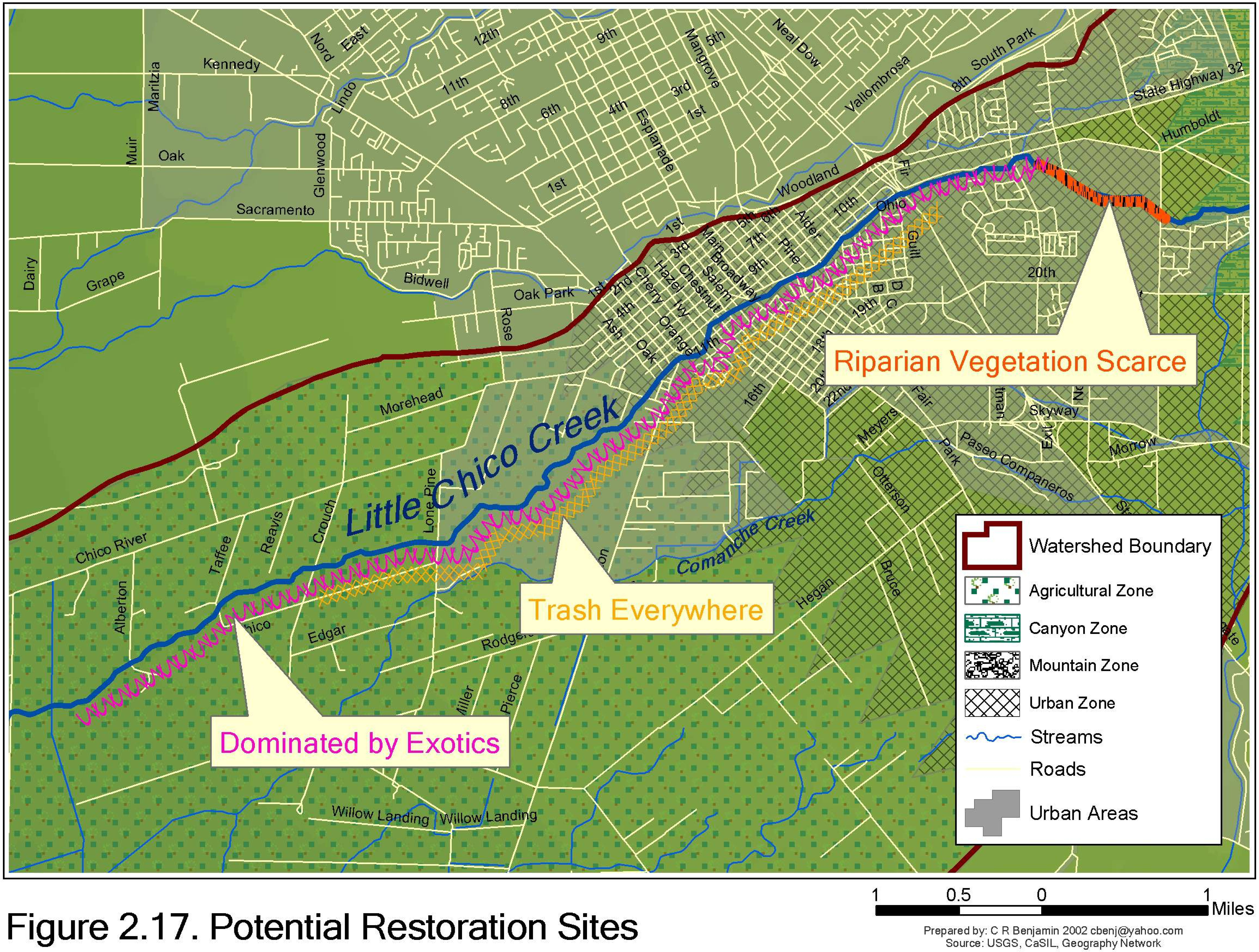
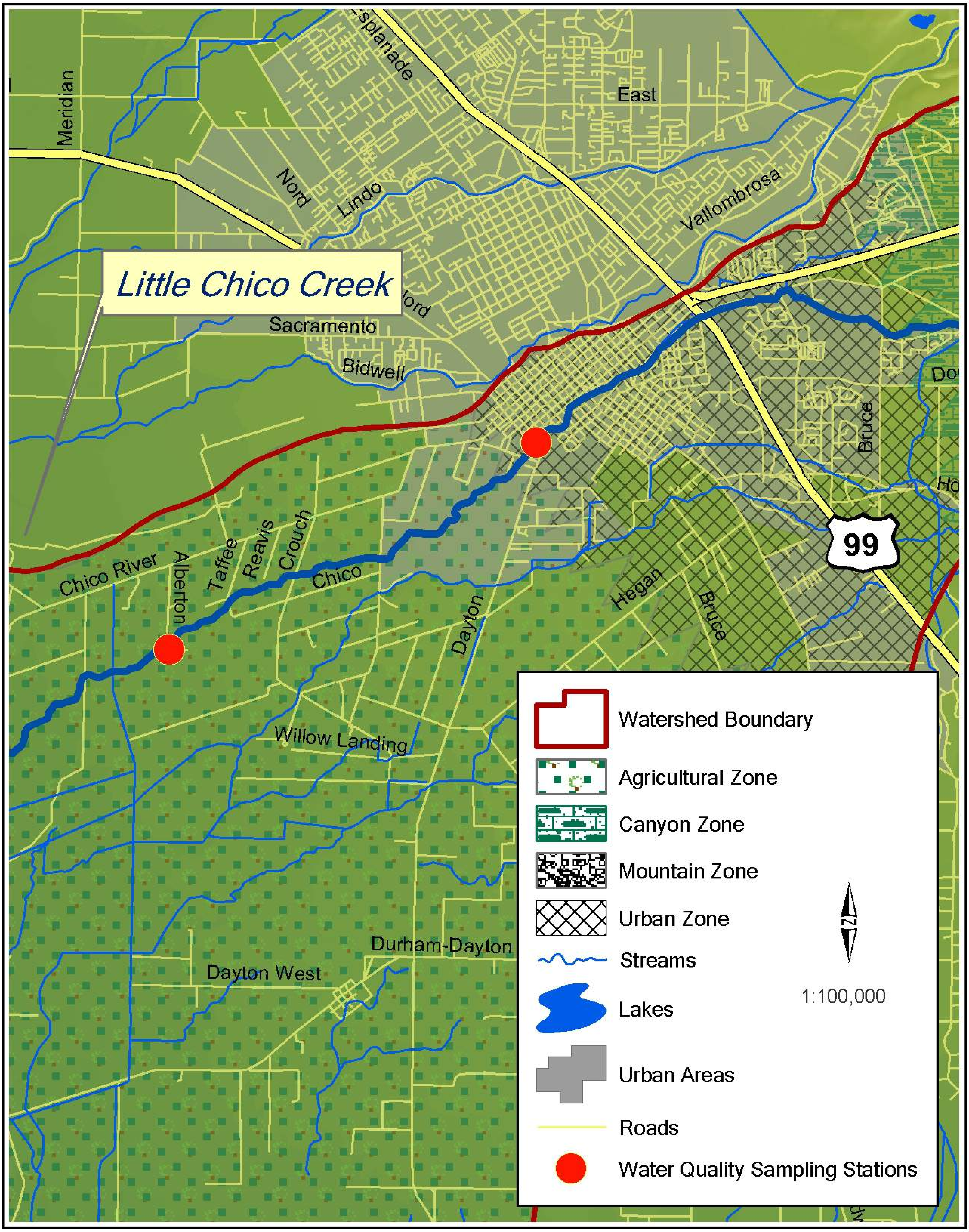


Figure 2.17. Potential Restoration Sites



Prepared by: C R Benjamin 2002 cbenj@yahoo.com
Source: USGS, CaSIL, Geography Network

