Pismo Creek/Edna Area Watershed Management Plan

March 2009

Prepared for
The Department of Fish and Game
State of California

This management plan was funded by the California Department of Fish and Game Fisheries Restoration Grant Program. The contents of this document do not necessarily reflect the views and policies of the CDFG.

Prepared by
Central Coast Salmon Enhancement
On Behalf of the Pismo Creek/Edna Area Steering Committee

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Executive Summary

The Pismo Creek/Edna Area Watershed Management Plan is a working documentation of history, information, and projects along the creek and its tributaries, and throughout the watershed. The plan describes the condition of creek water quality, identifies critical issues facing the watershed, and poses a set of recommendations to address the issues. Information garnered from projects sponsored by partner organizations is included when available. Future updates of the plan will include additional information that becomes pertinent as projects are implemented and monitored.

Central Coast Salmon Enhancement produced Phase 1 of the plan through funding provided by the City of Pismo Beach as part of a Supplemental Environmental Project (SEP), to settle an outstanding wastewater discharge violation by the Regional Water Quality Control Board. The SEP includes $100,000 to fund the top-ranked implementation projects arising out of the plan. Phase 2 was funded by the California Department of Fish and Game Fisheries Restoration Grant Program.

A steering committee was established prior to the advent of funding through an outreach effort by Salmon Enhancement and people who live and work in the watershed. The steering committee functioned to gather information for the plan, review the draft plan and guide the process of determining contents of the plan. A technical advisory committee was established to provide technical input to the plan.

The plan is structured in three parts. The first is to provide the reader background on ‘what we know’ about the watershed in the existing setting section. The second is to provide an idea on ‘what we’re concerned about’ in the watershed in the critical issues section. The third is ‘here’s what we want to do’ in the implementation section of the plan.

Summary of Findings

Preliminary assessment of the creek for water quality indicates that:

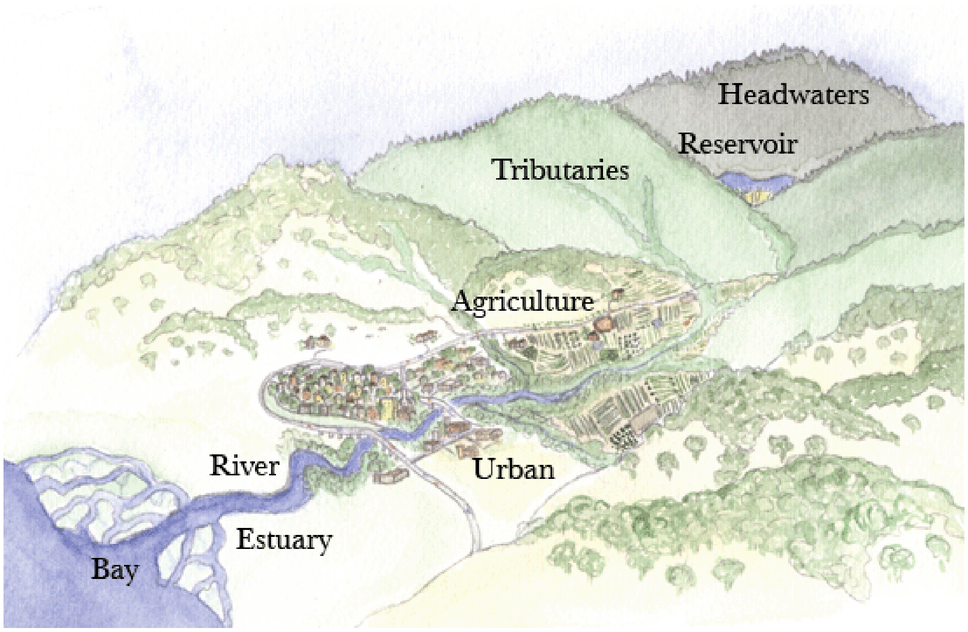
- Water quality regarding nutrients is generally good; however, immediate treatments for bacteria and sediment could reduce the likelihood for potential Total Maximum Daily Load listing.
- There are dry-season spikes in ocean bacterial levels in the near-shore ocean environment adjacent to the creek mouth.
- There is an urgent need to further research creek dynamics regarding water quantity during the low-flow season, which could affect water quality.
- The mouth of Pismo Creek is an artifact of land-use changes within the past 60-70 years.

Steelhead trout limiting factors for Pismo Creek watershed include increasing sedimentation, decreasing spawning gravel quality and quantity, fish passage barriers, and decreased water quantity.

NOTE TO READER: Quoted material from authors and sources presented in the Pismo Creek/Edna Area Watershed Management Plan are credited to the source, italicized and indented.

No matter where you live, you live in a watershed.

A watershed is the land area that drains to a single body of water such as a stream, lake, wetland, or estuary. Physical boundaries define the movement of water and delineate the watershed.



Source: http://www.napawatersheds.org/Content/10127/What_is_a_Watershed.html

A "watershed approach" uses hydrologically defined areas (watersheds) to coordinate the management of natural resources. The approach is advantageous because it considers all activities within a landscape that affect watershed health. Ideally, a watershed approach will integrate biology, chemistry, economics, and social considerations into decision-making. It considers local stakeholder input, along with national and state goals and regulations. A watershed approach recognizes needs for water supply, water quality, flood control, navigation, hydropower generation, fisheries, biodiversity, habitat preservation and recreation; and it recognizes that these needs often compete.

Chapter 1 Introduction

Mission

The mission of the Pismo Creek/Edna Area Watershed Forum is to produce and implement a watershed management plan that protects the beneficial land and water uses within the watershed, while enhancing the quality of natural resources. The plan will emphasize protecting fish and wildlife habitat, water quantity and quality, flood management, and erosion control through voluntary and collaborative measures, community education, and outreach and restoration projects.

Purpose and Need for the Plan

The purpose of the Pismo Creek/ Edna Area Watershed Management Plan (WMP) is to document historical conditions, existing conditions and other background information, and to link this information to critical issues also known as limiting factors. The Plan then recommends management actions and projects to address and improve critical issues. In the next 20 years, the watershed will face land-use changes and urban annexations that will affect the condition of the riparian and upland areas of the watershed. This plan will provide the first watershed-wide status assessment in order to track changes in conditions in the interest of balancing development pressures with environmental values.

> *Watershed management is a proactive, broad-based method for resolving water issues by comprehensively linking land use and water resources within a drainage basin. Linkage between land use and the associated impacts of water quality and flow-and between natural and human elements-is part of this approach. Once the linkage is made, problems related to water quality and flows are more easily solved through source control and flow management. Addressing a problem at its source with an integrated ecosystem approach is preferable, and far less costly than mitigating individual water quality issues after they become a problem. A watershed management approach can also help integrate goals for long-term ecosystem health and economic sustainability*
> Water and Land Use Planning, Johnson and Loux, 2004

How the Plan was Prepared

The genesis of the Pismo Creek/ Edna Area WMP began in 2003, when landowners in the watershed approached Central Coast Salmon Enhancement for assistance in addressing water quality and quantity concerns. Salmon Enhancement worked with local agencies and organizations to facilitate quarterly steering committee meetings comprised of key stakeholders, organized watershed tours and coordinated communitywide meetings in an effort to generate further interest and participation in the process of documenting critical issues and recommending projects to address them. In 2004, the City of Pismo Beach approached Salmon Enhancement to propose a Supplemental Environmental Project (SEP) ultimately required by the Central Coast Water Board as part of an enforcement order. In 2005, Salmon

Enhancement was awarded the SEP contract from the City to develop a Phase 1 watershed management plan, with a focus on water quality. The SEP included $100,000 to fund implementation projects arising out of the plan. Central Coast Water Board order R3-2005-0009 and the Scope of Work arising out of the order are included in Appendix A. Subsequently, the California Department of Fish and Game provided funding for a Phase 2 watershed management plan to expand the Phase 1 document. Phase 2 of the Plan includes habitat and hydrological assessments, and project implementation recommendations for key problems affecting steelhead trout habitat in the watershed. It also recommends additional specific project planning that will improve fish and wildlife habitat.

During Phase 1, the CDFG independently conducted a habitat assessment of the Pismo Creek main stem and West Corral de Piedra tributary. The final report of that assessment is excerpted here and used to inform recommendations and projects suggested in this plan. It is included in its entirety in the appendices. The Steering Committee and Technical Advisory Committee elected to contract with an outside consultant for assessment of hydrology and geology of the watershed. The final report of the assessment is also excerpted, used to inform recommendations and projects, and is included in the appendices.

Monthly stakeholder meetings and quarterly communitywide forums formed the basis of public vetting of critical issues facing the watershed. Informed stakeholders then proposed recommendations and projects to address these concerns. It is through these venues that agreement was reached on the contents of the document, including data generation and interpretation. Salmon Enhancement and the steering committee agreed that focusing on a publicly coordinated and vetted plan would lead to increased levels of implementation funding and provide opportunities to leverage resources against the available SEP funds.

The above-stated mission was formulated by the Pismo Creek/Edna Area Watershed Forum steering committee, a self-selected group of stakeholders comprised of landowners, residents, businesses and agency representatives who live and work in, or have jurisdiction within, the watershed. The steering committee meetings were attended by a core set of members and many additional people who attended for specific topics during the generation the WMP.

FIGURE 1.1 AERIAL PHOTO OF CITY OF PISMO BEACH FACING SOUTH

Pismo Creek enters the Pacific Ocean at the City of Pismo Beach. The mouth of Pismo Creek can be seen behind the pier.

Source: Google Earth, 2009

Watershed Overview

The Pismo Creek Watershed occupies approximately 47 square miles within southern San Luis Obispo County, California. The drainage rises to a maximum elevation of almost 2,865 feet above mean sea level. It includes approximately 54 percent mountainous and foothill area and 46 percent valley area.

Pismo Creek flows through relatively rugged terrain in a steep, incised channel, with small alluvial deposits appearing sporadically. The main stem originates at the confluence of East Corral de Piedra and West Corral de Piedra Creeks and flow south-southwest for approximately 5.5 miles to the City of Pismo Beach and the Pacific Ocean (Figure 1.1). The Creek is channelized and rock revetted within the first stream mile underneath the Highway 101 bridge adjacent to the waste water treatment plant. The mouth of Pismo Creek is in the dune region known locally as Pismo Beach, which is owned by the State of California, Department of Parks and Recreation. The coastal lagoon is typical of the small coastal watersheds that form sand-bars in low flow summer and fall periods. The sandbars typically wash away during heavy winter flows. At high tide, salt water flows into Pismo Creek for nearly 0.5 miles upstream, to about where the levee begins that protects the wastewater treatment plant. Pismo Creek stream flow is not gauged except for a short period of record by Balance Hydrologics, Inc. (January 1989 through September 1992). The elevation of the gauge site during this period was estimated to be 18 feet above mean sea level. The United State Geologic Survey (USGS) hydrologic unit code is HUC: 18060006.

The watershed has three major tributary basins with their headwaters in the Santa Lucia Mountains: West Corral de Piedra, East Corral de Piedra, and Cañada Verde (Figure 1.3). Cañada Verde may also be referred to as the ‘East Branch of Pismo Creek’. These tributaries cumulatively measure about 53 miles in length. A fourth significant tributary, Cuevitas Creek, enters Pismo Creek from the west in lower Price Canyon. The locations of these tributary basins are shown in Figure 1.2. Representative channel gradients for smaller upper watershed tributaries are approximately 6 to 8 percent; for the lower reaches of East and West Corral de Piedra it is approximately 0.5 to 3 percent, and for the lower main stem it is approximately 0.75 percent (Balance Hydrologics, 2008).

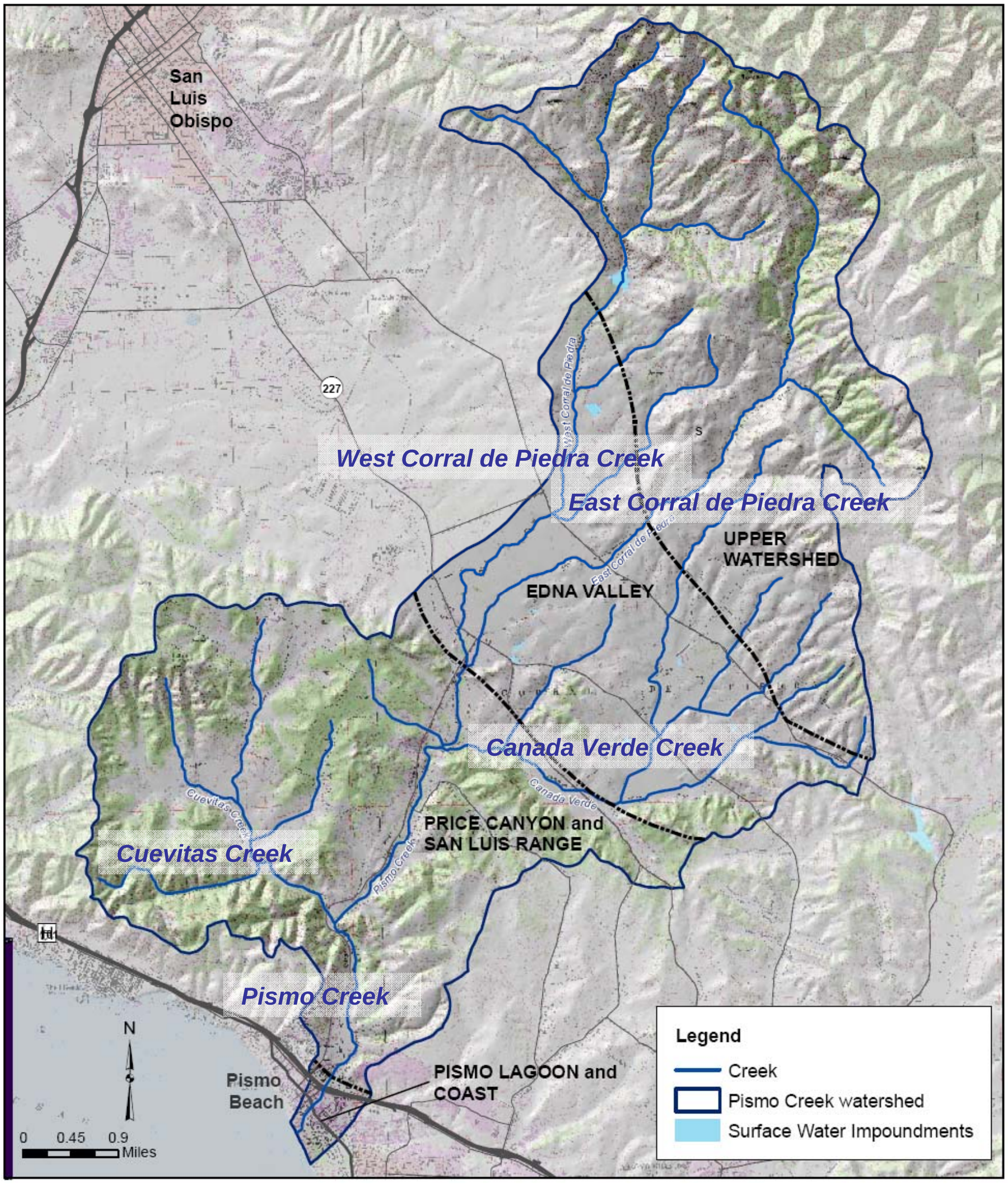
West Corral de Piedra Creek is dammed approximately 9.5 miles from the ocean and permitted for water diversion of 991 acre-feet per year (AFY) by the State Water Resources Control Board. In addition to surface flows within creek channels, there are at least six off-stream impoundments on private property.

FIGURE 1.2 CALWATER UNITS OF PISMO CREEK/EDNA AREA WATERSHEDS

Calwater Unit	Acres	Planning Watershed Name
331026010	5594	West Corral de Piedra Creek
331026011	3800	East Corral de Piedra Creek
331026012	6222	Canada Verde
331026013	2329	Upper Pismo Creek
331026014	7386	Lower Pismo Creek

Source: CCSE

FIGURE 1.3 PISMO CREEK WATERSHED MAP SHOWING GEOMORPHIC ZONES



Source: Balance Hydrologic, Inc, 2008

History of the Watershed

San Luis Obispo County has been home to the Northern Chumash, or Obispeno, for over 9,000 years and lies within the area described as the Obispeno Chumash culture area. Archaeologists have established a detailed cultural chronology based upon excavations and site surveys across the County (Greenwood, 1972; Gibson, 2005, Jones and Waugh 1995). Over 1,000 archaeological sites have been recorded in San Luis Obispo County, although many of these heritage resources have been destroyed or damaged by development.

Central Coast prehistory is divided into three broadly defined periods – the Early, Middle and Late. The Early Period dates from the arrival of humans in the county more than 10, 000 years before present and extends to 2,600 years before present. A local site at Diablo Canyon, SLO-2, was dated between 8,900 and 9,300 years ago (Greenwood, 1972). Early Period sites often contain milling stones and manos which indicate use of seed plants, in addition to shell middens left from intensive harvesting of shellfish (Erlandson, 1994). A basic array of rectangular shell bead ornaments also occurs throughout the Early Period. Village life was well organized with formal cemeteries and specialized resource sites being used. Interior areas were also settled during the Early Period.

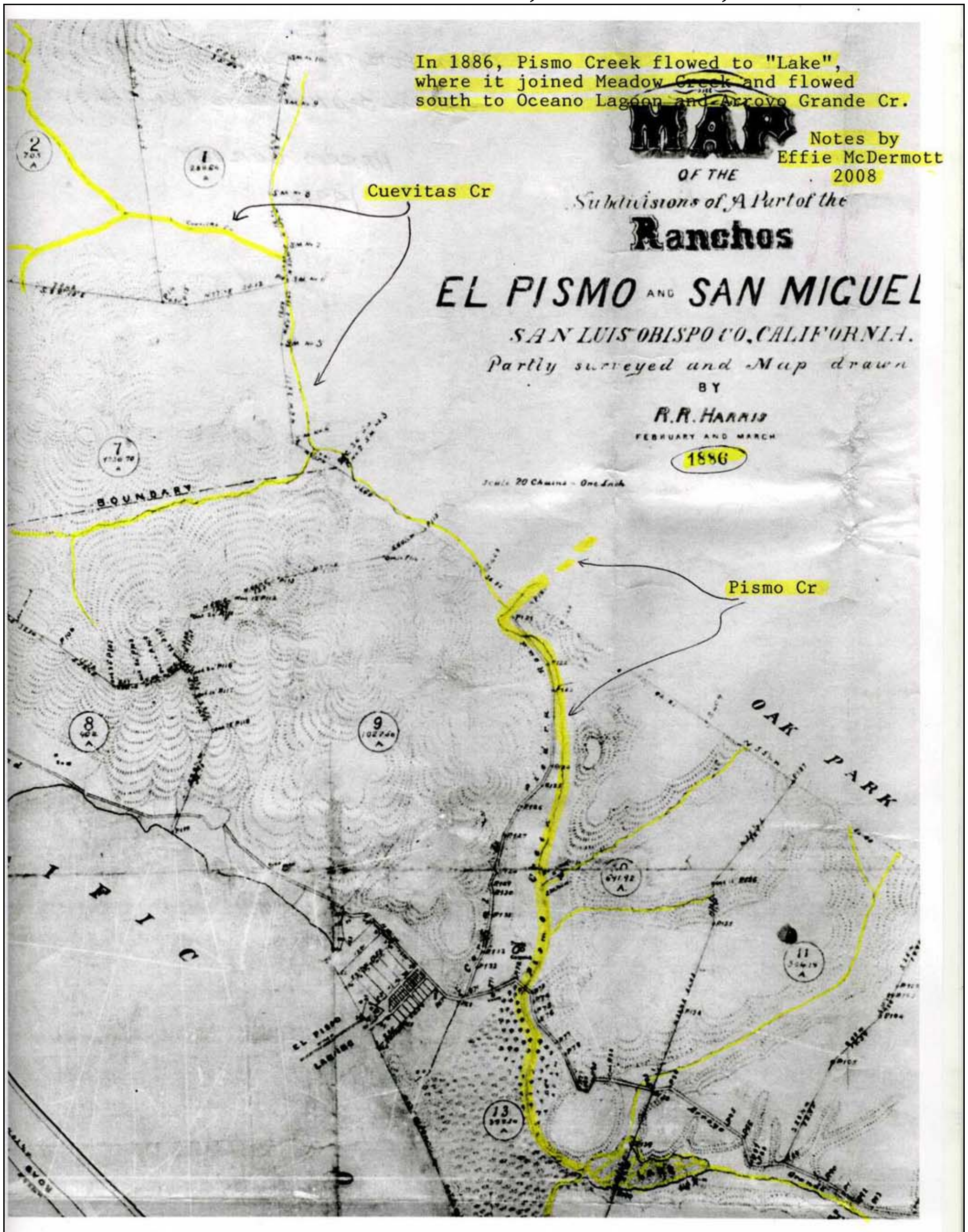
The Middle Period of Central Coast Chumash prehistory spans from 2,600 years before present to 750 years before present. During this time, Chumash society became increasingly complex with political and religious power structures. Artifact types change in the Middle Period and shell ornaments become more diverse. An important economic adaptation, the use of acorns, is indicated by the decline in milling stones and the increased use of mortars and pestles. Population size increased and trade networks became very well established in the Middle Period.