Figure 3.1. Water Quality Sampling Stations

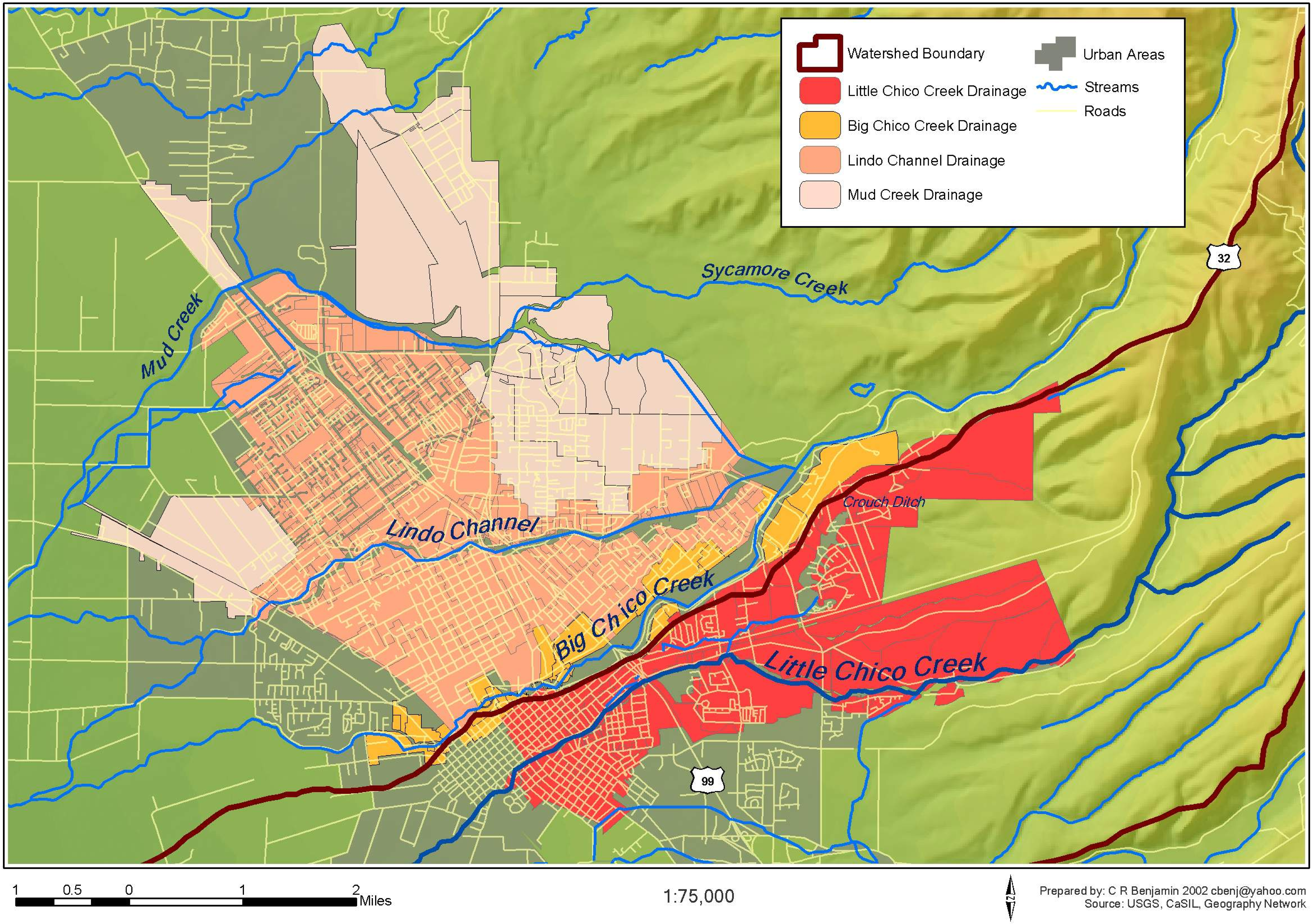


Figure 3.2. Storm Drain Map of Chico Urban Area

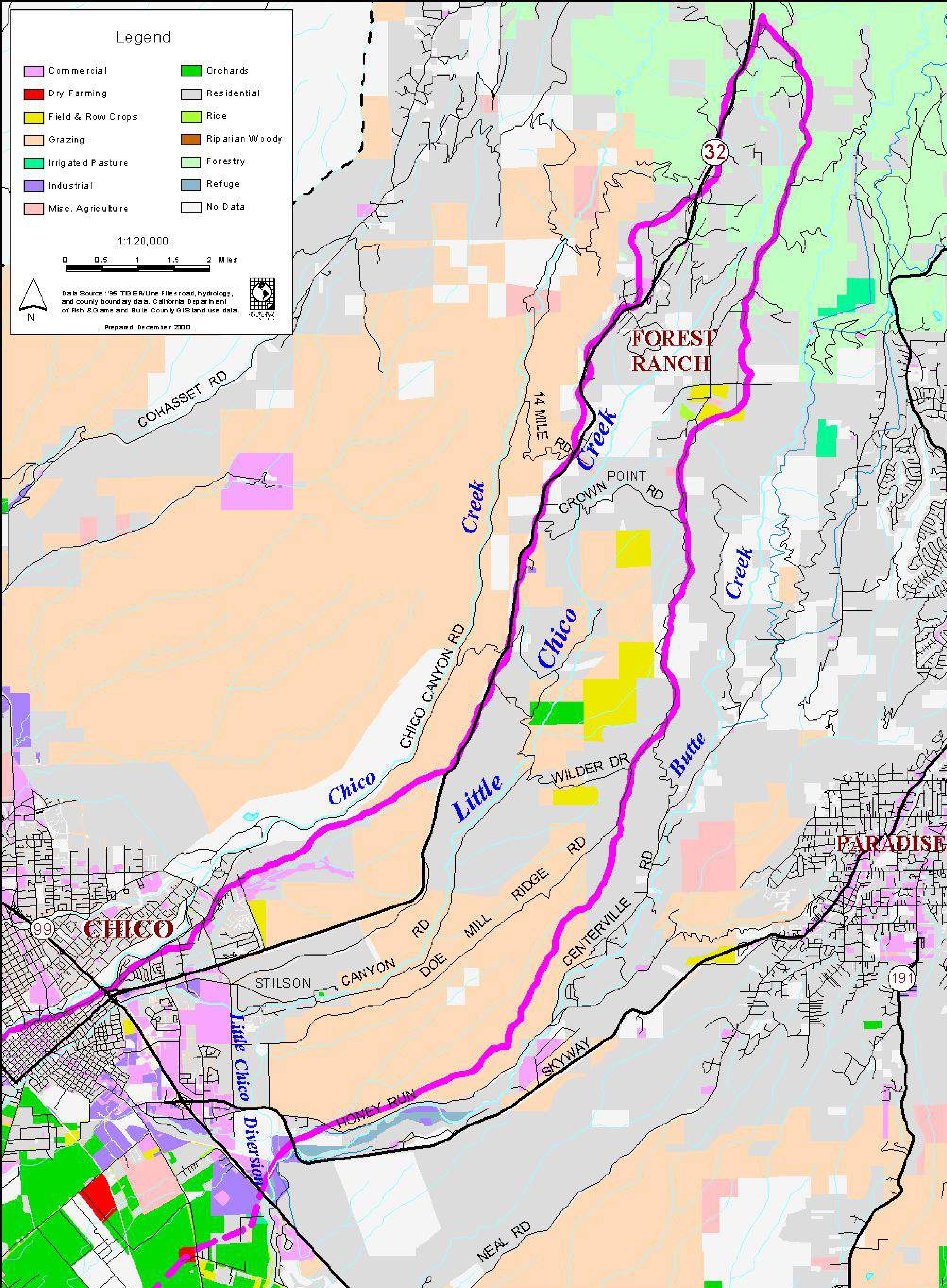


Fig. 4.1a Little Chico Creek Upper Watershed Land Use Map

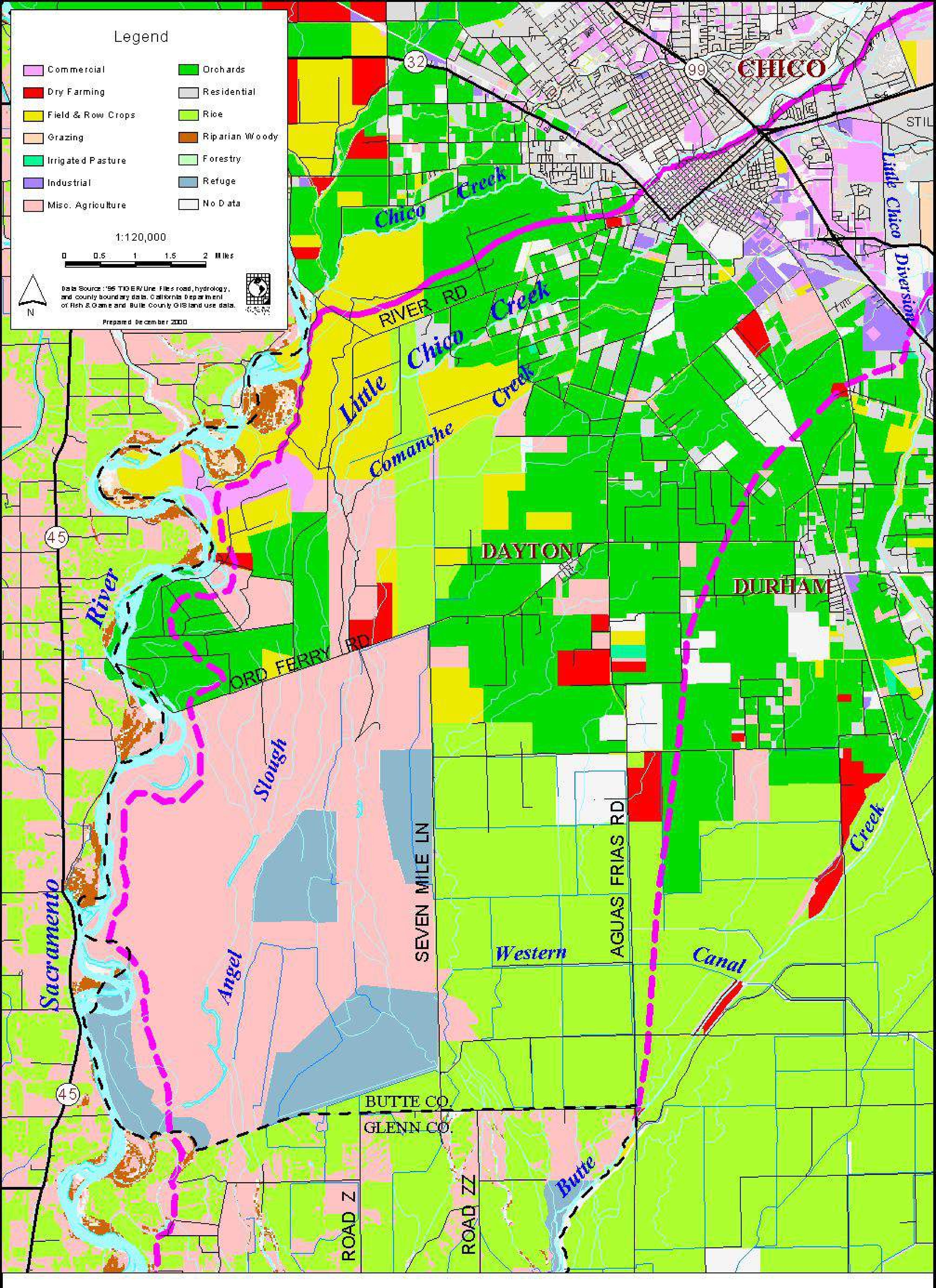


Fig. 4.1b Little Chico Creek Lower Watershed Land Use Map

APPENDIX A

COMMUNICATIONS RECEIVED CONCERNING THE DRAFT ECR

Several communications were received that address the Draft Little Chico Creek Existing Conditions Report. In the spaces below the authors of the document address the comments received in *italics*. Where appropriate, changes were made and appear in this final document

From Dan Breedon, Senior Planner, Planning Division, County of Butte.

November 1, 2002

Mr. David L. Brown
Department of Geosciences
California State University, Chico
Chico, CA 95929-0205

RE: Little Chico Creek Existing Conditions Report

Dear Mr. Brown:

Planning Division staff has reviewed a copy of the Little Chico Creek Existing Conditions Report and offers the following comments:

Although project timing probably prohibited referencing the new September 2002 EIR for the M&T Chico Ranch Mine project, the new September 2002 Draft EIR was completed on October 10, 2002. The 2002 Draft EIR does find that significant and unavoidable impacts are indicated in the areas of traffic and air quality, in contrast to the information presented on Page 58, Section 4.6.3 of the Report, which was based upon the earlier 1998 EIR. The 2002 Draft EIR also includes an extensive reassessment of the project's impact to water quality and flooding impacts, which may be of some use in your final report. The draft EIR for the M&T project has not been certified at this time. Staff estimates that the Planning Commission will be considering certification of this document sometime in January. This document is available for review on the County's website at: www.buttecounty.net/dds.

The above information was summarized in Section 4 of the Final Report (The document at hand).

Section 2.6.2 of the Report should describe that the Little Chico Creek Watershed encompasses an area of Critical Deer Wintering Range according to mapping provided to the County by the Department of Fish and Game. The Report should reference the County’s policy of implementing measures to protect local deer herds. These measures include limiting parcel sizes to 40 acres in most of the areas within the watershed, and limiting fencing for areas other than residential (maximum of 5 wire strands with the lower being at least 16" above the ground and the upper strand being no higher than 48" above the ground).

This information was incorporated into Section 2 of the Final Report.

On page 50 of the Report there is a reference to a Chapter regarding Issues and Concerns. While page 3 of the Report includes a list of issues of concerns, staff could not locate a chapter dealing with Issues and Concerns.

Staff would also like to point out that a small 5-acre gravel mining operation was approved for Deer Creek Rock on December 11, 2001, within the Little Chico Creek Watershed on assessor parcel numbers 63-290-056 and 63-290-057, on Canyon Shadows Road. This project has not been implemented at this time.

The authors decided to not include this information in this document because they would then have had to undertake the task of summarizing other approved projects, a task best left to County planning staff.

While the Report includes considerable detail on fish and wildlife resources located within the watershed, it should also include some information relative to various cultural influences on the watershed, such as population and growth trends, parcelization, and road development. These are important factors in the development of future management strategies for the watershed.

While the authors agree with this observation, time and budget did not allow for such an analysis. It is hoped that the next revision of the County General Plan will include this kind if information for all of the watersheds in the County.

Thank you for the opportunity to review the Existing Conditions Report for the Little Chico Creek Watershed. I hope that the information presented here will assist you in the preparation of the Final Report.

Sincerely,

Daniel C. Breedon
Senior Planner

From Rob Hill, Deputy Agricultural Commissioner, Butte County

Little Chico Crk. Watershed Existing Conditions Rpt.

This Draft document has its structural problems I.E. type-O's, data organization issues, but it appears to fulfill its intention: to adequately and generally assess and describe the existing condition of the water shed.

These "structural problems" have been addressed.

The following is a list of suggestions to address problem areas found in a cursory review of this document by the Recourse Deputy Ag Comm.

- The document could use a statement of purpose in the front mater; the copy I received was lacking the cover letter that had accompanied it.

See section 1.6 in this document.

- A table of aquatic plants would have been helpful to me, particularly any aquatic weeds. If for no other reason but to rule out their existence in the water shed, but I realize it's not the intent of the document to do that in every case, just a suggestion.

Aquatic plants (and weeds and particular) have been observed in Teichert Ponds by P. Maslin in the past. However, aquatic plants were not surveyed during this project.

- A number of the references could use further source location info. (Email addresses and Web sites)

More specific comments as to which references are needed to address this request.

- Table 2.13 (Invasive exotic plants) is not ref. In any of the "Plant communities" section for each zone.

Please see new Table 2.3 and relevant text sections.

- Table 2.6 List Taricha.torosa as a Plethodon I'm sure it's in the family Salamandridae.
-

This error has been corrected.

From: Guy Chetelat; Regional Water Quality Control Board

Hi Dave,

Here are my comments on the Draft Existing Conditions Report you sent us.

Figure 1.2   Titles of "Watershed Zones" mixes land uses with land forms. Perhaps the watershed zones should be land forms only (Mountain, Canyon, and Valley) and areas with dominate land uses (irrigated Ag, grazing, forestry, urban etc....)should be labeled in a different manner.

It was decided to comment on land use within the text and keep the landform names for tables, maps, figures. The mix of terms currently in use is intuitive. Perhaps an alternative for a later edition would be "Rural Mountain" and "Rural Canyon.

Is there a soil or rock unit that is especially susceptible to erosion or slope failures? Some erosion problems were noted in the Valley zone but it was unclear if the cause was debris accumulation, water conveyance design, channel meander bank erosion or something else.

It was not in the purview of this report to determine 'cause of erosion—although it does say "estimation of …bank stability" pg 4 of SOW. We believe that water conveyance design could easily contribute in the valley zones—constrained streams (i.e. where the floodplain has been removed) have greater potential for erosion. Our understanding is that the canyon and mountain zones are generally not prone to mass failures, except for occasional slow rotational slumps and small bank failures, often in response to disturbance. The Tuscan soil associations are pretty stable.

Does the Chico Formation have saltwater seeps in this watershed as it does in other watersheds?

Such seeps are v*ery likely but none were observed in the reaches surveyed. We are unaware of any—but the survey was restricted to riparian corridor.*

Is there any gold mining era legacy wastes such as dredge tailings, in the watershed?

There are no tailings. One mine tunnel was observed. Our understanding is there was a mine on one of the tributaries coming down from Doe Mill ridge as well as opportunistic tunnels along the creek in the upper watershed.

Do we know enough to say the mountain zone is a gaining reach, the canyon zone a wet season (?) gaining reach, and the valley zone a losing reach? If so maybe it should be said.

This is logically a true statement, based on water permanence but we have no measurements to verify it. All we have is a preliminary study in Big Chico Creek showing gains at the contact between the Lovejoy and Chico formations and losses with distance onto the alluvial fan. The authors added a statement in the Surface hydrology section of Chapter 2 (p. 8).

A sub chapter dedicated to water use/diversions would be informative. Surface and groundwater, known diversion points, extent of riparian rights pumping, known Ag return points, septic, etc.

This topic is outside the scope of work for the document.

Spring Run were the only salmon species listed as using LCC.

Steelhead have been observed, but were not distinguished from resident rainbow trout in the study.

Is this correct? Smallmouth bass also weren't listed. I thought smallmouth were in all the east side tribs. Smallmouth are absent in LCC**.**

Possibly because of the long reach of warm, still water (largemouth habitat) between the Sacramento River and suitable smallmouth habitat, smallmouth have not colonized LCC.

Perhaps more discussion of riparian habitat condition and the associated issues is warranted: invasives, development, channelization, grazing, etc. Also, Is the habitat healthy for fish or is it lacking structure, flushing flows etc.

Structure and flushing flows are suitable throughout the creek. Water availability is a problem downstream of the canyon zone. See inserted text on "condition" of Riparian vegetation. I did this evaluation from an ecological viewpoint of composition and function. The more natives composing the vegetation the better. Function—structural diversity for wildlife habitat, closed canopy for shading for fish, stable banks for water quality, floodplain still connected to main channel.

3.4.3 Urban Effects on the Creek. 3rd pph Metals discussion. Metals concentration is typically linked with TSS. I couldn't find any turbidity or TSS data for the samples. Event comparison needs to incorporate TSS, turbidity results.

This is correct, but we didn't do turbidity with each sampling event. Samples were analyzed for total metals which would include both dissolved and sorbed metals.

3.4.4 Summary of Current Water Conditions
Ist sentence: LCC "...does not seem to be seriously impaired...." Perhaps this could be stated more clearly. Are there impairments or not?

The word "seriously" was deleted from this statement.

3.4.4, 2nd pph "...remediation efforts at the Humboldt Road Burn Dump may liberate sediments observed to contain metals...." Is there some reason to think remediation work and erosion control at the dump would be done improperly? Is faulty erosion control at the dump more likely than sediment discharges from grading, grazing, or forestry?

No, but proposed grading and movement of waste materials may be in progress as early as this coming Spring. We have serious doubts that the contractors can completely eliminate the risk of erosion during a storm if one occurs at an inopportune time.

3.5 Future Needs and Monitoring
I suggest changing the title of this discussion and expand it and raise it to full chapter level. Monitoring is a future need so it could be a sub heading in a chapter that covers questions raised by the existing assessment.

Some questions this chapter might address are:

What habitat and water quality concerns were identified? Maybe all the major issues: erosion, riparian habitat, invasive species, urban runoff, litter, development, diversions, ag return, flood plain function, bacteria could be covered in this chapter. What issues/problems are likely to demand more attention in the future? Why are these issues important? Were any problems identified that could be addressed through education, outreach, or cooperation? What additional information/understanding is needed to develop technically sound projects? Bacteria for example: source ID, regrowth, monitoring needs, etc.   What obstacles are there to development and implementation of good projects? Are there approaches/opportunities to prevent habitat loss or water quality impairment?

I think putting effort in this chapter will make the report more useful for a watershed group, for development of good projects, and for successful grant writing.

The text revisions throughout this document reflect many of the above suggestions but the suggested new chapter was not written.

You've put together a lot of interesting info. It's going to be a useful document.

-Guy

From: Rich Reiner, PhD., Ecologist

Hi Dave,

The report is week on information that could direct restoration activities. Exotic plant control will require better mapping. Potential restoration of riparian forest in the flood plain will require an existing riparian vegetation map, a soils map, a floodplain map, and a parcel map. I was hoping that the report could have gone to this level of specificity.

We didn't map exotic plant control because of ownership issues and the ubiquity of the problems. Nearly every part of the creek has one to many exotic invaders. A riparian vegetation map can only occur with aerial photos, which thus far we have not had access to—should they become accessible our field data can act as the ground truth for these maps. Maybe this could happen for the next update of this document. A soils map is awaiting the new Butte County Soil Survey. A floodplain map would be a good addition.

The report seems week on issues of fragmentation. It would be useful for any future conservation planning to have a parcel map included showing parcel patterns. Some basic questions are not answered, for example, is much of the canyon section already broken into 20's or 40's. If so where? The large land owners are listed in a table but the report does not give any idea of where they are located and there is no discussion of the conservation implications of the current ownership pattern.