The Late Period covers the period from 750 years to150 years before present. Complex economic changes included the invention of money in the form of shell beads with all the associated implications of wealth and power. There was a decreasing reliance on coastal resources and a shift to interior settlements. With the arrival of the Spanish, especially after 1769 A.D., rapid changes altered Chumash political and economic achievements as well as reduced the size of the population through decimation by foreign diseases. Many contemporary Chumash maintain spiritual and cultural links to their rich heritage.

The Pismo Creek watershed has been used for ranching since the establishment of the Mission San Luis Obispo in 1772. The watershed covers portions of three Mexican land grants; the San Miguelito, the Pismo and the Corral de Piedra (Effie McDermott Archives). A Mexican land grant of 30,911 acres, called the Rancho Corral de Piedra, was established in February 11, 1841. Agricultural activity was continued after the establishment of the State of California in the 19th century, during which time the canyon was named after John Price, owner of 7,000 acres and local magistrate (Gibson 1992:6).

In 1865, Edgar Willis Steele and his brothers, dairy farmers who owned the Pescadero Ranch in San Mateo County, purchased 45,000 acres in the Edna Valley for $1.10 per acre and introduced the modern dairy industry to San Luis Obispo County. In 1866, Edgar Steele bought portions of Corral de Piedra, El Pismo, Bolsa de Chamisal and Arroyo Grande ranchos. They operated five dairy farms, each with 150 head of dairy cattle. The Steele's specialized in cheese, and in 1870, San Francisco's Commercial Herald, the standard commercial and credit reporter for the West, valued the Steele's holdings at $150 million. Figure 1.3 provides a map of this time period.

FIGURE 1.4 RANCHO MAP: EL PISMO AND SAN MIGUEL, SAN LUIS OBISPO, CALIFORNIA.



Pismo Creek and Cuevitas Creek as shown on 1886 Harris survey of Ranchos El Pismo and San Miguelito

Source: extracted from a copy of the "Map of the Subdivisions of A Part of the Ranchos El Pismo and San Miguelito, San Luis Obispo Co, California, Partly surveyed and Map drawn by R. R. Harris February and March 1886"in the Effie McDermott Archives, Pismo Beach, CA.

Changes in the Watershed

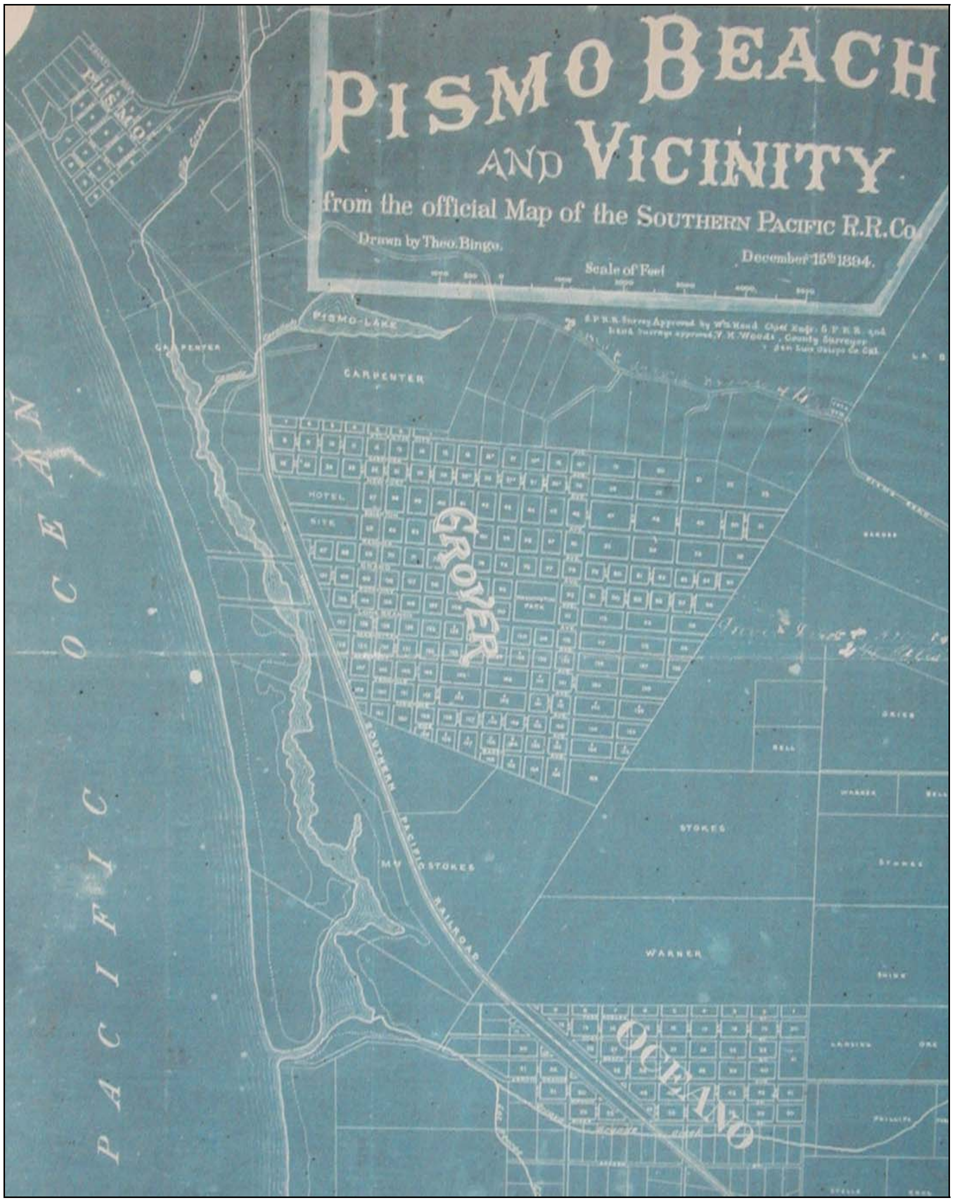
The current configuration of lower Pismo Creek bears little resemblance of its former course. Prior to 1911, Pismo Creek's lower drainage included Pismo Lake, and what today is called Meadow Creek. Lower Pismo Creek joined with Arroyo Grande Creek in its lowest reaches and flowed into the ocean.

The following is compiled from Hydrology of the Meadow Creek Drainage, San Luis Obispo County, California by Dr. David Chipping, 1989, and provides a more detailed historical perspective on changes to the lower watershed from the land grant period to the present.

- An 1837 map shows Pismo Creek and/or Meadow Creek joining Arroyo Grande Creek at the Oceano Lagoon area.
- An 1873 subdivision map shows Arroyo Grande Creek entering the eastern end of Oceano Lagoon, at which point it is shown joining a stream from the north, presumably Pismo Creek.
- An 1874 official county map shows Pismo Creek flowing southward behind the dunes to Oceano Lagoon. There is no indication of a Pismo Creek mouth at the present location.
- A map filed in 1880 shows Pismo Creek running behind the dunes at Oceano Lagoon, and being clearly labeled as Pismo Creek as it enters the lagoon. The lagoon is shown extending a considerable distance inland through the area presently occupied by the airport and waste water treatment plant.
- In 1894, the Southern Pacific Railroad Company produced a map showing Arroyo Grande Creek entering Oceano Lagoon at its southern end, and a narrow lake is drawn all the way up to Grand Ave. and into the North State Park Campground. Pismo Creek is called Villa Creek, and is shown joining the lake at the northern end of what is now the North Campground. No flow of Pismo Creek into Pismo Lake is shown (Figure 1.4).
- In an article entitled "When Mother Nature Wept, Her Tears Moved Land" by Jean Hubbard in the Five Cities Times-Press Recorder (date not found but assumed to be in the 1960's), a 1905 flood is described when, "Pismo Beach took the brunt of the storm that year and the old Café Royale, a tavern and dance hall, and 100 feet of the wharf were lost. Pismo Creek previously had meandered to a merger with Arroyo Grande Creek and flowed into the ocean near Oceano. Now it cut across the sand dunes and reopened an old channel to the sea." Chipping indicates that articles from 1905 Telegram-Tribune do not mention the breakthrough and that it may have occurred in 1911.
- Emma Boxfold provided photographs of the 'Villa Creek' flood of 1911 with explanations written on photocopies of the photographs stating that, "this creek followed the present Highway 1 into Oceano Creek along the side of the sand hills. After days and days of constant rain, Pismo Creek backed up little by little into the southern portion of Pismo. In order to stop this Hans Skov and Temple Boxfold opened up an outlet in the sand hills with a spade" and the pictures show that shacks were undercut and fell into the channel.
- During the 1950's the golf course area near Grand Avenue was graded, with dune sands being pushed into the Meadow Creek flood plain. It is thought that all vestigial remnants of the original Meadow Creek-Pismo Creek channel were destroyed at this time, except for a few ponds within the golf course.

Today, Meadow Creek is hydrologically disconnected from the Pismo Creek watershed except in storm events when overflow can enter the Pismo Creek lagoon through a flood gate next to the Cypress Street Bridge.

FIGURE 1.5 MAP OF PISMO CREEK 1894



Source: City of Pismo Beach

Geomorphic Changes in the Watershed

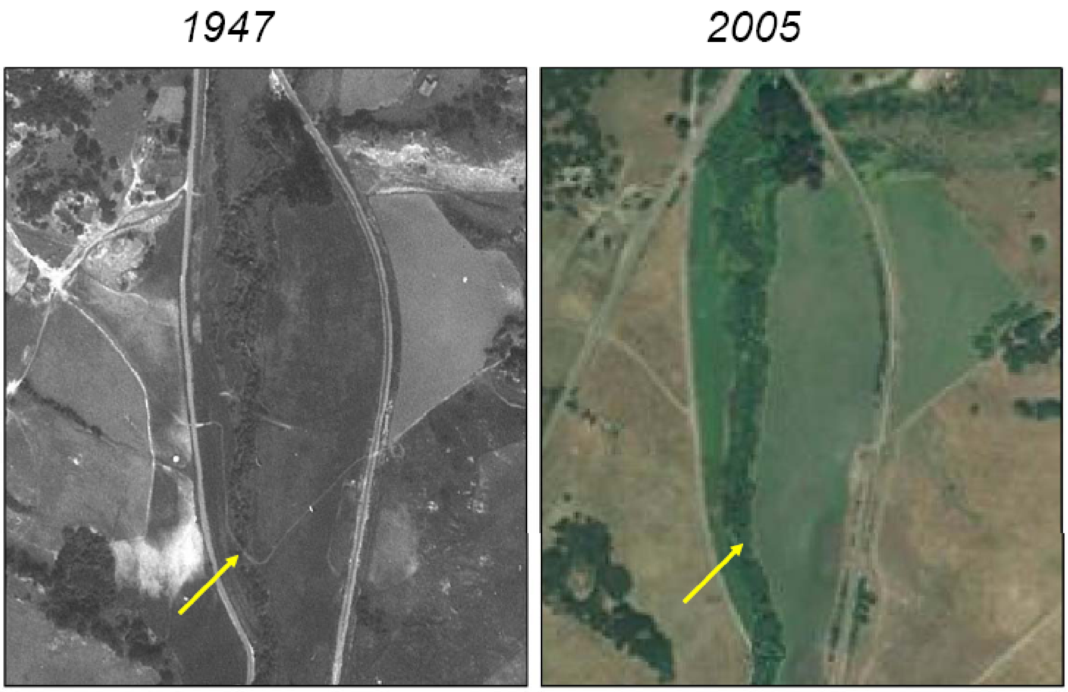
As part of the Pismo Creek Hydrology and Geology Assessment, Balance Hydrologics utilized aerial-photograph interpretation and reconnaissance-level observation to characterize the form of the creek over time.

> *The first Europeans settled the area in the early and mid-1800s and began a long tradition of ranching and intensive agriculture that continues today (Brown, 2002). As is the case with many of California's coastal streams, this period of settlement appears to have coincided with widespread channel incision and straightening, as compaction of soils by cattle increased runoff rates and the volume of water delivered to channels, while re-alignment or straightening of streams by farmers lead to lower channel roughnesses, higher velocities, and increased erosion, a process increasingly referred to as 'hydromodification'. Relatively recent residential and*

suburban development in the watershed typically contributes to hydromodification, especially if impervious surfaces such as roofs, driveways, and roads are constructed such that they route runoff directly into local channels, without reducing the accelerated flow peaks.

Channel incision is evident through field observations and aerial photograph interpretation. For example, Figure 15 contains side-by-side aerial photography of Pismo Creek near the head of Price Canyon. The presence of a road crossing in this area, as visible in stereo-paired photographs, implies that the creek was not substantially incised in 1947, while recent field investigations reveal the stream to be significantly incised in this reach by as much as 25 feet.

FIGURE 1.6 PISMO CREEK ABOVE PRICE CANYON IN 1947 AND 2005

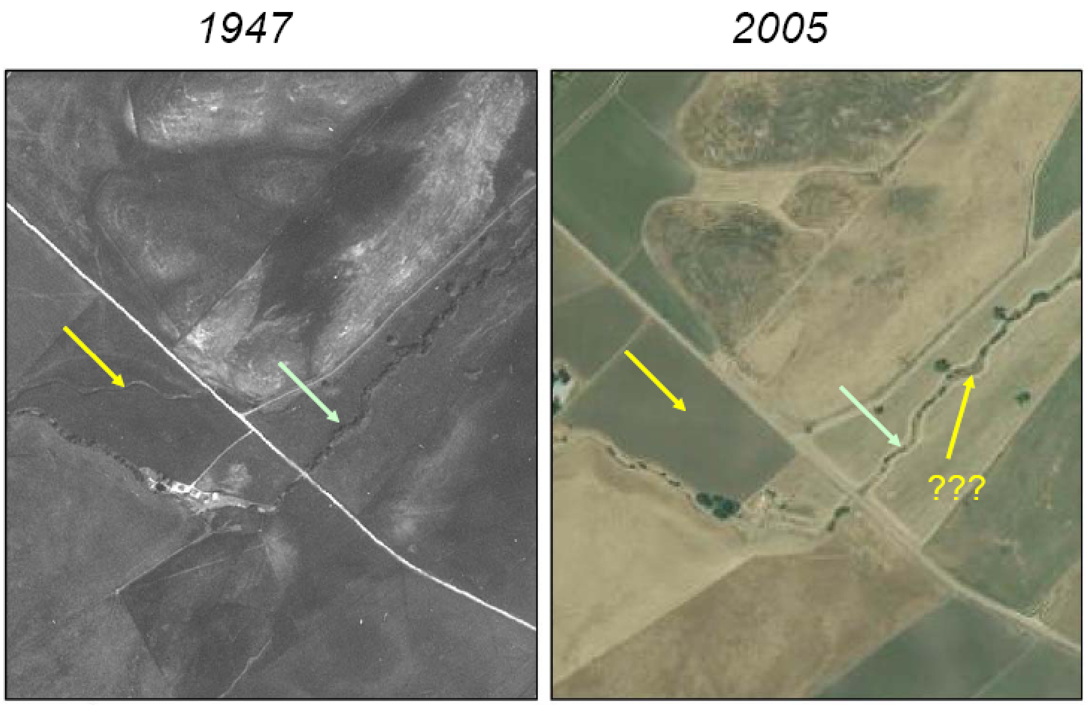


Source: Balance Hydrologics, 2008. ***Figure 15. Stereo-viewing and the presence of a road crossing indicate that the channel was not substantially incised in 1947, while recent field investigations imply it to be significantly (20 feet or more) incised under present-day conditions.***

Anecdotal evidence suggests that West Corral de Piedra regularly overtops its banks and a portion of flows are diverted out of the Pismo Watershed and into the San Luis Obispo Creek where the stream enters Edna Valley (Anonymous landowner, personal comm., 2007). Prior to the arrival of European grasslands and livestock approximately 200 years ago, this floodplain process likely persisted throughout Edna Valley, with East and West Corral de Piedra and Canada Verde Creeks flowing across the Edna Valley at about the elevation of the valley flat, frequently overtopping their banks, and changing course. In Edna Valley today, however, the streams have largely been re-aligned and straightened for agricultural purposes. Access roads and low-density residential development have been introduced into Edna Valley as well, resulting in a higher portion of rainfall now entering the channel network more quickly, leading to higher *peak flows, higher flow velocities, and increased erosion potential. These factors have led to widespread channel incision throughout the valley.*

Throughout Edna Valley, channels are typically incised and appear to be hydrologically disconnected from the surrounding valley flat, and in many cases are straight with a limited riparian vegetated buffer. Figure 16 shows channel conditions on East Corral de Piedra near where it exits the mountainous upper watershed. Historical aerial photos show the presence of an alternate channel that does not exist today, suggesting that historically, the stream frequently overtopped its banks and occupied alternate channels. The channel has become disconnected from the floodplain in relatively recent times, perhaps with the development of intensive viticulture in this reach, or simply because a local farmer chose to fill in the alternate channel. In either case, today's channel is incised significantly and floodplain processes do not appear to be present.

FIGURE 1.7 EAST CORRAL DE PIEDRA CREEK IN 1947 AND 2005



Source: Balance Hydrologics, 2008. Figure 16. The absence of alternate channels in more recent times suggests that the stream has become incised, with less-frequent inundation of the floodplain. Field observations reveal that the channel is currently incised approximately 15 feet below the floodplain. Note also the apparent decrease in vegetation, perhaps associated with the development of intensive viticulture on this parcel.

The 1947 aerial photos only cover the mid-watershed from Edna Valley southeast extending along Canada Verde Creek. The lack of contrast of this set of photos created some difficulties when identifying the riparian zone. The areas identified are considered less accurate than those digitized from 1970 or 2005 photos. In order to obtain a total historic riparian area, we used the 1970 photos to fill in the remaining portion of the watershed. These photos were much easier to interpret due to their high contrast. Compared to a current set of photos from 2005, it appears *that riparian areas have increased since 1947/1970 by approximately 40 acres in Edna Valley. This is likely due to diminished riparian areas associated with the 1969 flood. The 1970 aerial photographs may show a diminished riparian cover due to loss of riparian woodland during the January and February 1969 floods.*

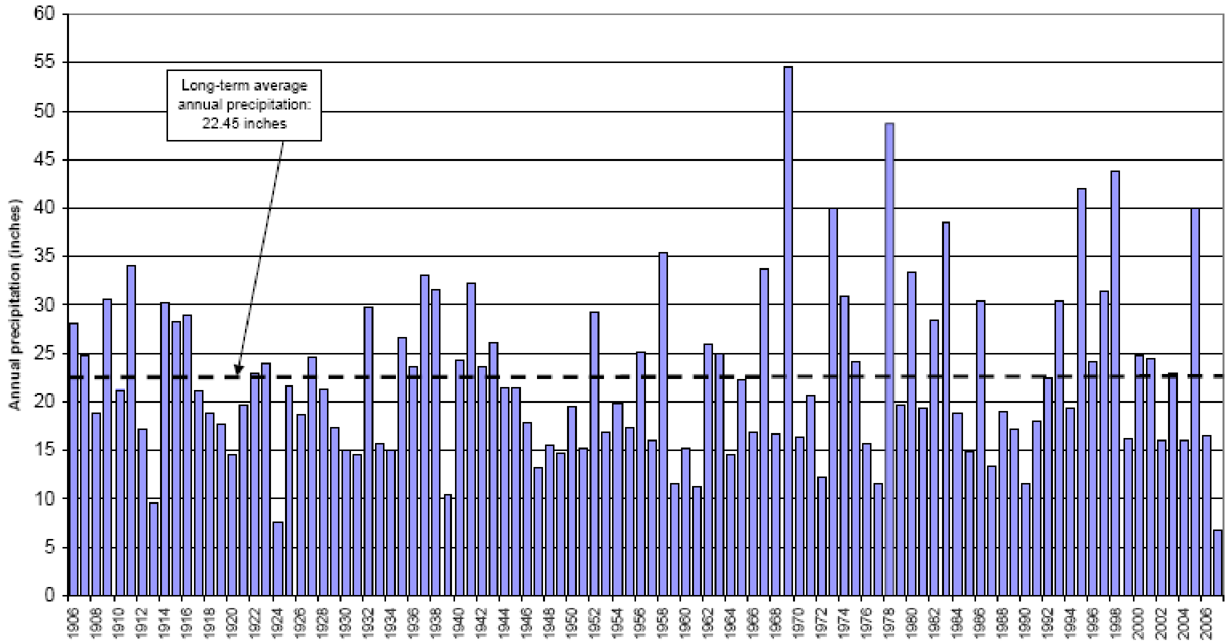
Chapter 2 Existing Conditions

Climate and Precipitation

The region experiences a Mediterranean-type climate with cool, wet winters and hot, dry summers. The wet season typically extends from November through March with local long-term, mean annual precipitation ranging from 16 inches near the coast to approximately 32 inches in the headwaters (City of San Luis Obispo and County of San Luis Obispo, 2003). Winter temperatures typically range from 40 to 70°F while summer temperatures typically range from 60 to 90°F. Summertime fog can be an important hydrologic component for sustaining vegetation near the coast during summer months, which are otherwise usually dry (Balance Hydrologics, 2008).