This concern has been clarified in Section 4 of this document.

The report would be more readable if the longer tables were moved to the back.

Selected tables were moved to the appropriate appendix.

Combine the individual chapter Table of Contents to the front of the report.

Done.

Some specific edits;
Page 1-1. Section 1-1. line 5 "topography over" should read "topography of"?

Done.

Page 1-1. Section 1-1 this section should include some general comments about the area the report covers. I was not sure regarding the coverage until I read the section on soils. This introduction section would be a good place to introduce how the report divides the watershed into reaches. I would also include a very brief discussion of the general character of each reaches at this forward point.

Done

Figure 1.1 There is no key to tell me what the large purple, blue and pink areas are?

Completely redone.

Page 2-1 The title of this section should be expanded. Perhaps " Riparian Habitat, Birds, Mammals, and Fish of the LCCW

Done

Page 2-4 The discussion of where the creek becomes intermittent is clumsy and spread across 2 paragraphs. Put into a single paragraph. Pick a point and stick to it though the whole report. (1/2 mile up from Stilson Bridge?)

Addressed in this document.

Page 2-9 Second paragraph line 1. reads " Notable species not listed" should read "Notable species not listed as rare?"

Corrected

Page 2-12 Paragraph 1 It would be good to include a short discussion of which exotic plants are found in this zone and what are the conservation implications of each species.

It is noted in this document that Mediterranean grasses, yellow-star thistle, many other weeds have completely changed the ecology of this area.

Page 2-13 section 2.3.5 I have heard talk of steel head in the creek. This is not mentioned.

Steelhead, like Chinook salmon, have been observed in high flow years. Neither currently maintain populations in the creek. (See p 2-13, line 13.)

Page 2-13 section 2.3.7 This section should list our exotic crawdads as well as bull frogs. Also the proper name is the "western pond turtle"

This is correct for the western pond turtle. Exotic bull frogs and two species of exotic crayfish (Orconectes virilis and Procambarus clarkii) are found in the lower canyon and permanent water areas of the urban zone.

Page 2-15 section 2.4.2 Privet is not mentioned. I have this on my property and I think it is invading elsewhere.

Privet and a shopping list of other invasive exotics are common in the urban zone. Some have colonized both above and below this zone.

Page 2-16 Starlings are a major problem for cavity nesters in the lower canyon.

True and also in the urban and agricultural areas.

Page 2-22 line 9 The section above the bridge goes dry and does not support resident fish. Should read 1/2 mile above the bridge?

Corrected to read roughly from Stilson Canyon Bridge to Headwaters Road.

Table 2.6 My key shows *Ensatina platenis* as the local species not *escholzii* as listed. Also I am not sure if Tiger Salamander would be found here. I did find a sharp-tailed snake at my place this summer so I know that correct!

Observation noted

Figure 2.11   Other figures refer to a sample point at Crown Point Rd. (Figure.14) yet it is not located on this map.

Crown Point is the same as Smith's.

Figure 2.12 It would be nice to have more points of reference on this map. Perhaps a few major roads.

Additions made

Figure 2.17 I did not see this Figure referenced in the text. Maybe I missed it?

Page 2-23 line 9

Page 4-7 Land Use Section   element CD-G-10 is listed twice

Done.

Page 4-11 There are a lot of un-explained acronyms here. What's a ROG?

Done.

4-12 There should be a discussion of where the land use data came from here.

Done

4-15 The table should be arranged by river reach.

Done

4-16 This table should be arranged by reach and perhaps combined into the previous table.

Done

Figure 4.1a I suspect the urban polygons came from Tiger Files. It shows a lot of the roadless area of the canyon as urban? A parcel density map would be much more useful for planning future conservation projects.

After discussing this issue, we decided to provide Butte County with parcel maps along the creek. A short section of text will be added to Chapter 2 directing people to this resource. Landowner attitudes are such that including these maps in our document would likely create more friction for the watershed group efforts.

Thanks for letting me look this over. Rich Reiner

From Loyd Heidinger and Ron Cinquini; Property Owners

October 30, 2002

TO: DAVID L. BROWN
Dept. of GEOSCIENCES
CALIF. STATE UNIV. CHICO

The LCC Draft Existing Conditions Report begins with Section 1. On p.4 it states there are 8000 landowners in the LCC Watershed. A survey was formed from responses of 69 landowners. This is exemplary of the lack of consensus LCCW Group has failed to build.

In Section 2 the underlying theme of restoration of LCC to pre-western european habitations, leaves little to accept or respect. This section stands on its' own assumptions, expectations, and exclusions. One has to wonder why every day species would be excluded. Page 20 paragraph 2 (sentences 1, 2, & 3) are particularly in conflict with property owner statements made at the March 28, 2002 meeting.

Section 3 is a science report on the water quality of LCC. It seems accurate, with conclusions explained. A problem is Figure 3.2 which is quite inaccurate.

Section 4 says its' purpose is to inform. It then proceeds to restate what is already public information. LCCECR doesn't benefit from plagerism or redundancy.

Except for Section 3, LCCECR can be characterized as a '72 Comet being purchased at a 2003 Cadillac price. There is certainly little or no justification for any commission on such a sale.

Sincerely,

Lloyd Heidinger

Ron Cinquini

The comments made in the letter dated 10-30-02 reflect the opinions of the writers and are noted and acknowledged here. The storm drain map on Figure 3.2 was corrected based the observation made above. We are working with Mr. Heidinger to improve the interpretation of the erosion problem referred to above (page 20, paragraph 2 in the public review draft). No other revisions to this document are seen to be necessary in response to the opinions given in the letter. ***[NOTE: as of December 22, 2002, we have not received the requested follow-up information from Mr. Heidinger. We will attempt to create an addendum to the final report if possible.]***

I have requested an electronic version of the Nov. 19 comments from the County. I hope to get them tomorrow.

December 16, 2002

Dr. Dave L. Brown PhD
Department of Geosciences
California State University, Chico
Chico, CA 95929-0205

RE: Little Chico Creek Existing Conditions Report

Dear Dr. Brown:

The Department of Water and Resource Conservation has reviewed the most recent edition of the Draft Little Chico Creek Existing Conditions Report (ECR). Our department has compiled additional comments submitted by the Butte County Agricultural Commissioner's Office, Department of Public Works and Office of Emergency Services. Please consider the following as combined comments.

Public Works Department, Stuart Edell:

1. Although metric units are much easier to use than English units, most people in the United States are accustomed to, and most reports within the watershed are written in, English units. The report mixes the two types of units, English units (inches, feet, miles, °F, cfs) should be used for the primary report and metric units (millimeters, meters, °C, m^3/s), if used, should be contained in parenthesis behind the English units.

This correction was made throughout the document as recommended.

2. Section 2.1.3 Surface Hydrology, should contain references to the latest FEMA flood/floodplain information.

This change was made in Sections 2.1.3 and 4.5.2.

3. Sections 4.3 and 4.4 should reference the County's current activity updating the elements of the General Plan.

This reference was added in the appropriate section.

4. The report references several guides or keys for identification of plants and animals, but it does not state who did the identification and there is no apparent concurrence from a qualified botanist or biologist.

It is unclear what type of technical background information is needed. There is no standard format for ECR documents regarding how professional background information is presented. In response to this particular question, biologists directly involved in this project included Ms. Jean Hubbell, M.S.; Dr. Paul Maslin, PhD; and Mr. John Hunt, M.S. Candidate. Outside reviews of this work came from at least one PhD ecologist and several professional staff with State and Federal wildlife agencies.

<u>Agriculture Commissioners Office, Deputy Ag . Comm. Rob Hill:</u>

1. Page A-3, Top of the page, change "Assistant" to Deputy

This correction has been made.

<u>Office of Emergency Services, Officer Mike Madden:</u>

1. The nomenclature (both scientific and common names) for the birds listed in the report is old, incorrect or have been changed since 1988. OES suggests that current names should be reflected in the ECR. "One day" bird counts are misleading as to what actual bird populations are in the Little Chico Creek Watershed.

More specific information is needed as to which nomenclature is in error. If OES biologists or other staff members have found specific errors in the Draft, we welcome that input and will make corrections in subsequent on-line errata to be posted on the Butte County website as part of the electronic version of the ECR being developed. Suitable limitations of the bird-count sampling methods were stated in the December 1 draft on page 10.

We hope that you find these comments useful in your preparation of the Final Existing Conditions Report for the Little Chico Creek Watershed. Please feel free to call if you have any questions.

Sincerely,

Pia Sevelius
Watershed Coordinator

cc. Deputy Ag. Comm. Rob Hill
OES Officer Mike Madden
Public Works, Stuart Edell
Water and Resource Conservation, Vickie Newlin

APPENDIX B

DATA TABLES AND ANALYSES FOR CHAPTER 2

Table B1. Coniferous tree species found in the riparian corridor of Little Chico Creek. Native species are in **bold**. Taxonomy follows the Jepson Manual (1993).

			Zones			
Common Name	**Scientific Name**	**Family**	**Mountain**	**Canyon**	**Urban**	**Agricultural**
incense cedar	***Calocedrus decurrens***	Cupressaceae	X	X		X
sugar pine	***Pinus lambertiana***	Pinaceae	X			
pacific ponderosa pine	***Pinus ponderosa***	Pinaceae	X	X		
foothill pine	***Pinus sabiniana***	Pinaceae	X	X		
Douglas-fir	***Pseudotsuga menziesii***	Pinaceae	X	X		
pacific yew	***Taxus brevifolia***	Taxaceae	X			
California nutmeg	***Torreya californica***	Taxaceae	X	X		

Table B2. Broadleaf tree species found in the riparian corridor of Little Chico Creek. Native species are in **bold**. Taxonomy follows the Jepson Manual (1993).

			Zones			
Common Name	**Scientific Name**	**Family**	**Mountain**	**Canyon**	**Urban**	**Agricultural**
vine maple	***Acer circinatum***	Aceraceae	X			
mountain maple	***Acer glabrum***	Aceraceae	X			
big-leaf maple	***Acer macrophyllum***	Aceraceae	X	X	X	
box elder	***Acer negundo***	Aceraceae			X	X
silver maple	*Acer saccharinum*	Aceraceae			X	X
pistachio	*Pistacia atlantica*	Anacardiaceae			X	
date palm	*Phoenix* species	Arecaceae			X	
white alder	***Alnus rhombifolia***	Betulaceae	X	X	X	X
hazelnut	***Corylus cornuta***	Betulaceae	X			
northern catalpa	*Catalpa speciosa*	Bignoniaceae			X	X
brown dogwood	***Cornus glabrata***	Cornaceae				X
mountain dogwood	***Cornus nuttallii***	Cornaceae	X			
American dogwood	***Cornus sericea***	Cornaceae	X			
dogwood	***Cornus sessilis***	Cornaceae	X	X		X
pacific madrone	***Arbutus menziesii***	Ericaceae	X			
honey-locust	*Gleditsia triacanthos*	Fabaceae			X	X
black locust	*Robinia pseudoacacia*	Fabaceae	X	X	X	X
tan oak	***Lithocarpus densiflorus***	Fagaceae	X			
canyon live oak	***Quercus chrysolepis***	Fagaceae	X	X		
blue oak	***Quercus douglasii***	Fagaceae		X		
California black oak	***Quercus kelloggii***	Fagaceae	X	X		
valley oak	***Quercus lobata***	Fagaceae		X	X	X
interior live oak	***Quercus wislizenii***	Fagaceae	X	X	X	
California buckeye	***Aesculus californica***	Hippocastanaceae	X	X	X	X
pecan	*Carya illinoinensis*	Juglandaceae			X	
California black walnut	***Juglans californica/J. hindsii***	Juglandaceae		X	X	X

Table B2. (continued) Broadleaf tree species found in the riparian corridor of Little Chico Creek. Native species are in **bold**. Taxonomy follows the Jepson Manual (1993).

			Zones			
Common Name	**Scientific Name**	**Family**	**Mountain**	**Canyon**	**Urban**	**Agricultural**
English walnut	*Juglans regia*	Juglandaceae			X	X
California bay	***Umbellularia californica***	Lauraceae	X	X		
white mulberry	*Morus alba*	Moraceae			X	X
eucalyptus sp.	*Eucalyptus* species	Myrtaceae			X	X
California ash	***Fraxinus dipetala***	Oleaceae			X	
Oregon ash	***Fraxinus latifolia***	Oleaceae	X	X	X	X
privet species 2	*Ligustrum* species 2	Oleaceae			X	
privet species 1	*Ligustrum* species 1	Oleaceae			X	X
olive	*Olea europaea*	Oleaceae			X	
American sycamore	*Platanus occidentalis*	Platanaceae			X	
western sycamore	***Platanus racemosa***	Platanaceae	X	X	X	X
sycamore hybrid	*Platanus* hybrid	Platanaceae			X	X
London plane-tree	*Platanus x acerifolia*	Platanaceae			X	
cherry plum	*Prunus cerasifera*	Rosaceae		X	X	X
almond	*Prunus dulcis*	Rosaceae			X	X
Fremont cottonwood	***Populus fremontii***	Salicaceae	X		X	X
Goodding's black willow	***Salix gooddingii***	Salicaceae		X	X	X
Goodding's black/arroyo hybrid willow	***Salix gooddingii x S. lasiolepis***	Salicaceae				X
tree of heaven	*Ailanthus altissima*	Simaroubaceae			X	X
hackberry	***Celtis reticulata***	Ulmaceae	X		X	
elm	*Ulmus* species	Ulmaceae			X	
persimmon	*Diospyros* species	Ebenaceae			X	
goldenrain tree	*Koelreuteria paniculata*	Sapindaceae			X	

Table B3. Shrub species found in the riparian corridor of Little Chico Creek. Native species are in **bold**. Taxonomy follows the Jepson Manual (1993).