Rainfall in the watershed ranges from 16 inches at the coast to approximately 32 inches in the upper watershed (City of San Luis Obispo and County of San Luis Obispo, 2003). Mean annual rainfall at the San Luis Obispo Edna Valley station is approximately 22.45 inches, according to the long-term record of rainfall collected just west of the watershed at California Polytechnic Institute. Figure 2.1 from The Hydrology and Geology Assessment illustrates the City of San Luis Obispo rainfall record from 1904 to 2007. It shows an increase in the number of extreme events during the latter half of the last century. The maximum annual rainfall occurred in 1969, the same year the flood of record was recorded on nearby streams. Work for the Hydrology and Geology Assessment was conducted during spring 2007, during the driest two-year period on record.

FIGURE 2.1 ANNUAL PRECIPITATION BY WATER YEAR, 1906-2007, SAN LUIS OBISPO, CALIFORNIA.



Source: Balance Hydrologics, 2008. ***Figure 5. Source from California Date Exchange Center, Station SLO 1906-1981, 1984-2007 and Western Regional Climate Center, Station SLO-Polytec, 1982-1983***

Topography

The topography of the coastal area is characterized by valleys and mountain ridges which generally trend northwest-southeast, paralleling the directions of the major faults in the area. The lower reaches of the valleys are open to the ocean, and are formed of broad alluvial plains frequently penetrated by tidal lagoons. The upper reaches of these valleys are narrow and finally terminate in precipitous mountain canyons (Flood Insurance Study, 1997).

The watershed ranges in elevation from sea level at the mouth to approximately 220 feet at the confluence of West and East Corral de Piedra creeks, and onto a maximum elevation of approximately 2,863 feet at Piney Ridge. West Corral de Piedra Creek drains an area of approximately 5,270 acres with approximately 2,990 acres above Righetti dam (State Water Resources Control Board, 1990).

Geology and Soils

Geology

The following geology information is excerpted from the Hydrology and Geology Assessment of Pismo Creek (Balance Hydrologics, 2008). Figures cited are located in the complete Hydrology and Geology Assessment of the Pismo Creek Watershed in Appendix B.

> *The Pismo Creek watershed consists of three distinct geologic blocks separated by the Edna and Huasna fault zones (Figures 2 and 3). This section of the report describes the three blocks and the*

fault zones, with factors affecting (a) ground-water-bearing properties and yields, and (b) geomorphology and sediment production. The most detailed geologic mapping has been carried out by Hall (1973), with some limited additional work in the watershed by Nitchmann (1988) and Dibblee (2004, 2006a, 2006b). Geologic mapping is generally consistent between these authors. For the purposes of this investigation, we have used digital geologic data provided by the County of San Luis Obispo with descriptions of geology from both Hall (1973) and Dibblee (2004, 2006a, 2006b).

The upper watershed is underlain by Franciscan metasediments and ultrabasic rocks (mainly serpentines), and upper Cretaceous and early Tertiary sedimentary units. The Edna Valley comprises the middle third of the watershed, with a critical veneer of water-bearing sedimentary rocks typically 100 feet in thickness – ranging up to 300 feet -- overlying Franciscan and consolidated-sedimentary rocks (Van Vlack, 1991). The Coastal San Luis Range is composed of mainly mid- to late-Miocene (late-Tertiary) consolidated sedimentary rocks of the Monterey and Pismo formations, plus coeval volcanic units of the Obispo formation, forming most of the ridge along the coast.

Upper Watershed Geology

North and east of the West Huasna Fault Zone, uplifted Tertiary marine sedimentary rocks are exposed in the watershed's highest elevations at the crest of the Santa Lucia Range. The Miocene Monterey formation caps the headwaters of the East and West Corral de Piedra subwatersheds, with some exposure of older underlying units, including the Point Sal, Obsipo (Hall, 1973), Toro (Dibblee, 2006) and other unnamed marine sedimentary units within the fault zone. Underlying Franciscan-assemblage basement rocks (and associated serpentine) are found immediately southwest of the fault zone in the hills which flank the northeast side of Edna Valley. As occurs elsewhere in Franciscan mélange, these metasediments and other basement rocks have no apparent stratigraphy or continuity, although small pockets of chert, greywacke, and greenstone have been mapped. These significant serpentine outcrops, metamorphosed masses of deep oceanic igneous materials, are likely associated with ancient fault movement in precursors to the West Huasna fault zone. Serpentines have been mapped in each of the three major tributaries to Pismo Creek, as shown on Figure 2.

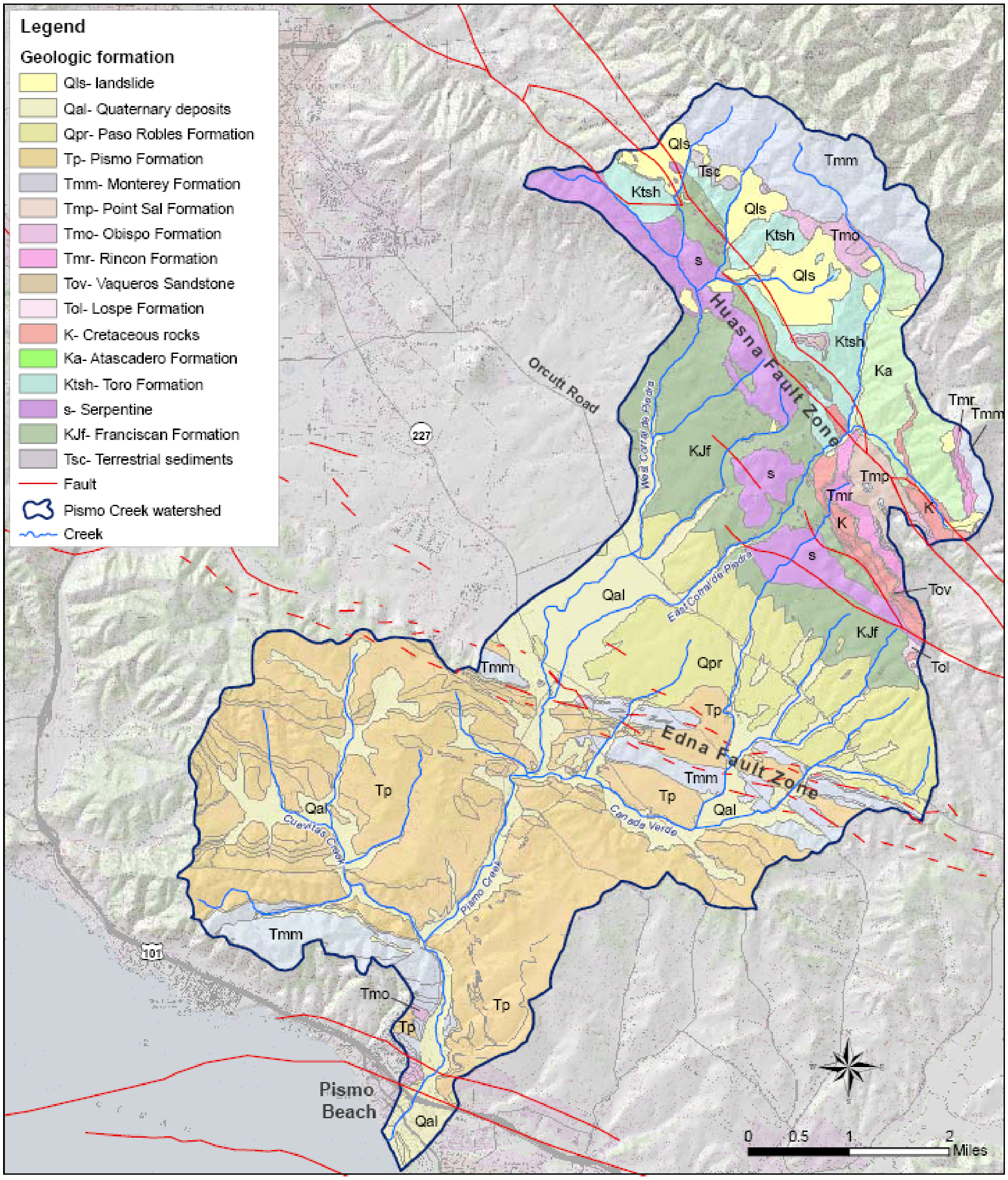
Rapid uplift, deep valleys and seismic activity in relatively weak rocks mean that landsliding and other forms of mass wasting are an intrinsic process by which sediment and wood enter the streams of the Pismo watershed. Landslides and other processes of rapid downslope movement are frequent, extensive, and often large. As shown in Figure 2, they are especially prevalent in the steep upper watershed.

Edna Valley Geology

Material eroded from the upper watershed areas has been deposited as alluvium, unconsolidated floodplain and channel deposits, in the basin between the Edna and West Huasna fault zones to form the Edna Valley. Prior to initiation of the Edna fault and uplift of the San Luis Range (probably during the early Pleistocene), streams generally flowed southwest and south, directly toward the coast, depositing the Paso Robles formation-- rounded pebbles and sandstone derived from the Monterey and Franciscan sediments of the Santa Lucia Range. Cleath (1978) divides the Paso Robles formation into two members, a lower marine and an upper non-marine member. Hall (1973) notes that water wells developed in the Paso Robles formation reflect a generally lower-transmissivity (lower permeability) aquifer than wells developed in the alluvium.

Following deposition of the Paso Robles formation, Quaternary alluvium was and continues to be deposited on the valley floor, typically atop the Paso Robles. Alluvium is generally the parent material of the richer valley-bottom soils supporting riparian vegetation, and is the substrate from which the bed and banks of the channels are formed. Locally, alluvium serves as an important aquifer for watershed residents.

FIGURE 2.2 GEOLOGIC MAP OF PISMO CREEK WATERSHED



Source: Balance Hydrologics, 2008. Figure 2.

Geology of the Coastal Mountains

The Pismo and Monterey formations are part of the broad Pismo Syncline, which spans the San Luis Range in the area of Price Canyon. Both formations are exposed throughout the range, and are noted as oil- and petroleum-bearing. In particular, the Edna member of the Pismo formation is cited by Hall (1973) as consisting of both non-bituminous and bituminous sandstone beds, and is the likely source of the prominent tar-filled beds and dikes, as well as saltier connate waters which drain to the creek and its tributaries. Several seeps and springs are also evident in heavily - fractured portions of the Pismo formation, such as along Price Canyon Road, just south of the town of Edna.

The Squire Member of the Pismo formation is also present along the Edna fault zone, especially in portions of the Canada Verde watershed.

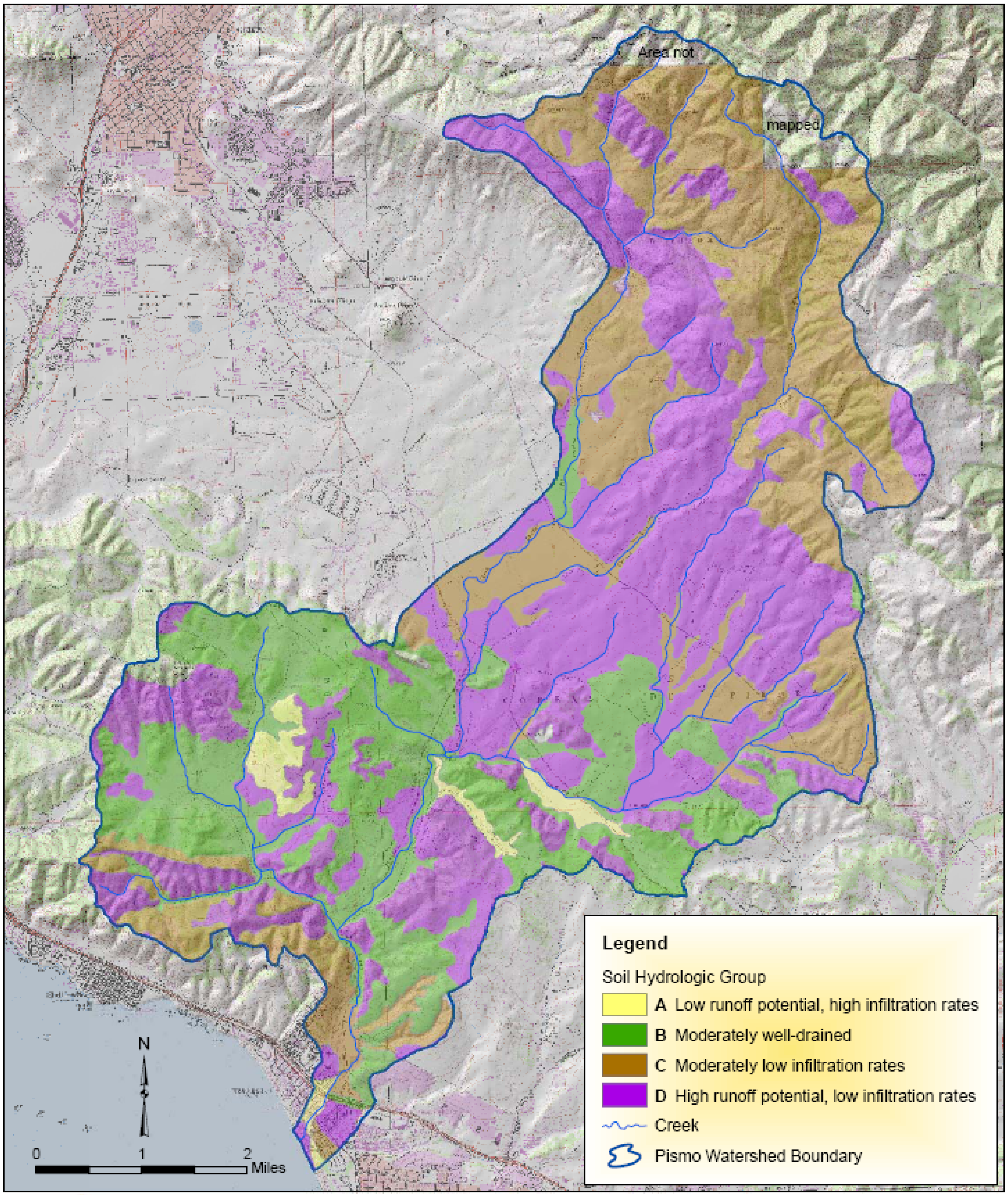
Soils

The following soils information is excerpted from the Hydrology and Geology Assessment of Pismo Creek (Balance Hydrologics, 2008). A soils key can be found in Appendix I.

The soils mantling these formations generally reflect the underlying geologic units from which they have developed. As with the geology, the distribution of soils is relatively heterogeneous, and many of the soils consist of silt and clay loams. These are prone to limited infiltration and ground-water recharge rates, as well as rapid and extensive erosion from land uses practices, which also compact or further diminish the permeability of the soils, or which concentrate flows beyond those typical of natural drainage (such as channel re-alignment for agriculture, urbanization, or confined animal grazing).

Figure 4 is a map showing the distribution of soils according to standard hydrologic groups, and indicates that the most permeable soils (Group A) are found in floodplains along the main stem of Canada Verde Creek and Tiber Canyon, as well as in a portion of the Cuevitas watershed. Group B soils are largely concentrated in the lower watershed and the San Luis Range, developed from the Pismo and Monterey formations, while Group C and D soils (silty and clayey loams with low infiltration rates and high runoff potential) are largely derived from and mapped as overlying Cretaceous basement rocks in the upper watershed. Soils developed in Edna Valley alluvium derived from the silt- and clay-rich rocks in the upper watershed are also mapped largely as Group D soils.

FIGURE 2.3 SOIL HYDROLOGIC GROUPS, PISMO CREEK WATERSHED, SAN LUIS OBISPO COUNTY, CALIFORNIA



Source: Balance Hydrologics, 2008. Figure 4.

Hydrology

NOTE TO READER: Quoted material from authors and sources are credited to the source, italicized and indented.

Stream flow within the watershed, as in most California central coastal streams, is characterized as flashy whereby runoff is often negligible except during or after periods of precipitation, when stream discharge quickly rises and falls as the storm passes over the watershed and drops its precipitation. During the dry summer months, stream flow is not typically sustained and usually diminishes toward the end of the precipitation season in April (Flood Insurance Study, 1997).

The USGS and San Luis Obispo County have maintained a streamflow gauging station on Arroyo Grande near Arroyo Grande since 1939, and collected sediment transport data in the Arroyo Grande watershed during water years 1968 to 1972. Water-quality data were collected in the watershed during water year 1977. Balance Hydrologics calculated a relationship between streamflow in Lopez Creek, a tributary to Arroyo Grande, to that on Pismo Creek, which was measured and recorded by Balance Hydrologics during water years 1990 to 1992. This relationship was used to produce a synthetic Pismo Creek streamflow record for 1939 through the present, as described the *Hydrology and Geology Assessment of the Pismo Creek Watershed* (Balance Hydrologics, 2008).

Peak Flows

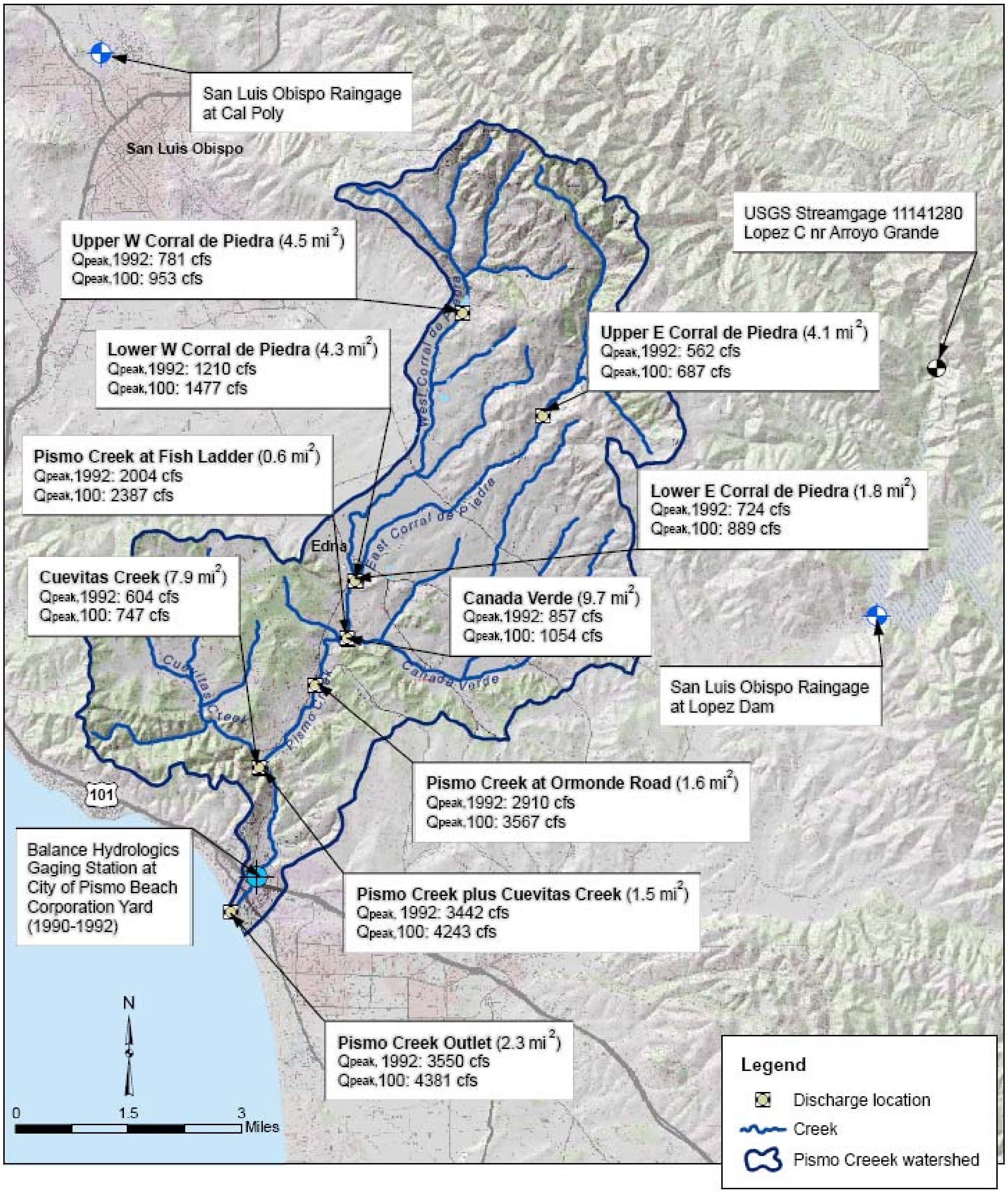
Peak flow information can be used in determining sediment loads for water quality, pulse flows for steelhead upstream migration, and potential flood management measures needed in watersheds. A mathematical watershed model referred to HEC-HMS was utilized by Balance Hydrologics to calculate peak flows for the watershed using 100-year and 2-year storm meteorological data. Figure 2.4 in the Hydrology and Geology Assessment illustrates subwatershed locations and HEC-HMS peak flow estimates for the Pismo Creek Watershed, San Luis Obispo, California.