			Zones			
Common Name	Scientific Name	Family	Mountain	Canyon	Urban	Agricultural
western poison oak	***Toxicodendron diversilobum***	Anacardiaceae	X	X	X	X
oleander	*Oleander* species	Apocynaceae			X	
mule fat, seep-willow	***Baccharis salicifolia***	Asteraceae		X	X	X
heavenly bamboo	*Nandina domestica*	Berberidaceae			X	
spicebush	***Calycanthus occidentalis***	Calycanthaceae	X	X	X	X
red elderberry	***Sambucus racemosa***	Caprifoliacaeae	X	X		
blue elderberry	***Sambucus mexicana***	Caprifoliaceae			X	X
manzanita species (horticultural var.)	*Arctostaphylos* species	Ericaceae			X	
white-leaved manzanita	***Arctostaphylos viscida***	Ericaceae		X		
rhodendron	***Rhododendron macrophyllum***	Ericaceae	X			
western redbud	***Cercis occidentalis***	Fabaceae		X	X	X
Spanish broom	*Spartium junceum*	Fabaceae		X		
gooseberry	***Ribes* species**	Grossulariaceae	X			
California greenbriar	***Smilax californica***	Liliaceae	X			X
edible fig	*Ficus carica*	Moraceae		X	X	X
lilac	*Syringa vulgaris*	Oleaceae			X	
wild mock orange	***Philadelphus lewisii***	Philadelphaceae	X	X		
deer brush	***Ceanothus integerrimus***	Rhamnaceae	X	X		
ceanothus species	*Ceanothus* species	Rhamnaceae			X	
hoary coffeeberry	***Rhamnus tomentella***	Rhamnaceae		X	X	X
toyon, Christmas berry	***Heteromeles arbutifolia***	Rosaceae	X	X	X	
firethorn	*Pyracantha angustifolia*	Rosaceae			X	
California rose	***Rosa californica***	Rosaceae	X	X	X	X
rose species	*Rosa* species	Rosaceae	X			
Himalayan blackberry	*Rubus discolor*	Rosaceae	X	X	X	X
cut-leaved blackberry	*Rubus laciniatus*	Rosaceae	X			
thimbleberry	***Rubus parviflorus***	Rosaceae	X			
blackberry species	*Rubus* species	Rosaceae	X			

Table B3. (continued) Shrub species found in the riparian corridor of Little Chico Creek. Native species are in **bold**. Taxonomy follows the Jepson Manual (1993).

			Zones			
Common Name	**Scientific Name**	**Family**	**Mountain**	**Canyon**	**Urban**	**Agricultural**
California blackberry	***Rubus ursinus***	Rosaceae	X	X	X	X
California button willow	***Cephalanthus occidentalis***	Rubiaceae			X	X
narrow-leaved willow	***Salix exigua/S. hindsiana***	Salicaceae			X	X
red willow	***Salix laevigata***	Salicaceae		X	X	
arroyo willow	***Salix lasiolepis***	Salicaceae	X		X	X
yellow willow	***Salix lutea***	Salicaceae		X	X	
willow species 1	*Salix* species 1	Salicaceae	X	X		
willow species 2	*Salix* species 2	Salicaceae	X			
willow species 3	*Salix* species 3	Salicaceae	X			

Table B4. Vine species found in the riparian corridor of Little Chico Creek. Native species are in **bold**. Taxonomy follows the Jepson Manual (1993).

			Zones			
Common Name	**Scientific Name**	**Family**	**Mountain**	**Canyon**	**Urban**	**Agricultural**
English ivy	*Hedera helix*	Araliaceae			X	
pipevine	***Aristolochia californica***	Aristolochiaceae	X	X	X	X
chaparral honeysuckle	***Lonicera interrupta***	Caprifoliacaeae	X	X		
virgin's bower	***Clematis ligusticifolia***	Ranunculaceae		X		
Virginia creeper, woodbine	***Parthenocissus vitacea***	Vitaceae			X	
California wild grape	***Vitis californica***	Vitaceae	X	X	X	X

Table B5. Amphibians expected to occur within the LCC watershed by zone.

Family/ Common name	Scientific Name	Status Federal[a]/State[b]	Mtn	Can	Urb	Ag
Salamanders						
Salamandridae						
California newt	*Taricha torosa*		X	X		
Ambystomatidae						
Long-toed salamander	*Ambystoma macrodactylum*		X	X		
Plethodontidae						
California slender salamander	*Batrachoseps attenuatus*		X	X		
Ensatina	*Ensatina escholtzii*		X	X		
Frogs and Toads						
Pelobatidae						
Western spadefoot toad	*Spea hammondii*			X		X
Bufonidae						
California western toad	*Bufo boreas*		lower	X	X	X
Hylidae						
Pacific treefrog	*Hyla regilla*		X	X	X	X
Ranidae						
Bullfrog	*Rana catesbiana*	I	X	X	X	X
(California) Red-legged frog	*Rana aurora draytonii*	FE/SSC	?[c]	?[c]		
Foothill yellow-legged frog	*Rana boylii*	CSC	X	X		

[a]Federal Status: FE = Endangered; FT = Threatened

[b]State Status: SE = Endangered; ST-Threatened; CSC = Species of Special Concern

I = Introduced

[c]? = The California red-legged frog *R.boylii ssp draytonii* extirpated from most of its historic range.

Table B6. Reptiles expected to occur within the LCC watershed by zone.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Mtn	Can	Urb	Ag
Turtles						
Emydidae						
Western pond turtle	*Clemys marmarota*	--/CSC	X	X	X	X
Red-eared slider	*Pseudemys scripta*	I			?	X
Lizards						
Phrynosomatidae						
Western fence lizard	*Sceloporus occidentalis*		X	X	X	X
Western sagebrush lizard	*Sceloporus graciosus*		X	X		
California horned lizard	*Phrynosoma coronatum frontale*	FC-/CSC	X	X		
Scincidae						
Northern Alligator Lizard	*Gerrhonotus caeruleus*		X	X		
Western skink	*Eumeces skiltonianus*		X	X	X	X
Western whiptail	*Cnemidophorus tigris*			X	?	X
Southern alligator lizard	*Gherronotus multicarinatus*		X	X	X	X
Snakes						
Boidae						
Rubber boa	*Charina bottae*		X	X		
Colubridae						
Ringneck snake	*Diadophus punctatus*		X	X		
Racer	*Colubra constrictor*			X	?	X
California whipsnake (Striped racer)	*Masticophus lateralis*		X	X		?
Gopher snake	*Pituophis melanoleucus*		X	X	?	X
Common kingsnake	*Lampropeltus getulus*		X	X		X
Mountain kingsnake	*Lampropeltus zonata*		?			
Common garter snake	*Thamnophis sirtalis*		X	X	X	X
Long-nosed snake	*Rhinocheilus lecontei*					?
Western terrestrial garter snake	*Thamnophis elegans*		X	X	X	X
Western aquatic garter snake	*Thamnophis couchii*		X	X	X	X
Giant garter snake	*Thamnophis gigas*	FT/ST				X
Sharp-tailed snake	*Contia tenuis*		X	X		
Night snake	*Hypsiglena torquata*		X	X		
Viperidae						
Western rattlesnake	*Crotalus viridis*		X	X		X

[a]Federal Status: FE = Endangered; FT = Threatened; FSC = Species of Special Concern

[b]State Status: SE = Endangered; ST-Threatened; CSC = Species of Special Concern

I = Introduced

Table B7. Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone				Seasonality[d]				
			Mt	Can	Urb	Ag	W	S	R	N	M
Podicipedidae											
Pied-billed Grebe	*Podilymbus podiceps*					X			X	X	
Eared Grebe	*Podiceps nigricollis*					X	X	?	?	?	
Western Grebe	*Aechmophorus occidentalis*					X	X				
Pelecanidae											
American White Pelican	*Pelecanus erythrorhynchos*	--/CSC				X	X	X			
Phalacrocoracidae											
Double-crested Cormorant	*Phalacrocorax auritus*	--/CSC				X			X	*	
Ardeidae											
American Bittern	*Botaurus lentiginosus*	FSC/--				X			X	X	
Great Blue Heron	*Ardea herodias*		X	X	X	X			X	*	
Great Egret	*Ardea alba*		X	X		X			X	*	
Snowy Egret	*Egretta thula*	FSC/--				X			X	*	
Cattle Egret	*Bubulcus ibis*	I							X	*	
Green Heron	*Butorides virescens*			X		X			X	X	
Black-crowned Night-Heron	*Nycticorax nycticorax*					X			X	*	
Threskiornithidae											
White-faced Ibis	*Plegadis chihi*	FSC/CSC				X	X				
Cathartidae											
Turkey Vulture	*Cathartes aura*		X	X					X	*	
Anatidae											
Greater White-fronted Goose	*Anser albifrons*					X	X				
Snow Goose	*Chen caerulescens*					X	X				
Ross's Goose	*Chen rossii*					X	X				
Canada Goose	*Branta canadensis*					X	X				
Tundra Swan	*Cygnus columbianus*					X	X				
Trumpeter Swan	*Cygnus buccinator*	--/FP				X	X				
Wood Duck	*Aix sponsa*		?	X	X	X			X	X	
Gadwall	*Anas strepera*					X	X				

[a]Federal Status: FE = Endangered; FT = Threatened; FSC = Species of Special Concern
[b]State Status: SE = Endangered; ST-Threatened; CSC = Species of Special Concern; FP = Fully Protected
I = Introduced
? = Information lacking
[d]Seasonality: W = Winter; S = Summer; R = Year-round Resident; N = Nesting (* - potential nester, but specific information lacking); M = Spring/Fall migrant

Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone				Seasonality[d]				
			Mt	Can	Urb	Ag	W	S	R	N	M
Anatidae (continued)											
Eurasian Wigeon	*Anas penelope*					X	X				
American Wigeon	*Anas americana*					X			X	*	
Mallard	*Anas platyrhynchos*			X		X			X	*	
Blue-winged Teal	*Anas discors*					X	X				
Cinnamon Teal	*Anas cyanoptera*					X			X	*	
Northern Shoveler	*Anas clypeata*					X			X	*	
Northern Pintail	*Anas acuta*					X			X	*	
Green-winged Teal	*Anas crecca*					X	X				
Canvasback	*Aythya valisineria*					X	X				
Redhead	*Aythya americana*					X	X				
Ring-necked Duck	*Aythya collaris*					X	X				
Lesser Scaup	*Aythya affinis*					X	X				
Bufflehead	*Bucephala albeola*					X	X				
Barrow's goldeneye	*Bucephala islandica*	**--/CSC**				X	X				
Common Goldeneye	*Bucephala clangula*					X	X				
Hooded Merganser	*Lophodytes cucullatus*		X	X		X	X				
Common Merganser	*Mergus merganser*		X	X					X	X	
Ruddy Duck	*Oxyura jamaicensis*					X	X				
Accipitridae											
Osprey	*Pandion haliaetus*	**--/CSC**	X	X	X	X			X	*	
White-tailed Kite	*Elanus leucurus*	**FSC/FP**		X		X			X	X	
Bald Eagle	*Haliaeetus leucocephalus*	**FT/SE,FP**				X	X				
Northern Harrier	*Circus cyaneus*	**--/CSC**				X			X	X	
Sharp-shinned Hawk	*Accipiter striatus*	**--/CSC**	X	X	X	X			X	X	
Cooper's Hawk	*Accipiter cooperii*	**--/CSC**	X	X	X	X			X	X	
Northern Goshawk	*Accipiter gentilis*	**FSC/CSC**	X				?[e]				
Red-shouldered Hawk	*Buteo lineatus*			X	X	X			X	X	

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Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone Mt	Can	Urb	Ag	Seasonality[d] W	S	R	N	M
Accipitridae (continued)											
Swainson's Hawk	*Buteo swainsoni*	--/ST				?		X		X	
Red-tailed Hawk	*Buteo jamaicensis*		X	X	X	X			X	X	
Ferruginous Hawk	*Buteo regalis*	FSC/CSC		X		X	X				
Rough-legged Hawk	*Buteo lagopus*			X			X				
Golden Eagle	*Aquila chrysaetos*	--/CSC,FP	X	X		X			X	*	
Falconidae											
American Kestrel	*Falco sparverius*		X	X		X			X	X	
Merlin	*Falco columbarius*	--/CSC				X	X				
Peregrine Falcon	*Falco peregrinus anatum*	FSC/SE,FP				X	X				
Prairie Falcon	*Falco mexicanus*	--/CSC	X	X		X			X	*	
Phasianidae											
Ring-necked Pheasant	*Phasianus colchicus*	I		?	X	X			X	X	
Blue Grouse	*Dendragapus obscurus*		X				X	?	?		
Wild Turkey	*Meleagris gallopavo*	I		X		X			X	X	
Odontophoridae											
Mountain Quail	*Oreortyx pictus*		X	X					X	X	
California Quail	*Callipepla californica*		X	X		X			X	X	
Rallidae											
Virginia Rail	*Rallus limicola*					X			X	*	
Sora	*Porzana carolina*					X			X	*	
Common Moorhen	*Gallinula chloropus*					X			X	X	
American Coot	*Fulica americana*					X			X	X	
Gruidae											
Sandhill Crane	*Grus canadensis tabida*	--/ST,FP				X	X				
Charadriidae											
Black-bellied Plover	*Pluvialis squatarola*					X	X				X
Pacific Golden Plover	*Pluvialis fulva*					X					X

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Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone Mt	Can	Urb	Ag	Seasonality[d] W	S	R	N	M
Charadriidae (continued)											
Killdeer	*Charadrius vociferus*		X	X	X	X			X	X	
Semipalmated Plover	*Charadrius montanus*					X					X
Recurvirostridae											
Black-necked Stilt	*Himantopus mexicanus*					X	X	X			X
American Avocet	*Recurvirostra americana*					X	X	X			X
Scolopacidae											
Greater Yellowlegs	*Tringa melanoleuca*		X	X		X	X	X			
Lesser Yellowlegs	*Tringa flavipes*					X					X
Willet	*Catoptrophorus semipalmatus*					X	X				
Spotted Sandpiper	*Actitis macularia*		X	X	?	X			X	X	
Whimbrel	*Numenius phaeopus*					X	X				X
Long-billed Curlew	*Numeniua americanus*	**-/CSC**				X	X				X
Western Sandpiper	*Calidris mauri*					X	X				X
Least Sandpiper	*Calidris minutilla*					X					X
Dunlin	*Calidris alpina*					X					X
Long-billed Dowitcher	*Limnodromus scolopaceus*					X					X
Common Snipe	*Gallinago gallinago*					X	X				
Laridae											
Ring-billed Gull	*Larus delawarensis*					X	X				
California Gull	*Larus californicus*	**--/CSC**				X	X				
Herring Gull	*Larus argentatus*					X	X				
Caspian Tern	*Sterna caspia*					X			X		
Forster's Tern	*Sterna forsteri*					X					X
Black Tern	*Chlidonias niger*	**FSC/CSC**				X		X			
Columbidae											
Rock Dove	*Columba livia*	**I**		X	X	X			X	X	
Band-tailed Pigeon	*Columba fasciata*		X	X					X	X	

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Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone				Seasonality[d]				
			Mt	Can	Urb	Ag	W	S	R	N	M
Columbidae (continued)											
Mourning Dove	*Zenaida macroura*		X	X	X	X			X	X	
Cuculidae											
Yellow-billed Cuckoo	*Coccyzus americanus*	--/SE				X		X			X
Greater Roadrunner	*Geococcyx californianus*			X		?			X	X	
Tytonidae											
Barn Owl	*Tyto alba*		?	X	X	X			X	X	
Strigidae											
Flammulated Owl	*Otus flammeolus*		X					X		?	
Western Screech-Owl	*Otus kennicottii*		X	X	X	X			X	X	
Great Horned Owl	*Bubo virginianus*		X	X	X	X			X	X	
Northern Pygmy-Owl	*Glaucidium gnoma*		X	X					X	X	
Burrowing Owl	*Athene cunicularia*	FSC/CSC		?		?	?	?		*	
Spotted Owl	*Strix occidentalis occidentalis*	--/CSC	X				?				
Barred Owl	*Strix varia*	I	X				?				
Long-eared Owl	*Asio otus*	--/CSC							X	*	
Short-eared Owl	*Asio flammeus*	--/CSC	X	X		X			X	*	
Northern Saw-whet Owl	*Aegolius acadicus*		X				?				
Caprimulgidae											
Lesser Nighthawk	*Chordeiles acutipennis*					X		X		X	
Common Nighthawk	*Chordeiles minor*		X								X
Common Poorwill	*Phalaenoptilus nuttallii*		X	X				X		X	
Apodidae											
Black swift	*Cypseloides niger*	FSC/CSC	X	X				X		*	
Vaux's swift	*Chaetura vauxi*	FSC/CSC	X					X		*	
White-throated Swift	*Aeronautes saxatalis*		X	X				X		*	

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Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone Mt	Can	Urb	Ag	Seasonality[d] W	S	R	N	M
Trochilidae											
Black-chinned Hummingbird	*Archilochus alexandri*		X	X	*	X		X		X	
Anna's Hummingbird	*Calypte anna*		X	X	X	X		X		X	
Calliope Hummingbird	*Stellula calliope*		X	X				X		?	
Rufous Hummingbird	*Selasphorus rufus*		X	X	X	X					X
Alcedinidae											
Belted Kingfisher	*Ceryle alcyon*		X	X	X	X			X	X	
Picidae											
Lewis's Woodpecker	*Melanerpes lewis*	**FSC/--**	X	X			X	X	?	*	
Acorn Woodpecker	*Melanerpes formicivorus*				X	X			X	X	
Williamson's Sapsucker	*Sphyrapicus thyroideus*		X	?					X	X	
Red-breasted Sapsucker	*Sphyrapicus ruber*		X				X			X	
Nuttall's Woodpecker	*Picoides nuttallii*		X	X	X	X			X	X	
Downy Woodpecker	*Picoides pubescens*		?	X	X	X			X	X	
Hairy Woodpecker	*Picoides villosus*		X	X					X	X	
White-headed Woodpecker	*Picoides albolarvatus*		X	?					X	X	
Black-backed Woodpecker	*Picoides arcticus*		X	?					X	X	
Northern Flicker	*Colaptes auratus*		X	X	X	X			X	X	
Pileated Woodpecker	*Dryocopus pileatus*		X						X	*	
Tyrannidae											
Olive-sided Flycatcher	*Contopus cooperi*	**FSC/--**	X					X		X	
Western Wood-Pewee	*Contopus sordidulus*		X	X		X		X		X	
Willow Flycatcher	*Empidonax traillii*	**--/SE**	X	X		X		X		*	?
Hammond's Flycatcher	*Empidonax hammondii*		X	X	X	X					X
Pacific-slope Flycatcher	*Empidonax difficilis*		X	X				X		X	

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Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone Mt	Can	Urb	Ag	Seasonality[d] W	S	R	N	M
Tyrannidae (continued)											
Dusky Flycatcher	*Empidonax oberholseri*		X	X	X	X					X
Black Phoebe	*Sayornis nigricans*		X	X	X	X			X		
Say's Phoebe	*Sayornis saya*		X	X	X	X	X				
Ash-throated Flycatcher	*Myiarchus cinerascens*		X	X	X	X		X		X	
Western Kingbird	*Tyrannus verticalis*		X	X	X	X		X		X	
Laniidae											
Loggerhead Shrike	*Lanius ludovicianus*	**FSC/CSC**		X	X	X			X	X	
Vireonidae											
Plumbeous Vireo	*Vireo plumbeous*		X					X		X	
Cassin's Vireo	*Vireo cassinii*		X					X		X	
Hutton's Vireo	*Vireo huttoni*		X	X					X	X	
Warbling Vireo	*Vireo gilvus*		X	X	?			X		X	
Corvidae											
Steller's Jay	*Cyanocitta stelleri*		X	X					X	X	
Western Scrub-Jay	*Aphelocoma californica*			X	X	X			X	X	
Yellow-billed Magpie	*Pica nuttalli*				X	X			X	X	
American Crow	*Corvus brachyrhynchos*			X	X	X			X	X	
Common Raven	*Corvus corax*		X	X					X	X	
Alaudidae											
Horned Lark	*Eremophila alpestris*	**--/CSC**		X		X			X	X	
Hirundinidae											
Purple Martin	*Progne subis*	**CSC**	X	X		X				?	X
Tree Swallow	*Tachycineta bicolor*		X	X	X	X			X	X	
Violet-green Swallow	*Tachycineta thalassina*		X	X	X	X		X	X	X	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*			X	X	X		X	X	X	
Bank Swallow	*Riparia riparia*	**FSC/ST**				X		X			

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Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone Mt	Can	Urb	Ag	Seasonality[d] W	S	R	N	M
Hirundinidae (continued)											
Cliff Swallow	*Petrochelidon pyrrhonota*		X	X	X	X		X		X	
Barn Swallow	*Hirundo rustica*			X	X	X		X		X	
Paridae											
Chestnut-backed Chickadee	*Poecile rufescens*		X	X			X				
Oak Titmouse	*Baeolophus inornatus*			X	X	X			X	X	
Mountain Chickadee	*Poecile gambeli*		X						X	X	
Aegithalidae											
Bushtit	*Psaltriparus minimus*		X	X	X	X			X	X	
Sittidae											
Red-breasted Nuthatch	*Sitta canadensis*		X						X	X	
White-breasted Nuthatch	*Sitta carolinensis*		X	X					X	X	
Pygmy Nuthatch	*Sitta pygmaea*		X						X	X	
Certhiidae											
Brown Creeper	*Certhia americana*		X						X	X	
Troglodytidae											
Rock Wren	*Salpinctes obsoletus*		X	X					X	*	
Canyon Wren	*Catherpes mexicanus*		X	X					X	*	
Bewick's Wren	*Thryomanes bewickii*		X	X	X	X			X	X	
House Wren	*Troglodytes aedon*		X	X	X	X			X	X	
Winter Wren	*Troglodytes troglodytes*		X	X			X	?	?	?	
Marsh Wren	*Cistothorus palustris*					X			X	X	
Cinclidae											
American Dipper	*Cinclus mexicanus*		X	X					X	X	
Regulidae											
Golden-crowned Kinglet	*Regulus satrapa*		X	X			X		?	*	
Ruby-crowned Kinglet	*Regulus calendula*		X	X					X	X	

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Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone Mt	Can	Urb	Ag	Seasonality[d] W	S	R	N	M
Sylviidae											
Blue-gray Gnatcatcher	*Polioptila caerulea*		X	X				X		X	
Turdidae											
Western Bluebird	*Sialia mexicana*		X	X	X	X			X	X	
Mountain Bluebird	*Sialia currucoides*		X		X	X	X				
Townsend's Solitaire	*Myadestes townsendi*		X	X			X				
Swainson's Thrush	*Catharus ustulatus*		X	X				X		X	
Hermit Thrush	*Catharus guttatus*		X	X	X	X	X				
American Robin	*Turdus migratorius*		X	X	X	X			X	X	
Varied Thrush	*Ixoreus naevius*		X	X	X	X	X				
Timaliidae											
Wrentit	*Chamaea fasciata*			X					X	X	
Mimidae											
Northern Mockingbird	*Mimus polyglottos*			X	X	X			X	X	
California Thrasher	*California Thrasher*			X					X	X	
Sturnidae											
European Starling	*Sturnus vulgaris*	I	X	X	X	X			X	X	
Motacillidae											
American Pipit	*Anthus rubescens*			X	X	X	X				
Bombycillidae											
Cedar Waxwing	*Bombycilla cedrorum*		X	X	X	X	X				
Ptilogonatidae											
Phainopepla	*Phainopepla nitens*			X					X	X	
Parulidae											
Orange-crowned Warbler	*Vermivora celata*		X	X				X		X	
Nashville Warbler	*Vermivora ruficapilla*		X	X				X		X	
Yellow Warbler	*Dendroica petechia*	--/CSC	X	X						X	

[a]Federal Status: FE = Endangered; FT = Threatened; FSC = Species of Special Concern
[b]State Status: SE = Endangered; ST-Threatened; CSC = Species of Special Concern; FP = Fully Protected
I = Introduced
? = Information lacking
[d]Seasonality: W = Winter; S = Summer; R = Year-round Resident; N = Nesting (* - potential nester, but specific information lacking); M = Spring/Fall migrant

Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone				Seasonality[d]				
			Mt	Can	Urb	Ag	W	S	R	N	M
Sylviidae											
Yellow-rumped Warbler	*Dendroica coronata*		X	X	X	X	X				
Black-throated Gray Warbler	*Dendroica nigrescens*		X	X				X		X	
Townsend's Warbler	*Dendroica townsendi*		X	X	X	X					X
Hermit Warbler	*Dendroica occidentalis*	**FSC/--**	X	X	X	X					X
MacGillivray's Warbler	*Oporornis tolmiei*		X	X				X		X	
Common Yellowthroat	*Geothlypis trichas*					X			X	X	
Wilson's Warbler	*Wilsonia pusilla*		X	X	X	X					X
Yellow-breasted Chat	*Icteria virens*	**--/CSC**	X	X		X		X		X	
Thraupidae											
Western Tanager	*Piranga ludoviciana*		X	X				X		X	
Emberizidae											
Green-tailed Towhee	*Pipilo chlorurus*		?	?			X				
Spotted Towhee	*Pipilo maculatus*		X	X	X	X			X	X	
California Towhee	*Pipilo crissalis*		X	X	X	X			X	X	
Rufous-crowned Sparrow	*Aimophila ruficeps*			X					X	*	
Black-chinned Sparrow	*Spizela atrogulris*	**FSC/--**		X				X		X	
Chipping Sparrow	*Spizella passerina*		X	X				X		*	
Lark Sparrow	*Chondestes grammicus*	**FSC/--**						X		X	
Savannah Sparrow	*Passerculus sandwhichensis*			X	X	X			X	X	
Fox Sparrow	*Passerella iliaca*		X	X					X	X	
Lincoln's Sparrow	*Melospiza lincolnii*		X	X					X	X	
White-throated Sparrow	*Xonotrichia albicollis*					X					X
White-crowned Sparrow	*Zonotrichia luecophrys*		X	X	X	X	X				

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I = Introduced
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[d]Seasonality: W = Winter; S = Summer; R = Year-round Resident; N = Nesting (* - potential nester, but specific information lacking); M = Spring/Fall migrant

Table B7 (continued). Birds expected to occur within the LCC watershed by zone. Only *breeding season* distribution given for species expected to nest within LCC watershed.

Family/ Common Name	Scientific Name	Status Federal[a]/State[b]	Zone Mt	Can	Urb	Ag	Seasonality[d] W	S	R	N	M
Emberizidae (continued)											
Song Sparrow	*Melospiza melodia*		X	X	?	?			X	X	
Golden-crownedSparrow	*Zonotrichia atricapilla*		X	X	X	X	X				
Dark-eyed Junco	*Junco hyemalis*		X	?					X	X	
Vesper's Sparrow	*Pooecetes gramineus*					X	X				
Cardinalidae											
Black-headed Grosbeak	*Pheucticus melanocephalus*		X	X	X	X		X		X	
Blue Grosbeak	*Guiraca caerulea*		X	X		X		X		X	
Lazuli Bunting	*Passerina amoena*			X		X		X		X	
Icteridae											
Red-winged Blackbird	*Agelaius phoeniceus*			?		X			X	X	
Tricolored Blackbird	*Agelaius tricolor*	**FSC/CSC**				X			X	*	
Western Meadowlark	*Sturnella neglecta*			X					X	X	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*		?	?		X					X
Brewer's Blackbird	*Euphagus cyanocephalus*			X	X	X			X	X	
Brown-headed Cowbird	*Molothrus ater*	**I**	X	X	X	X			X		
Bullock's Oriole	*Icterus bullockii*		X	X	X	X		X		X	
Fringillidae											
Purple Finch	*Carpodacus purpureus*		X	X					X	X	
Cassin's Finch	*Carpodacus cassinii*		X	X			X	?	?	?	
House Finch	*Carpodacus mexicanus*		X	X	X	X			X	X	
Red Crossbill	*Loxia curvirostra*		X	?					X	?	
Pine Siskin	*Carduelis pinus*		X	X					X	?	
Lesser Goldfinch	*Carduelis psaltria*		X	X	X	X			X	X	
Lawrence's Goldfinch	*Carduelis lawrencei*	**FSC/--**	?	X					X	X	
American Goldfinch	*Carduelis tristis*			X	X	X			X	X	
Evening Grosbeak	*Coccothraustes vespertinus*		X	X			X				
Passeridae											
House Sparrow	*Passer domesticus*	**I**	?	X	X	X			X	X	

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[b]State Status: SE = Endangered; ST-Threatened; CSC = Species of Special Concern; FP = Fully Protected

I = Introduced

? = Information lacking

[d]Seasonality: W = Winter; S = Summer; R = Year-round Resident; N = Nesting (* - potential nester, but specific information lacking); M = Spring/Fall migrant

Table B8. Mammals expected to occur within the LCC watershed by zone.

Common Name	Species Name	Status Federal[a]/State[b]	Mtn	Can	Urb	Ag
Didelphidae						
Virginia Opossum	*Didelphis virginiana*	I	X	X	X	X
Soricidae						
Vagrant Shrew	*Sorex vagrans*		X	?		
Water Shrew	*Sorex palustris*		X	?		
Trowbridge's Shrew	*Sorex trowbridgii*		?			
Ornate Shrew	*Sorex ornatus*			X	?	X
Talpidae						
Broad-footed Mole	*Scapanus latimanus*		X	X	?	?
Vespertilionidae						
Little Brown Myotis	*Myotis lucifugus*		X	?		
Yuma Myotis	*Myotis yumanensis*	FSC/--	X	X	X	X
Long-eared Myotis	*Myotis evotis*	FSC/--	X	?		
Long-legged Myotis	*Myotis volans*	FSC/--	X	X	?	
Fringed Myotis	*Myotis thysanodes*	FSC/--	X	X	?	
California Myotis	*Myotis californicus*		X	X	X	X
Western Small-footed Myotis	*Myotis ciliolabrum*		X	X		
Silver-haired Bat	*Lasionycteris noctivagans*		X	X		
Western Pipistrelle	*Pipistrellus hesperus*		X	X	X	X
Big Brown Bat	*Eptesicus fuscus*		X	X	X	X
Western Red Bat	*Lasiurus blossevillii*		X	X	X	X
Spotted Bat	*Euderma maculatum*	FSC/CSC	X	X		
Hoary Bat	*Lasiurus cinereus*		X	X	X	X
Townsend's Big-eared Bat	*Corynorhinus townsendii*	FSC/CSC	X	X	X	X
Pallid Bat	*Antrozous pallidus*	--/CSC	X	X	X	X
Molossidae						
Western Mastiff Bat	*Eumops perotus*	FSC/CSC	X	X	X	X
Brazilian Free-tailed Bat	*Tadarida brasiliensis*		?	X	X	X
Leporidae						
Brush Rabbit	*Sylvilagus bachmani*			X		
Audubon's (Desert) Cottontail	*Sylvilagus audubonii*					X
Black-tailed (Hare) Jackrabbit	*Lepus californicus*			X		X

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[b]State Status: SE = Endangered; ST-Threatened; SSC = Species of Special Concern; FP = Fully Protected

? = Information lacking

I = Introduced

Table B8 (continued). Mammals expected to occur within the LCC watershed by zone.