> *The HEC-HMS watershed model for Pismo Creek was run with the 100-year and the 2-year storm meteorological data, calculating flows for these events at various locations within the watershed, as presented in Table 5 and shown in Figure 8. Modeled stream flows agree fairly well with the moderate peak flows measured during water year 1992 near the mouth of Pismo Creek (Hecht, 2006), suggesting that the model is fairly predictive at intermediate flows. We have described the 1992 peak as a 1.6-year event, based on the long-term record in Lopez Creek. Assuming that this event was of the same relative magnitude in Pismo Creek, the 1.6-year event may be described as 3,550 cfs in Pismo Creek, roughly 95 cfs per square mile. The unit runoff from the 1.6-year event in Lopez Creek was approximately 15 cfs per square mile in Lopez Creek, corresponding to approximately 935 cfs in the Pismo Watershed.*[1]

> *Existing estimates of the 100-year discharge on Pismo Creek are fairly wide-ranging as well, as there is not a sufficiently long period of record to calculate the 100-year flow. Figure 13 is an annual peak series plot for Lopez Creek, and indicates the 100-year flow in that watershed to be on the order of 3,650 cfs (175 cfs per square mile). This corresponds to a 100-year flow of roughly 6,530 cfs in the Pismo Watershed. These two estimates are both well below the Federal Emergency Management Administration's 100-year flow estimate of 14,700 cfs (393 cfs per square mile), but in line with San Luis Obispo County's (Smith and Banerdt, 2004) estimate of 2387 cfs (156 cfs per square mile) at the Southern Pacific Railroad crossing. Entrix (2006) has estimated the 100-yr discharge on Pismo Creek at 55,937 cfs, based on extrapolation of estimates of the 100-year flow in Toro Creek near Morro Bay. It should be noted that 100-year flow in Toro Creek is based on a limited (7-year) data set. These estimates are all independent of a private impoundment on West Corral de Piedra near the mouth of the canyon; little is known about the operation and size of that reservoir.*

[1] *Runoff in the Santa Ynez watershed (USGS gauging station 11123500) during the February 1992 storm was approximately 70 cfs per square mile.*

FIGURE 2.4 SUBWATERSHED LOCATIONS AND HEC-HMS PEAK FLOW ESTIMATES



Source: Balance Hydrologics Inc, 2008. ***Figure 8 Qpeak, 1992: Estimated peak discharge associated with rainfall observed during the February 15, 1992 storm, an approximately 1.6-year flood event as measured on Lopez Ck. Qpeak, 100: Estimated peak discharge associated with the 100-yr, 24-hr rainfall event.***

The peak discharge on Lopez Creek for the period of record was 2,830 cfs on January 25, 1969, equal to a unit runoff of 135 cfs/sq. mi. Application of this peak unit runoff to Pismo Creek yields an estimate of about 5,000 cfs at the mouth for the 1969 storm. In fact, flows were large in the

Pismo watershed; we have seen 1972[2] aerial photographs showing nearly all of the riparian vegetation in lowermost Price Canyon as having been episodically re-set (stripped away), a critical process in streams of similar size throughout the Central Coast region (c.f., Singer and Swanson, 1983; Capelli and Keller, 1988; Hecht, 1993) but one not documented on Pismo Creek.

[2] The 1972 date is significant in assigning this re-set to the January and February 1969 storms, as a very localized major storm affected the San Luis Obispo area on January 18, 1973. The latter event is the storm of record for San Luis Obispo Creek and several adjacent tributaries (such as Los Osos Creek), but did not generate noteworthy peaks on many other regional streams (U.S. Army Corps of Engineers, 1973). We do not yet know the magnitude or effects of the 1973 event in the Pismo watershed, a topic worthy of future inquiry by the watershed group, perhaps through seeking eyewitness accounts of 1969 and 1973 floods.

In conclusion, regarding high-flow hydrology, Balance Hydrologics indicates that:

Peak flows (100-year recurrence) can be expected to be on the order of 150 to 200 cfs per square mile and intermediate (1.6-year recurrence) flows can be expected to be on the order of 15 to 90 cfs per square mile, based on the modeling conducted, and calibrated to measured flows in nearby similar watersheds.

Base Flow

Surface water base flow is critical in maintaining habitat for steelhead under low flow conditions. Groundwater seepage into a stream channel is called base flow. During most of the year, stream flow is composed of both groundwater discharge and land surface runoff. When groundwater provides the entire flow of a stream, base flow conditions are said to exist. Anecdotally, E. Corral de Piedra Creek at the Hwy 227 Bridge had no surface flow between 2001 and 2003.

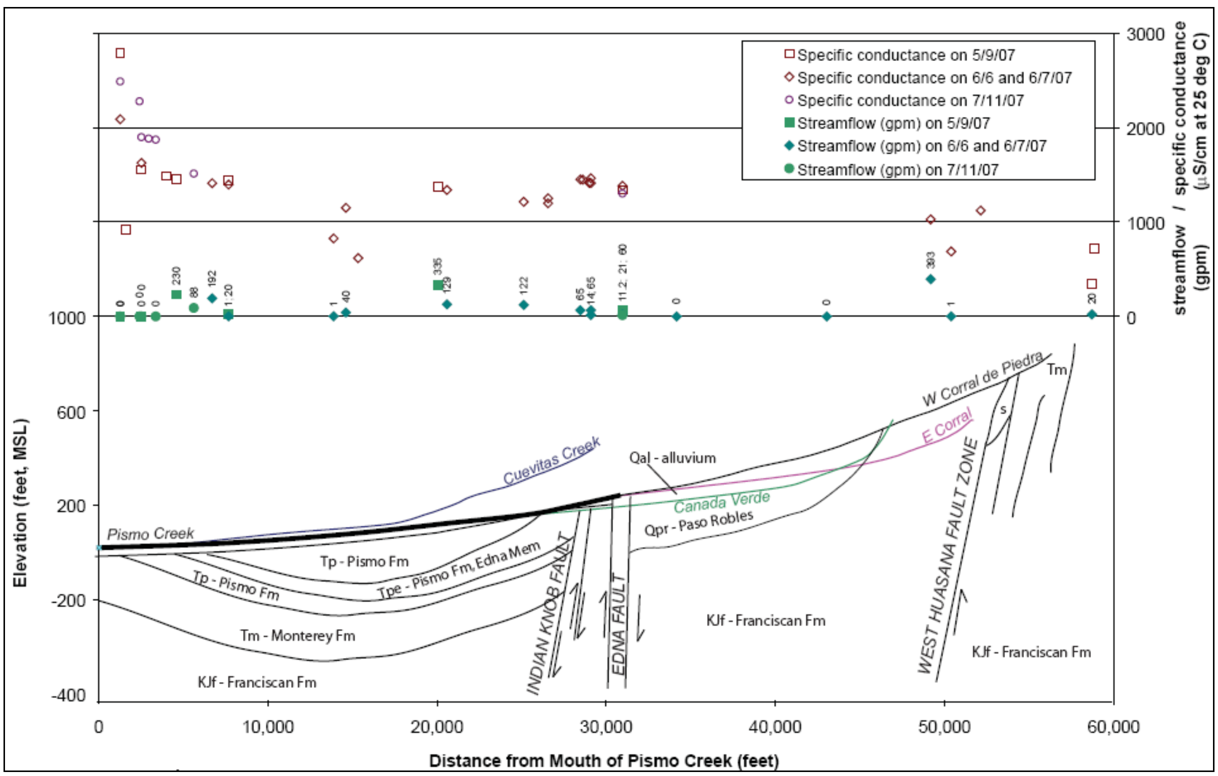
Balance Hydrologics conducted base flow surveys from May 9-July 11, 2007, and had gauged the creek about 100 yards downstream of the lowest railroad bridge in 1990-1992. They used the gage data to compute stream flow. The following base flow information is excerpted from the Hydrology and Geology Assessment of Pismo Creek (Balance Hydrologic, 2008). Figures identified in the excerpt can be found in Appendix B.

Specific conductance is a widely used measure of the ability of water to conduct electricity, and indicates the concentration of total dissolved solids (or 'salinity') in the water. As water passes over and through the ground, salts are dissolved, increasing the conductance. Higher specific conductance therefore often indicates longer residence times in the ground, transmittal through soils or geologic units which may have higher natural concentrations of salts, or evaporation and concentration of dissolved ions; it can also derive from human or cultural sources that may be saltier than the stream. Lower specific conductance generally reflects runoff or recharge from direct rainfall, or limited residence time in the ground. As a result, we have used specific conductance as a tool for inferring water origin and movement.

We measured specific conductance – an index of salinity -- many times throughout water year 1992. Data collected concurrent with streamflow measurements or stage observations are described in Hecht (2006). The data show that specific conductance increased exponentially as streamflow *diminished, a relationship that is quite unusual in coastal streams. This pattern suggests that the relationship is best interpreted as a combination of the typical regional pattern with a low-volume source or sources of water of elevated salinity. Work preceding our streamflow and specific conductance measurements pointed toward the conclusion that elevated salinities are found scattered in the southern third of the watershed, in waters emanating from tributaries and from springs reported to also discharge detectable levels of natural gasses and other atypical constituents, an inference consistent with the limited measurements of specific conductance made in April 2006, although flows were too large to point strongly to any particular aquifer, spring, or area as a source. Specific conductance may serve as an indicator to help assess where unusual constituents may be entering the stream system, should future sampling establish our inferred linkage.*

Table 3 and Figure 10 summarize field baseflow data collected in the watershed during the study period. As expected, streamflows decreased through the summer at nearly all locations. Maximum streamflows were observed in the upper watershed on East Corral de Piedra Creek and in the lower watershed along Pismo Creek at Ormonde Road and at the Price House property, while several channels (East and West Corral de Piedra Creeks) were observed to be dry in May. These data suggest that streamflow readily infiltrates into the sands and gravels of the Edna Valley alluvium where streams enter the valley.

FIGURE 2.5 CROSS SECTION AND STREAM LONGITUDINAL PROFILE SHOWING SHOWING LOCATIONS OF SPECIFIC CONDUCTANCE AND STREAM DISCHARGE MEASUREMENTS AS RELATED TO THE LOCAL UNDERLYING GEOLOGY.