Common Name	Species Name	Status Federal[a]/State[b]	Mtn	Can	Urb	Ag
Sciuridae						
Yellow-pine Chipmunk	*Eutamias amoenus*		X			
Long-eared Chipmunk	*Eutamias quadrimaculatus*		X			
California Ground Squirrel	*Spermophilus beecheyi*		X	X		X
Golden-mantled Ground	*Spermophilus lateralis*		X	?		
Western Gray Squirrel	*Sciurus griseus*			X	X	X
Douglas' Squirrel	*Tamiasciurus douglasii*		X			
Northern Flying	*Glaucomys sabrinus*		?			
Geomyidae						
Mountain Pocket Gopher	*Thomomys monticola*		X			
Botta's Pocket Gopher	*Thomomys bottae*		X	X	X	X
Heteromyidae						
Heermann's Kangaroo Rat	*Dipodomys heermanni*			X		
California Kangaroo Rat	*Dipodomys californica*			X		
Castoridae						
American Beaver	*Castor canadensis*			X		X
Muridae						
Western Harvest Mouse	*Reithrodontomys megalotis*		X	X	X	X
Deer Mouse	*Peromyscus maniculatus*		X	X	?	X
Pinon Mouse	*Peromyscus truei*		X	X	?	?
Brush Mouse	*Peromyscus boylii*		X	X	?	?
Dusky-footed Woodrat	*Woodrat Neotoma fuscipes*		X	X		X
Black Rat	*Rattus rattus*	I	X	X	X	X
Norway Rat	*Rattus norvegicus*	I	X	X	X	X
House Mouse	*Mus musculus*	I	X	X	X	X
California Vole	*Microtus californicus*		X	X	X	X
Montane Vole	*Microtus montanus*		?			
Long-tailed Vole	*Microtus longicaudus*		?			
Muskrat	*Ondatra zibethicus*	I				
Zapodidae						
Western Jumping Mouse	*Zapus princeps*		X	X		

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[b]State Status: SE = Endangered; ST-Threatened; SSC = Species of Special Concern; FP = Fully Protected

? = Information lacking

I = Introduced

Table B8 (continued). Mammals expected to occur within the LCC watershed by zone.

Common Name	Species Name	Status Federal[a]/State[b]	Mtn	Can	Urb	Ag
Erithizontidae						
Common Porcupine	*Erethizon dorsatum*		X	X		X
Canidae						
Coyote	*Canis latrans*		X	X		X
Ursidae						
Black Bear	*Ursus americanus*		X	X		
Procyonidae						
Ringtail	*Bassariscus astutus*	FP	X	X		X
Raccoon	*Procyon lotor*		X	X	X	X
Mustelidae						
Short-tailed Weasel	*Mustela erminea*		X	X		
Long-tailed Weasel	*Mustela frenata*		X	X		X
American Mink	*Mustela vison*					?
Northern River Otter	*Lontra canadensis*					X
Mephitidae						
Western Spotted Skunk	*Spilogale gracilis*		X	X		?
Striped Skunk	*Mephitis mephitis*		X	X	X	X
Felidae						
Feral Cat	*Felis cattus*	I	?	?	X	X
Mountain Lion	*Puma concolor*		X	X		
Bobcat	*Lynx rufus*		X	X		X
Suidae						
Wild Pig	*Sus scrofa*	I	?	?		
Cervidae						
Mule Deer	*Odocoileus hemionus*		X	X		X

[a]Federal Status: FE = Endangered; FT = Threatened; FSC = Species of Special Concern

[b]State Status: SE = Endangered; ST-Threatened; SSC = Species of Special Concern; FP = Fully Protected

? = Information lacking

I = Introduced

Table B9. Total number of individuals detected and percent occurrence of each species within each zone of the Little Chico Creek riparian corridor at 19 point-count stations located between the headwaters of Little Chico Creek and Llano Seco, Butte Co., CA.

Common Name	Mtn.		Can		Urb		Ag		*Total*	
	#	%	#	%	#	%	#	%	#	%
Acorn Woodpecker	0	0	6	5	1	1	0	0	7	1.1
American Crow	3	3	0	0	13	18	5	2	21	3.3
American Dipper	1	1	1	1	0	0	0	0	2	0.3
American Goldfinch	0	0	2	2	0	0	7	2	9	1.4
American Robin	8	7	5	4	2	3	2	1	17	2.6
Ash-throated Flycatcher	0	0	2	2	0	0	7	2	9	1.4
Band-tailed Pigeon	1	1	4	3	0	0	0	0	5	0.8
Barn Swallow	0	0	0	0	0	0	8	2	8	1.2
Bewick's Wren	1	1	0	0	0	0	1	0	2	0.3
Black Pheobe	0	0	3	2	5	7	4	1	12	1.9
Black-headed Grosbeak	10	8	10	8	0	0	5	2	25	3.9
Black-throated Gray Warbler	9	8	1	1	0	0	0	0	10	1.6
Blue-Gray Gnatcatcher	0	0	2	2	0	0	0	0	2	0.3
Brewer's Blackbird	0	0	1	1	0	0	0	0	1	0.2
Brown Creeper	2	2	0	0	0	0	0	0	2	0.3
Brown-headed Cowbird	3	3	2	2	0	0	5	2	10	1.6
Bullock's Oriole	0	0	0	0	0	0	2	1	2	0.3
Bushtit	8	7	8	6	0	0	2	1	18	2.8
California Quail	1	1	4	3	0	0	0	0	5	0.8
California Towhee	0	0	4	3	0	0	6	2	10	1.6
Cassin's Vireo	6	5	0	0	0	0	0	0	6	0.9
Cliff Swallow	0	0	0	0	0	0	67	21	67	10.4
Common Raven	0	0	2	2	0	0	0	0	2	0.3
Common Yellowthroat	0	0	0	0	0	0	2	1	2	0.3
Dark-eyed Junco	6	5	1	1	0	0	0	0	7	1.1
Downy Woodpecker	0	0	1	1	0	0	1	0	2	0.3
European Starling	0	0	8	6	15	21	14	4	37	5.7
Geen Heron	0	0	1	1	0	0	0	0	1	0.2
Great Egret	0	0	0	0	0	0	1	0	1	0.2
Hairy Woodpecker	4	3	0	0	0	0	0	0	4	0.6
House Finch	0	0	3	2	1	1	7	2	11	1.7
House Sparrow	0	0	2	2	5	7	8	2	15	2.3
House Wren	1	1	0	0	1	1	1	0	3	0.5
Hutton's Vireo	4	3	2	2	0	0	0	0	6	0.9
Killdeer	0	0	0	0	0	0	2	1	2	0.3
Kingfisher	0	0	0	0	0	0	1	0	1	0.2
Lesser goldfinch	4	3	8	6	3	4	6	2	21	3.3
MacGillivray's Warbler	2	2	0	0	0	0	0	0	2	0.3
Mallard	0	0	0	0	0	0	4	1	4	0.6
Marsh Wren	0	0	0	0	0	0	4	1	4	0.6

Table B9 (continued). Total number of individuals detected and percent occurrence of each species within each zone of the Little Chico Creek riparian corridor at 19 point-count stations located between the headwaters of Little Chico Creek and Llano Seco, Butte Co., CA.

Common Name	Mtn.		Can		Urb		Ag		*Total*	
	#	%	#	%	#	%	#	%	#	%
Mourning Dove	0	0	5	4	0	0	3	1	8	1.2
Nashville Warbler	6	5	0	0	0	0	0	0	6	0.9
Nutall's Woodpecker	0	0	1	1	2	3	0	0	3	0.5
Oak Titmouse	1	1	4	3	5	7	3	1	13	2.0
Orange-crowned Warbler	7	6	4	3	0	0	0	0	11	1.7
Pacific-slope Flycatcher	5	4	2	2	0	0	0	0	7	1.1
Purple Finch	1	1	0	0	0	0	0	0	1	0.2
Red-breasted Nuthatch	5	4	0	0	0	0	0	0	5	0.8
Red-tailed Hawk	0	0	0	0	0	0	3	1	3	0.5
Red-winged Blackbird	0	0	0	0	0	0	90	28	90	14.0
Ring-necked Pheasant	0	0	0	0	0	0	3	1	3	0.5
Rock dove	0	0	0	0	5	7	0	0	5	0.8
Rough-winged Swallow	0	0	0	0	1	1	0	0	1	0.2
Spotted Towhee	11	9	7	6	0	0	2	1	20	3.1
Steller's Jay	6	5	2	2	0	0	0	0	8	1.2
Tree Swallow	0	0	0	0	1	1	10	3	11	1.7
Turkey Vulture	0	0	0	0	1	1	2	1	3	0.5
Unknown Hummingbird	0	0	0	0	0	0	1	0	1	0.2
Warbling Vireo	1	1	0	0	0	0	0	0	1	0.2
Western Kingbird	0	0	0	0	0	0	5	2	5	0.8
Western Meadowlark	0	0	5	4	0	0	0	0	5	0.8
Western Scrubjay	0	0	10	8	11	15	6	2	27	4.2
Western Tanager	1	1	2	2	0	0	0	0	3	0.5
Western Wood-pewee	0	0	0	0	0	0	1	0	1	0.2
White-Breasted Nuthatch	0	0	2	2	0	0	0	0	2	0.3
Willow Flycatcher	0	0	0	0	0	0	1	0	1	0.2
Wood Duck	0	0	0	0	1	1	0	0	1	0.2
Yellow-billed Magpie	0	0	0	0	0	0	23	7	23	3.6
Yellow-breasted Chat	0	0	0	0	0	0	1	0	1	0.2
Total	**118**	**100**	**127**	**100**	**73**	**100**	**326**	**100**	**644**	**100.0**

Table B10. Fish species observed and expected in Little Chico Creek.

Family/ Common name	Scientific Name	Status Federal[a]/State[b]	Mtn	Can	Urb	Ag
Salmonidae						
Chinook salmon (spring-run)	*Oncorhynchus tshawytscha*	FT/ST	*	*	*	*
Steelhead	*O. mykiss*	FT/--		*	*	*
Rainbow trout (resident)	*O. mykiss*	--/--	X	X		
Cyprinidae						
Sacramento pike-minnow	*Ptychocheilus grandis*	--/--		X	X	X
California roach	*Hesperoleucus symmetricus*	--/--		X	X	X
Catostomidae						
Sacramento sucker	*Catostomus occidentalis*	--/--		X	X	X
Ictaluridae						
Brown bullhead	*Ictalurus nebulosus*	Introduced			X	X
Centrarchidae						
Bluegill	*Lepomis macrochirus*	Introduced			X	X
Green sunfish	*L. cyanellus*	Introduced			X	X
Largemouth bass	*Micropterus salmoides*	Introduced			X	X
Poeciliidae						
Mosquitofish	*Gambusia affinis*	Introduced			X	
Cottidae						
Riffle sculpin	*Cottus gulosus*	--/--		X		
Additional species of fish that might be expected to occur in Little Chico Creek[c]						
Petromyzontidae						
Pacific lamprey	*Lamperta tridentata*	--/CSC		X	X	X
Hardhead	*Mylopharodon conocephalus*	--/CSC		X	X	X
Carp	*Cyprinus carpio*	Introduced				X
Hitch	*Lavinia exilicauda*	--/--				X

[a] Federal Status: E = Endangered; T= Threatened; SC= Species of Concern

[b] California State Status: E = Endangered; T = Threatened; CSC = Species of Concern

[c]Where Little Chico Creek flows through the Sacramento River Floodplain, any species found in the Sacramento River may be present after flow events in which the river accessed its floodplain.

Table B11. Summary table of historic fish sampling data along Little Chico Creek.

		Rainbow Trout			California Roach			Sac. Sucker			Sac. Pike-minnow		
			F L (mm)			F L (mm)			F L (mm)			F L (mm)	
Site	Date	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.
Roger Cole's	1/5/2000	44	37	190									
Schott Road	3/2/1992	19	45	185									
Schott Road	4/29/1996	53	27	189									
Schott Road	4/27/1998	55	64	195									
Hubbell/Wood's	9/18/1999	69	49	234									
Bob Smith's	3/30/1992	9	92	135	116	21	89	1	48	48			
Brigham Ranch	1/6/2000	33	59	193	61	45	93	3	26	300			
Jeff Mott's	4/15/1996	9	130	295	71	25	98	5	142	255			
Jeff Mott's	5/4/1998	10	120	185	136	27	98	2	79	185			
Stilson Canyon	4/24/2000				30	30	89	6	75	315	3	75	173
Stilson Canyon	10/12/2000				345	17	74	5	61	79			
Bruce Road	4/24/2000				28	36	61	4	75	315	3	89	159
Forest Ave.	4/24/2000	2	180	219	26	51	95				1	80	80
Highway 99	3/30/1998				52	18	70	2	84	85			
Highway 99	4/24/2000				21	46	97	3	90	140	1	104	104
Mill Street	4/14/1986				54	38	81	2	83	83	1	59	59
Boucher St.	3/30/1998				37	27	103	1	285	285			
Park Ave.	4/24/2000				76	42	114	4	139	151			
Ivy Street	3/30/1998				14	N.D.	N.D.						
Pomona	4/24/2000				a few observed						one observed		
Lone Pine	4/24/2000												

Table B11. (Continued) Summary table of historic fish sampling data along Little Chico Creek.

		Riffle Sculpin T L (mm)			Green Sunfsh F L (mm)			Bluegill Sunfish F L (mm)			Black Bullhad F L (mm)		
Site	Date	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.	No.	Min.	Max.
Roger Cole's	1/5/2000												
Schott Road	3/2/1992												
Schott Road	4/29/1996												
Schott Road	4/27/1998												
Hubbell/Wood's	9/18/1999												
Bob Smith's	3/30/1992												
Brigham Ranch	1/6/2000												
Jeff Mott's	4/15/1996												
Jeff Mott's	5/4/1998												
Stilson Canyon	4/24/2000	1	70	70	5	55	78	2	109	123			
Stilson Canyon	10/12/2000	12	42	83									
Bruce Road	4/24/2000												
Forest Ave.	4/24/2000												
Highway 99	3/30/1998												
Highway 99	4/24/2000	1	74	74									
Mill Street	4/14/1986												
Boucher St.	3/30/1998												
Park Ave.	4/24/2000				2	59	65						
Ivy Street	3/30/1998										1	136	136
Pomona	4/24/2000												
Lone Pine	4/24/2000												

APPENDIX C

DATA TABLES AND ANALYSES FOR CHAPTER 3

Table C1. FWS Water Sample Results, LCC Grab Samples

Sample Number	Sample Location	Date	Wet Weight (mg/L)									
			Al	As	B	Ba	Be	Ca	Cd	Cr	Cu	Fe
97003	a	10/05/1994	<0.05	<0.005	<0.1	0.023	<0.0005	16	<0.0005	<0.003	<0.005	<0.1
97007	a	11/06/1994	<0.05	<0.005	<0.1	0.019	<0.0005	17.8	<0.0005	<0.003	<0.005	0.113
97011	a	11/10/1994	0.089	<0.005	<0.1	0.02	<0.0005	18.4	<0.0005	<0.003	<0.005	0.262
97047	a	12/15/1994	0.237	<0.005	<0.1	0.01	<0.0005	8.68	<0.0005	<0.003	<0.005	0.268
97071	a	01/04/1995	0.398	<0.005	<0.1	0.013	<0.0005	9.02	<0.0005	<0.003	<0.005	0.518
97105	a	01/18/1995	0.241	<0.005	<0.1	0.014	0.002	6.48	<0.0005	<0.003	0.006	0.21
97166	a	03/09/1995	16.6	<0.005	<0.1	0.137	0.001	12.2	<0.0005	0.006	0.013	12.3
8217	b	04/09/1994	0.28	0.0002	0.0085	0.0134	<0.00004	10.8	<0.0003	<0.001	<0.0008	0.434
8218	b	04/12/1994	0.15	0.0003	0.0055	0.0127	<0.00004	10.7	<0.0003	<0.001	<0.0008	0.229
8219	b	04/20/1994	0.11	0.00033	0.0082	0.0149	<0.00004	12.3	<0.0003	<0.001	<0.0008	0.165
97006	b	11/06/1994	0.102	<0.005	<0.1	0.022	<0.0005	14	<0.0005	<0.003	<0.005	0.125
97010	b	11/10/1994	0.072	<0.005	<0.1	0.026	<0.0005	13	<0.0005	<0.003	<0.005	<0.1
97029	b	12/04/1994	0.308	<0.005	<0.1	0.023	<0.0005	11.9	<0.0005	<0.003	<0.005	0.325
97046	b	12/15/1994	0.227	<0.005	<0.1	0.024	<0.0005	12	<0.0005	<0.003	<0.005	0.244
97069	b	01/04/1995	0.359	<0.005	<0.1	0.025	0.001	10.5	<0.0005	0.003	0.008	0.439
97083	b	01/08/1995	1.31	<0.005	<0.1	0.024	<0.0005	8.27	<0.0005	0.007	0.007	1.4
97103	b	01/18/1995	0.525	<0.005	<0.1	0.104	0.043	10.3	<0.0005	<0.003	0.091	0.53
97168	b	03/09/1995	1.78	<0.005	<0.1	0.026	<0.0005	7.83	<0.0005	0.01	<0.005	1.86
8212	c	03/24/1994	0.068	0.0001	0.036	0.016	<0.00004	15.2	<0.0003	<0.001	0.001	0.109
8213	c	04/04/1994	0.14	0.0003	0.048	0.0226	<0.00004	17.5	0.0005	0.002	0.0025	0.152
8214	c	04/09/1994	0.2	0.0003	0.017	0.0156	<0.00004	12.4	<0.0003	<0.001	0.0008	0.349
8215	c	04/12/1994	0.08	0.0002	0.031	0.0156	<0.00004	13.1	<0.0003	<0.001	0.001	0.198
8216	c	04/20/1994	0.098	0.0003	0.047	0.0205	<0.00004	15.7	<0.0003	<0.001	0.002	0.115
97009	c	11/10/1994	0.395	<0.005	0.107	0.026	0.002	12.4	<0.0005	<0.003	0.005	0.502
97079	c	01/08/1995	8.89	<0.005	<0.1	0.077	<0.0005	10.6	<0.0005	0.019	0.017	8.4
97021	d	12/04/1994	1.73	<0.005	<0.1	0.025	<0.0005	8.67	<0.0005	0.004	0.005	1.65
97085	d	01/08/1995	1.37	<0.005	<0.1	0.023	0.001	6.93	<0.0005	0.004	<0.005	1.64
97160	d	03/09/1995	4.21	<0.005	<0.1	0.043	<0.0005	7.92	<0.0005	0.008	0.011	5.17
8208	e	03/24/1994	1.98	0.00082	0.034	0.0318	<0.00004	12.2	<0.0003	0.004	0.0033	1.96
8209	e	04/04/1994	1.63	0.0011	0.03	0.0317	<0.00004	10.5	<0.0003	0.0051	0.0055	2.14
8210	e	04/12/1994	2.53	0.00094	0.029	0.0207	<0.00004	10.4	<0.0003	0.0061	0.0053	2.11
8211	e	04/20/1994	9.96	0.0026	0.04	0.521	0.00017	12.2	<0.0003	0.019	0.012	7.77
97032	e	12/05/1994	0.702	<0.005	0.107	0.023	0.002	8.44	<0.0005	<0.003	0.009	0.909
97049	e	12/15/1994	0.496	<0.005	<0.1	0.018	<0.0005	9.52	<0.0005	<0.003	<0.005	0.517
97075	e	01/04/1995	1.05	<0.005	<0.1	0.023	<0.0005	9.22	<0.0005	0.004	0.007	1.37
97089	e	01/13/1995	1.74	<0.005	<0.1	0.028	<0.0005	8.56	<0.0005	0.005	<0.005	2.14
97097	e	01/18/1995	1.33	<0.005	0.108	0.034	0.003	9.98	<0.0005	0.005	0.012	1.67
97115	e	01/24/1995	1.71	<0.005	<0.1	0.034	<0.0005	10.9	<0.0005	0.005	0.009	2.21
97120	e	01/27/1995	4.85	<0.005	<0.1	0.061	0.001	14.2	<0.0005	0.015	0.007	6.44
97176	e	03/13/1995	3.92	<0.005	<0.1	0.048	<0.0005	10.1	<0.0005	0.011	0.011	5.03

a: grab sample LCC at Stilson Canyon

b: sample LCC at Forest Rd. and Humboldt Ave.

c: grab sample LCC at Taffee Rd.

d: grab sample LCC at Ord Ferry Rd.

e: grab sample LCC at Llano Seco

Table C1. (Continued) FWS Water Sample Results, LCC Grab Samples

Sample Number	Sample Location	Date	Wet Weight (mg/L)									
			Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
97003	a	10/05/1994	<0.0005	9.3	0.066	<0.05	<0.005	<0.01	<0.005	0.12	0.005	<0.01
97007	a	11/06/1994	<0.0005	10.1	0.005	<0.05	<0.005	<0.01	<0.005	0.129	0.006	<0.01
97011	a	11/10/1994	<0.0005	10.2	<0.005	<0.05	<0.005	<0.01	<0.005	0.128	0.006	<0.01
97047	a	12/15/1994	<0.0005	4.9	0.005	<0.05	<0.005	<0.01	<0.005	0.061	0.005	<0.01
97071	a	01/04/1995	<0.0005	5.13	0.018	<0.05	<0.005	<0.01	<0.005	0.063	0.006	<0.01
97105	a	01/18/1995	<0.0005	3.78	0.014	<0.05	<0.005	<0.01	<0.005	0.045	0.003	<0.01
97166	a	03/09/1995	<0.0005	5.61	0.459	<0.05	<0.005	<0.01	<0.005	0.105	0.009	0.021
8217	b	04/09/1994	<0.0003	6.52	0.0173	<0.0003	<0.001	<0.005	<0.0001	0.081	0.0046	0.001
8218	b	04/12/1994	<0.0003	6.67	0.012	<0.0003	<0.001	<0.005	<0.0001	0.0822	0.0049	0.001
8219	b	04/20/1994	<0.0003	7.76	0.012	<0.0003	<0.001	<0.005	<0.0001	0.0957	0.005	0.001
97006	b	11/06/1994	<0.0005	7.95	0.088	<0.05	<0.005	<0.01	<0.005	0.1	0.005	<0.01
97010	b	11/10/1994	<0.0005	9.1	0.01	<0.05	<0.005	<0.01	<0.005	0.093	0.003	<0.01
97029	b	12/04/1994	<0.0005	7.66	0.016	<0.05	<0.005	<0.01	<0.005	0.083	0.003	<0.01
97046	b	12/15/1994	<0.0005	7.21	0.01	<0.05	<0.005	<0.01	<0.005	0.079	0.003	<0.01
97069	b	01/04/1995	<0.0005	5.97	0.023	<0.05	<0.005	<0.01	<0.005	0.069	0.004	<0.01
97083	b	01/08/1995	<0.0005	4.52	0.06	<0.05	<0.005	<0.01	<0.005	0.056	0.009	<0.01
97103	b	01/18/1995	<0.0005	5.61	0.103	<0.05	<0.005	<0.01	<0.005	0.058	0.004	0.094
97168	b	03/09/1995	<0.0005	4.25	0.091	<0.05	0.005	<0.01	<0.005	0.051	0.014	<0.01
8212	c	03/24/1994	<0.0003	9.75	0.0031	<0.0003	0.002	<0.005	<0.0001	0.106	0.002	0.001
8213	c	04/04/1994	<0.0003	11.2	0.0082	<0.0003	0.002	<0.005	<0.0001	0.123	0.0048	0.0027
8214	c	04/09/1994	<0.0003	7.46	0.0073	<0.0003	<0.001	<0.005	<0.0001	0.0886	0.0045	0.0037
8215	c	04/12/1994	<0.0003	8.22	0.0045	<0.0003	<0.001	<0.005	<0.0001	0.0954	0.0046	0.0038
8216	c	04/20/1994	<0.0003	10.4	0.0155	<0.0003	<0.001	<0.005	<0.0001	0.12	0.006	0.002
97009	c	11/10/1994	<0.0005	7.14	0.023	<0.05	<0.005	<0.01	<0.005	0.082	0.005	0.017
97079	c	01/08/1995	<0.0005	4.88	0.329	<0.05	0.011	0.01	<0.005	0.083	0.033	0.032
97021	d	12/04/1994	<0.0005	5.41	0.044	<0.05	<0.005	<0.01	<0.005	0.06	0.008	<0.01
97085	d	01/08/1995	<0.0005	3.99	0.042	<0.05	<0.005	<0.01	<0.005	0.048	0.009	0.01
97160	d	03/09/1995	<0.0005	4.81	0.171	<0.05	0.007	<0.01	<0.005	0.059	0.014	0.025
8208	e	03/24/1994	<0.0003	8.59	0.0642	<0.0003	0.0057	<0.005	<0.0001	0.084	0.011	0.0041
8209	e	04/04/1994	<0.0003	7.46	0.0278	<0.0003	0.0073	<0.005	<0.0001	0.0749	0.01	0.0039
8210	e	04/12/1994	<0.0003	6.86	0.0464	<0.0003	0.0071	<0.005	<0.0001	0.0682	0.022	0.0089
8211	e	04/20/1994	<0.0003	8.48	0.35	<0.0003	0.019	0.005	<0.0001	0.279	0.044	0.022
97032	e	12/05/1994	<0.0005	5.47	0.022	<0.05	<0.005	<0.01	<0.005	0.058	0.008	0.012
97049	e	12/15/1994	<0.0005	5.58	0.013	<0.05	<0.005	<0.01	<0.005	0.064	0.005	<0.01
97075	e	01/04/1995	<0.0005	5.56	0.021	<0.05	<0.005	<0.01	<0.005	0.064	0.008	<0.01
97089	e	01/13/1995	<0.0005	4.95	0.04	<0.05	<0.005	<0.01	<0.005	0.06	0.009	0.01
97097	e	01/18/1995	<0.0005	5.98	0.028	<0.05	<0.005	<0.01	<0.005	0.068	0.009	0.014
97115	e	01/24/1995	<0.0005	7	0.031	<0.05	<0.005	<0.01	<0.005	0.073	0.011	<0.01
97120	e	01/27/1995	<0.0005	10.1	0.071	<0.05	0.011	<0.01	<0.005	0.097	0.022	0.02
97176	e	03/13/1995	<0.0005	6.63	0.094	<0.05	0.009	<0.01	<0.005	0.071	0.018	0.021

a: grab sample LCC at Stilson Canyon

b: sample LCC at Forest Rd. and Humboldt Ave.

c: grab sample LCC at Taffee Rd.

d: grab sample LCC at Ord Ferry Rd.

e: grab sample LCC at Llano Seco

Table C2. FWS Sample Results, Dry Weight Sediment and Tissue Samples

Sample Number	Sample Location	Date	Dry Weight (mg/L)									
			Al	As	B	Ba	Be	Ca	Cd	Cr	Cu	Fe
Sediments												
8241	h	03/02/1994	33900	3.7	6.2	267	0.86	na	0.3	81.5	39	31400
8242	h	03/24/1994	31500	na	5	247	0.83	na	0.4	82	41	32200
8243	h	04/04/1994	29000	3.5	4.6	269	0.79	na	0.3	76.5	38	29600
8244	g	03/24/1994	28700	4.6	3.8	187	0.84	na	0.4	79	40	33000
8245	g	04/04/1994	35200	4.1	3.9	183	0.9	na	0.4	91.6	50.8	37400
8246	g	04/12/1994	34100	4.1	4	196	0.93	na	0.5	88.4	50.1	37300
8247	e	03/24/1994	37000	2.7	4.4	155	0.83	na	0.5	89.6	56.4	32600
8248	e	04/04/1994	31400	2.2	5.6	139	0.75	na	0.3	81.1	48	30400
8249	e	04/12/1994	28200	1.9	4.2	118	0.62	na	0.4	74.8	39	25800
8250	e	04/20/1994	42500	2.6	5.4	165	0.85	na	0.5	102	56.9	36400
8251	c	03/24/1994	24100	1.2	2	77.6	0.52	na	0.5	48	18	22700
8252	c	04/04/1994	18300	1.5	2	73	0.47	na	0.82	44	17	20800
8253	c	04/12/1994	26700	1.9	3.3	85.9	0.65	na	0.2	61.3	22	27000
8254	c	04/20/1994	16700	1.5	2	58	0.44	na	0.2	41	15	19300
97401	h	04/24/1995	39630	6.2	18.3	278	1.9	na	<0.2	93.2	46.8	34701
97402	e	04/24/1995	49941	6.1	<10	203	2.32	na	0.25	103	58.9	43606
97403	f	04/24/1995	53689	5.2	11.9	206	2.39	na	<0.2	114	54.7	42496
97404	h	05/18/1995	40667	5.2	14	280	1.98	na	<0.2	97.6	45.8	37178
97405	g	05/18/1995	46205	6.2	<10	221	1.89	na	<0.2	105	50.1	42797
97406	f	05/18/1995	58783	6.2	12.3	228	2.13	na	<0.2	122	57.2	45458
97407	e	05/18/1995	43289	4.6	<10	167	1.63	na	<0.2	99.8	47.1	34974
97408	e	06/06/1995	39316	6.3	<10	226	1.56	na	<0.2	94.6	41.9	34379
Whole Body												
8255	c	04/20/1994	886	na	<1	10.4	<0.04	na	0.34	5.4	8.6	719
8256	c	04/20/1994	767	na	<2	9.76	<0.07	na	0.37	3.6	8.4	619
Invertebrate												
**8257	h	03/02/1994	2700	na	<100	527	<4	na	3.9	<40	100	2500
**8258	g	03/24/1994	2990	na	<3	27.1	<0.1	na	0.47	20	21	2480
*97343	h	02/16/1995	7760	3.7	6.73	152	0.29	na	0.3	16.2	17.5	6082
*97346	f	02/16/1995	15905	5.4	6.4	106	0.55	na	0.4	33	23.9	13562
*97348	g	02/24/1995	12547	4.5	2.73	98.1	<0.1	na	0.6	24.2	20.3	9720
*97352	h	02/24/1995	7458	3.2	6.56	159	0.28	na	0.5	14.1	15.3	5741
*97354	g	03/02/1995	6922	3.9	50.1	101	0.27	na	0.8	14.7	18.3	5414
*97357	g	03/08/1995	7229	4.2	2.9	98.4	0.27	na	1.4	13.5	17	5532

** Common Name: Copepods, Family: Diaptomidae

* Common Name: Water Flea, Family: Cladoceran, Genus: Daphnia

a: LCC at Stilson Canyon

b: sample LCC at Forest Rd. and Humboldt Ave.

c: sample LCC at Taffee Rd.

d: sample LCC at Ord Ferry Rd.

e: sample LCC at Llano Seco

f: sample Beehive vernal pool on Llano Seco

g: sample Feedlot vernal pool at Llano Seco

h: sample Sanctuary II Tract 5 West venal pool on Llano Seco

na: not available/data missing

Table C2. (Continued) FWS Sample Results, Dry Weight Sediment and Tissue Samples

Sample Number	Sample Location	Date	Dry Weight (mg/L)									
			Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
Sediments												
8241	h	03/02/1994	0.021	8800	845	<0.3	78	20	0.08	48.2	98	63.4
8242	h	03/24/1994	0.024	8030	782	<0.3	79.8	23	0.1	44.3	93.6	68.2
8243	h	04/04/1994	0.024	7240	1090	<0.3	78.9	21	0.06	43.1	89.1	61.7
8244	g	03/24/1994	0.028	7110	758	<0.3	75.4	22	0.07	39.4	99	61.7
8245	g	04/04/1994	0.057	8230	520	<0.3	78.1	33	0.099	41.6	110	86.4
8246	g	04/12/1994	0.05	8220	580	<0.3	77.2	31	0.1	44	111	85.1
8247	e	03/24/1994	0.067	8110	402	<0.3	76.3	30	0.17	60	115	88.2
8248	e	04/04/1994	0.068	7290	348	<0.3	69.5	27	0.13	53.3	102	78
8249	e	04/12/1994	0.048	6210	300	<0.3	61.3	22	0.14	49.7	79.3	63.2
8250	e	04/20/1994	0.061	8440	430	<0.3	81	30	0.16	64	108	92.1
8251	c	03/24/1994	0.022	5410	354	<0.3	43	31	0.08	77.1	91.2	55.2
8252	c	04/04/1994	0.02	5320	377	<0.3	41	25	0.18	48.5	75.5	54.1
8253	c	04/12/1994	0.024	5090	391	<0.3	47	33	<0.03	60.7	116	94.1
8254	c	04/20/1994	0.032	5400	293	<0.2	40	32	0.04	40.2	77.5	48.4
97401	h	04/24/1995	0.03	8775	943	<5	91	8	1.1	47	111	83.4
97402	e	04/24/1995	0.05	10940	1109	<5	95.3	11	1	60.6	120	110
97403	f	04/24/1995	0.03	9625	789	<5	93.8	11	<1	68.9	134	95.2
97404	h	05/18/1995	0.02	8726	863	<5	97.8	9	<1	44.6	110	96.2
97405	g	05/18/1995	0.04	8047	899	<5	98.9	23	<1	43.5	123	101
97406	f	05/18/1995	0.05	10173	773	<5	105	12	1	72.8	142	118
97407	e	05/18/1995	0.03	8509	736	<5	84.5	7	<1	58.2	119	72.8
97408	e	06/06/1995	0.02	7585	1299	<5	86.5	7	<1	61	129	68.1
Whole Body												
8255	c	04/20/1994	0.08	1590	25.2	<0.2	1.9	1.44	0.45	39.5	2.8	127
8256	c	04/20/1994	0.1	1670	22.3	<0.4	1.6	1.2	0.62	38.7	2.1	140
Invertebrate												
**8257	h	03/02/1994	<5	1800	140	<30	20	36	<6	295	30	60
**8258	g	03/24/1994	<0.1	1370	48.5	<1	7.7	1.6	0.97	16.3	8.6	85.7
*97343	h	02/16/1995	0.06	3321	293	<2	18.9	1.4	0.5	148	27.4	86.7
*97346	f	02/16/1995	0.17	4207	679	<2	32	3.3	0.5	143	46.9	96.7
*97348	g	02/24/1995	0.06	3363	270	<2	27.3	2.7	<0.5	82.4	35	90.7
*97352	h	02/24/1995	0.07	2877	274	<2	16	1.4	0.5	198	20.8	75.7
*97354	g	03/02/1995	0.06	2620	202	<2	15.8	1.5	<0.5	143	20.3	85.2
*97357	g	03/08/1995	0.06	2567	144	2.14	15.3	1.8	1	191	18.7	82

** Common Name: Copepods, Family: Diaptomidae

* Common Name: Water Flea, Family: Cladoceran, Genus: Daphnia

a: LCC at Stilson Canyon

b: sample LCC at Forest Rd. and Humboldt Ave.

c: sample LCC at Taffee Rd.

d: sample LCC at Ord Ferry Rd.

e: sample LCC at Llano Seco

f: sample Beehive vernal pool on Llano Seco

g: sample Feedlot vernal pool at Llano Seco

h: sample Sanctuary II Tract 5 West venal pool on Llano Seco

na: not available/data missing

Table C3. Biological metrics by reach for macroinvertebrates sampled from Little Chico Creek April 2002

StationID	**LCCA 4/02**			**LCCB 4/02**			**LCCD 4/02**		
Transect Number	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
ABL Laboratory Number	8223	8224	8225	8226	8227	8228	8229	8230	8231
Taxonomic Richness	20	23	28	11	12	10	15	15	15
Percent Dominant Taxon	33	17	20	61	56	47	22	29	43
Ephemeroptera Taxa	4	4	6	2	1	2	2	3	2
Plecoptera Taxa	2	1	3	0	0	0	0	0	0
Trichoptera Taxa	3	4	5	0	0	0	0	0	0
EPT Taxa	9	9	14	2	1	2	2	3	2
EPT Index (%)	54	73	66	7	6	4	16	13	10
Sensitive EPT Index (%)	34	54	44	7	6	4	14	12	10
Percent Chironomidae	43	22	30	86	83	87	50	23	56
Percent Hydropsychidae	11	8	10	0	0	0	0	0	0
Percent Baetidae	9	10	10	0	0	0	3	1	0
Shannon Diversity	2.2	2.4	2.5	1.2	1.3	1.3	2.2	2.0	1.9
Tolerance Value	3.3	2.2	2.8	5.0	5.2	5.5	5.3	5.4	5.5
Percent Intolerant Taxa (0-2)	36	57	46	10	16	7	0	13	11
Percent Tolerant Taxa (8-10)	1	1	1	8	14	13	9	35	15
Percent Collectors	48	40	39	97	92	91	60	60	81
Percent Filterers	18	12	17	0	6	7	34	5	7
Percent Grazers	31	46	39	2	1	2	5	34	12
Percent Predators	1	0	2	1	2	0	1	1	0
Percent Shredders	2	1	2	0	0	0	0	0	0

Table C4. Five most abundant taxa by reach for macroinvertebrates from Little Chico Creek April 2002

StationID	**1**	**2**	**3**	**4**	**5**
LCCA4/02	Orthocladiinae (23.9)	Epeorus (19.2)	Baetis (9.7)	Agapetus (9.2)	Hydropsyche (8.4)
LCCB4/02	Orthocladiinae (83.1)	Naididae (6.1)	Ephemerella (5.0)	Simulium (1.3)	Chironomini (0.9)
LCCD4/02	Orthocladiinae (20.1)	Chironomini (19.1)	Crangonyx (13.2)	Physa/ Physella (13.1)	Tanytarsini (6.7)

NOTE: Numbers in parentheses are % of total taxa observed.

Table C5. Taxa list and abundance calculations for the benthic macroinvertebrates sampled from Little Chico Creek April 2002, identified by Ryan Brosius

							LCCA 4/02				LCCB 4/02				LCCD 4/02			
				Life Stage				Subsamples				Subsamples				Subsamples		
Order	**Family**	**Tribe**	**Taxon**		**TV**	**FFG**	**1**	**2**	**3**	**Total**	**1**	**2**	**3**	**Total**	**1**	**2**	**3**	**Total**
Coleoptera																		
	Dytiscidae																	
			Hydroporus sp.	Adults	5	p	--	--	--	--	--	--	--	--	--	1	--	1
	Dytiscidae			Larvae	5	p	--	1	--	1	--	--	--	--	--	--	--	--
	Elmidae																	
			Optioservus sp.	Adults	4	g	--	1	--	1	--	--	--	--	--	--	--	--
			Zaitzevia sp.	Larvae	4	c	--	1	--	1	--	--	--	--	--	--	--	--
	Psephenidae																	
			Psephenus sp.	Larvae	4	g	--	1	--	1	--	--	--	--	--	--	--	--
Diptera																		
	Chironomidae																	
		Chironomini			6	c	3	2	10	12	2	4	2	6	5	6	105	111
		Chironomini		Pupae	--	--	--	--	--	--	--	--	--	--	--	1	--	1
		Tanytarsini			6	f	19	7	14	21	1	2	5	7	26	5	10	15
		Tanytarsini		Pupae	--	--	3	1	3	4	--	--	--	--	--	--	--	--
					5	c	96	33	57	90	172	70	105	175	48	16	16	32
				Pupae	--	--	3	4	1	5	67	159	132	291	32	6	5	11
					6	p	1	--	2	2	--	--	--	--	--	--	--	--
				Pupae	--	--	--	1	1	2	--	1	--	1	--	--	--	--
	Empididae				6	p	--	--	--	--	1	1	--	1	--	--	--	--
			Clinocera sp.		6	p	--	--	1	1	--	--	--	--	--	--	--	--
			Neoplasta sp.		--	--	2	2	4	6	--	--	--	--	--	--	--	--
	Empididae			Pupae	--	--	2	1	2	3	--	--	--	--	--	--	--	--
	Simuliidae																	
			Simulium sp.		6	f	1	--	1	1	--	5	6	11	34	--	5	5
	Tipulidae																	
			Antocha sp.		3	c	--	2	--	2	--	--	1	1	--	--	--	--
			Dicranota sp.		3	p	--	--	1	1	--	--	--	--	--	--	--	--

Table C5. (Continued) Taxa list and abundance calculations for the benthic macro invertebrates sampled from Little Chico Creek April 2002, identified by Ryan Brosius

							LCCA 4/02				LCCB 4/02				LCCD 4/02			
								Subsamples				Subsamples				Subsamples		
Order	**Family**	**Tribe**	**Taxon**	**Life Stage**	**TV**	**FFG**	**1**	**2**	**3**	**Total**	**1**	**2**	**3**	**Total**	**1**	**2**	**3**	**Total**
Ephemeroptera																		
	Ameletidae																	
			Ameletus sp.		0	g	--	--	--	--	--	--	--	--	--	1	--	1
	Baetidae																	
			Baetis sp.		5	c	26	23	30	53	--	--	--	--	6	2	1	3
	Ephemerellidae																	
			Drunella sp.		0	g	12	26	24	50	4	--	3	3	--	--	--	--
			Ephemerella sp.		1	c	8	22	9	31	17	18	7	25	--	17	24	41
			Serratella sp.		2	c	--	--	1	1	--	--	--	--	--	--	--	--
	Ephemeridae																	
			Ephemera sp.		3	c	--	--	--	--	--	--	--	--	30	--	--	0
	Heptageniidae																	
			Epeorus sp.		0	g	60	38	58	96	--	--	--	--	--	--	--	--
			Rhithrogena sp.		0	g	--	--	1	1	--	--	--	--	--	--	--	--
Hemiptera																		
	Corixidae				10	p	--	--	--	--	--	--	--	--	1	--	1	1
Megaloptera																		
	Corydalidae				0	p	--	--	--	--	1	1	--	1	--	--	--	--
Odonata																		
	Coenagrionidae																	
			Argia sp.		7	p	--	--	1	1	--	--	--	--	--	--	--	--
Plecoptera																		
	Perlodidae																	
			Isoperla sp.		2	p	1	--	1	1	--	--	--	--	--	--	--	--
			Osobenus sp.		--	--	--	--	1	1	--	--	--	--	--	--	--	--
	Pteronarcyidae																	
			Pteronarcys sp.		0	s	6	3	7	10	--	--	--	--	--	--	--	--

Table C5. (Continued) Taxa list and abundance calculations for the benthic macro invertebrates sampled from Little Chico Creek April 2002, identified by Ryan Brosius

							LCCA 4/02				LCCB 4/02				LCCD 4/02			
				Life				Subsamples				Subsamples				Subsamples		
Order	**Family**	**Tribe**	**Taxon**	**Stage**	**TV**	**FFG**	**1**	**2**	**3**	**Total**	**1**	**2**	**3**	**Total**	**1**	**2**	**3**	**Total**
Trichoptera																		
	Glossosomatidae																	
			Agapetus sp.		0	g	14	32	29	61	--	--	--	--	--	--	--	--
	Hydropsychidae																	
			Cheumatopsyche sp.		5	f	8	2	3	5	--	--	--	--	--	--	--	--
			Hydropsyche sp.		4	f	24	16	28	44	--	--	--	--	--	--	--	--
	Philopotamidae																	
			Chimarra sp.		4	f	--	1	2	3	--	--	--	--	--	--	--	--
	Rhyacophilidae																	
			Rhyacophila sp.		0	p	--	--	1	1	--	--	--	--	--	--	--	--
Amphipoda																		
	Crangonyctidae																	
			Crangonyx sp.		4	c	--	--	--	--	--	--	--	--	16	40	25	65
Lumbricina					--	c	--	--	--	--	--	--	--	--	1	--	8	8
Lumbriculida																		
	Lumbriculidae				8	c	3	3	3	6	1	--	--	0	1	--	3	3
Tubificida																		
	Enchytraeidae				10	c	--	--	--	--	1	--	--	0	--	--	--	--
	Naididae				10	c	--	--	--	--	16	16	20	36	3	2	1	3
	Tubificidae				--	--	--	--	--	--	--	5	1	6	5	6	11	17
Veneroida																		
	Pisidiidae																	
			Pisidium sp.		8	f	--	--	--	--	--	--	--	--	2	2	1	3
Basommatophora																		
	Physidae																	
			Physa/ Physella		8	g	1	--	--	--	--	1	--	1	10	44	26	70
	Planorbidae																	
			Planorbella sp.		7	g	--	--	--	--	--	--	--	--	--	2	--	2