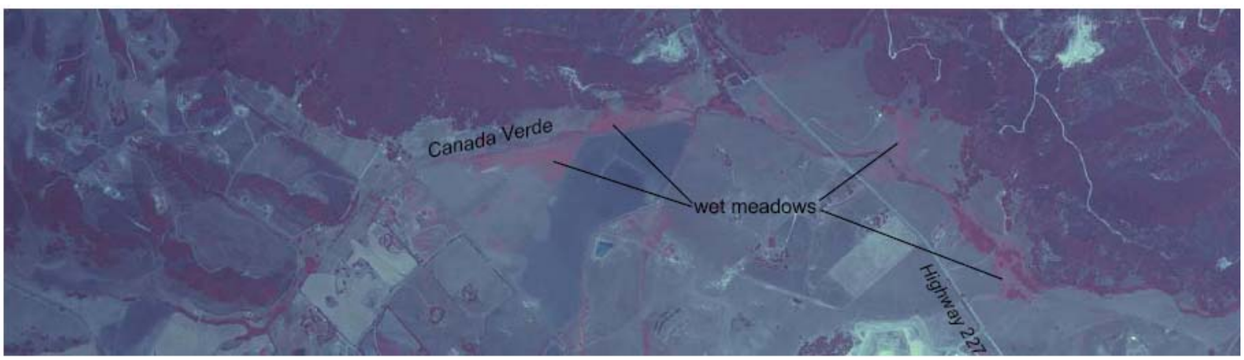


Source: Balance Hydrologics, 2008. ***Figure 10.***

Streamflow returns to the channels at the south end of the valley where the Edna fault zone truncates alluvium and the Paso Robles formation (Figure 10). Ground-water up-welling along the fault is observable in East Corral de Piedra Creek in the town of Edna where noticeable increases in streamflow are evident over a short reach, in stream banks on the Main Stem of Pismo Creek downstream of the confluence of East and West Corral de Piedra Creeks, and just upstream of the confluence with Canada Verde Creek.

Similarly, streamflow in Canada Verde Creek was found to persist later into the summer, especially downstream of the Edna fault and the Squire member of the Pismo formation. Higher streamflow in this area may be attributed to upwelling of deeper ground-water in the Edna fault zone, or perhaps discharge from bedrock to a channel with limited alluvium and infiltration potential. The rolling hills of Canada Verde's tributaries are largely incised into the Paso Robles formation, with limited volumes of recent alluvium. Soils are mapped in this area largely as belonging to hydrologic soil group A and B (Figure 4), indicating that these areas may be especially suitable for ground-water recharge during storms, and also slow release of ground-water to streams during baseflow periods. Enhanced color-infrared photography (Figure 11) of the watershed indicates that the Canada Verde floodplain below the Edna fault consists of extensive wet meadows, perhaps related to seeps and springs emanating from either the Paso Robles or deeper formations. As a result, the riparian corridor in this area is fairly well-intact, with the exception of certain heavily-grazed areas.

FIGURE 2.6 ENHANCED COLOR INFRARED PHOTOGRAPH OF CANADA VERDE CREEK, JUNE 1989

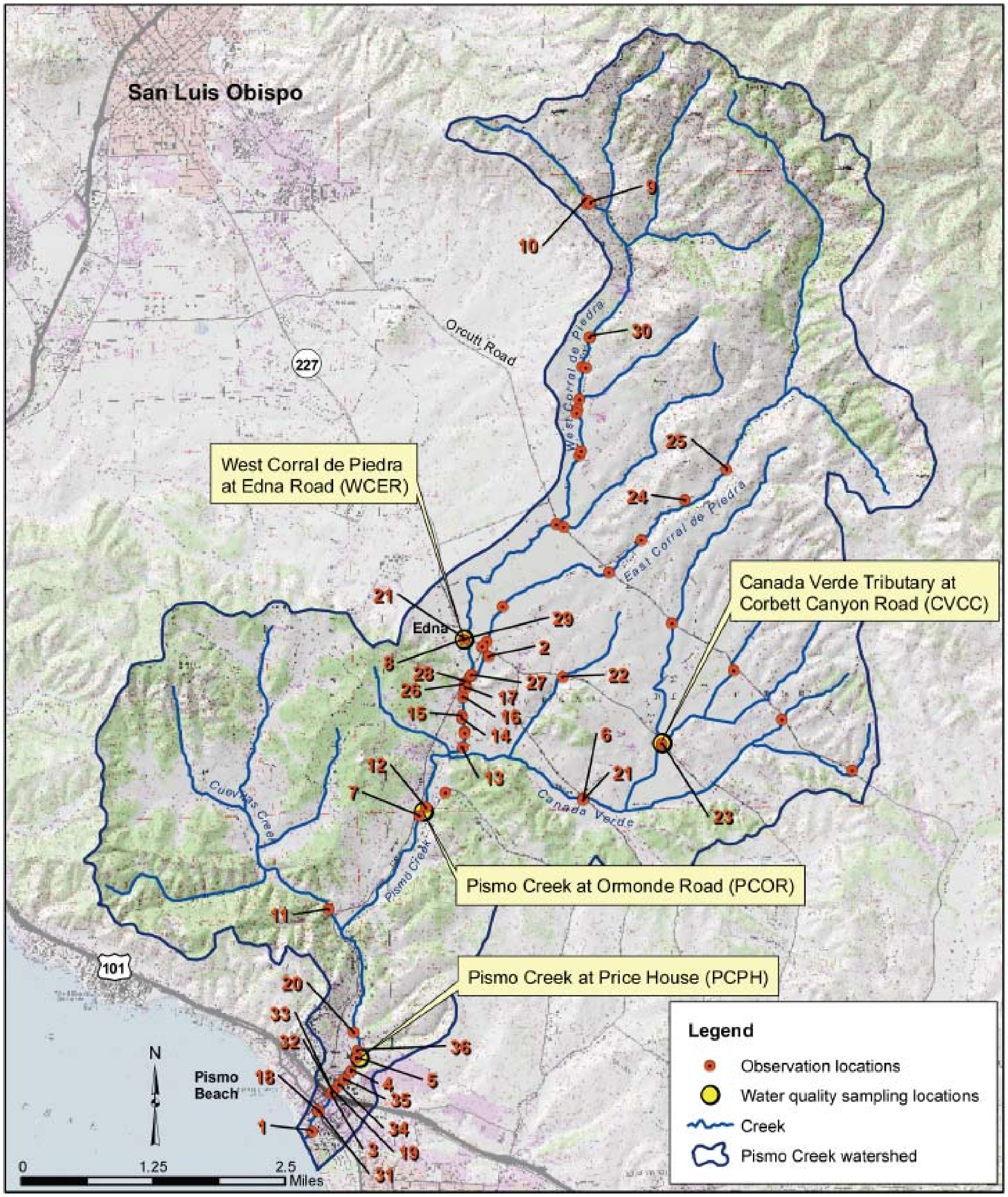


Source: Balance Hydrologics, 2008. *Figure 11. Darker red colors represent increased plant vigor. Shallow ground water along the floodplain appears to be emanating from both adjacent hillsides (Tertiary sedimentary geologic formations), as well as the valley floor itself (Quaternary Paso Robles Formation and alluvium) to create extensive wet meadows.*

At the confluence of East and West Corral de Piedra, the flow contribution from West Corral de Piedra was found to be greater than flows in East Corral de Piedra. A flow of 65 gallons per minute (gpm) was measured in West Corral compared to 14 gpm in East Corral.

We have applied the correlation equations shown in Figure 9 to the long-term record from Lopez Creek, a largely undisturbed watershed, to estimate an appropriate range of low flows in Pismo Creek, as presented in Table 6. Table 7 suggests that these low flows are not necessarily related to the total rainfall in a given year, so future evaluations of whether low flows in Pismo Creek are affected by changing land use in the watershed is perhaps best accomplished by continued *comparison to the Lopez Creek gage. It should also be noted that the correlation presented in Figure 9 reflects watershed land use conditions in the early 1990s, after the West Corral de Piedra impoundment was in place, so using the correlation as a basis of comparison is valuable in terms of assessing the deviation from early 1990's conditions, but not necessarily deviation from pre-European contact conditions.*

FIGURE 2.7 LOCATIONS OF STREAMFLOW AND SPECIFIC CONDUCTANCE MEASUREMENTS



Source: Balance Hydrologics, 2008. *Figure 7. Unnumbered locations were dry at the time of field work.*

As shown in Table 6, the correlated baseflow record in Pismo Creek indicates a range of historical low flows, from 0 cfs in August and September of dry years (such as 2007) to as high as 7.5 cfs in extremely wet years. The median September low flow (to be expected in half of the years) was calculated to be 0.11 cfs. Correlations of low flows are simply estimates, warranting calibration, and may differ considerably along a sandy stream such as Pismo Creek.

It is important to note that both significant geomorphic and beaver activity and the impounding of water throughout the City Corporation Yard Reach has made it difficult to re-occupy the Balance Hydrologics gage that was established near Highway 1 in the early 1990s. Late summer baseflow measurements made near the Price House Property in 2007, an extremely dry year, were in fact higher than those measured at the City Corporation Yard in 1991 and 1992 (Appendix A). This may perhaps be an indication that the City Corporation Yard reach may have been a losing reach prior to the development of the beaver dam.[3] *Summer low flows can also be affected by even moderate levels of ground-water pumping adjoining the stream. These estimates of typical low flows may therefore not be applicable to areas immediately upstream of the former gauging site (e.g., the Price House Property).*

Balance Hydrologics reported the following as a summary of summer 2007 field surveys for the assessment which further describes base flow conditions.

Stream temperatures ranged from 13°C to 25.5°C with minimum temperatures occurring near the location where most ground-water inflow occurs at the confluence of East and West Corral de Piedra Creeks. Maximum temperatures were observed in areas of slow moving water at a variety of locations. Specific conductance ranged from 618 mhos/cm to 2486 mhos/cm, normalized to the standard 25°C. Minimum specific conductance was observed in the upper watershed in waters emanating from Cretaceous basement rocks, while maximum conductance was observed in the lower reaches of Pismo Creek just upstream and downstream of Highway 101. Figure 10 may suggest a slight increase in specific conductance associated with waters near the Edna fault zone, an influx of slightly fresher water as the stream passes through the Pismo formation, and a slight rise in conductance toward the mouth of the creek. While this rise may reflect in part brackish summer conditions in Pismo Lagoon, it likely is associated with inflows from bedrock seeps just upstream of the corporation yard. In fact, Hecht (2006) showed that measurements of specific conductance at Balance's corporation yard gage – well above the possible influence of the lagoon -- rose to the range of 2000 to 3000 mhos/cm during the extended hard drought of 1990 and early 1991. We believe the rise in dry-year specific conductance is an indication of persistent bedrock inflows.

Table 4 presents the results of general minerals sampling and Figure 12 is a trilinear ('Piper') plot of the general mineral data. The Piper plot is a useful interpretative tool in illustrating differences and similarities among waters. Total dissolved solids and specific conductance were found to be lower in Canada Verde at Corbett Canyon Road. Pismo Creek at the Price House was found to be slightly higher in relative sulfate concentrations, perhaps due to upstream contact with bituminous sandstones and the related shales, either through natural seepage or indirectly as inflow from oil-production areas. Data reported by Entrix (2006) did not indicate an increase in sulfur

[3] City staff report that tidal influences do not extend more than 100 feet upstream of Highway 101.

concentrations upstream of Cuevitas Creek, and relationships shown in Figure 10 and discussed above imply the salinity increases are associated with areas upstream and downstream of the Entrix sampling stations. Therefore, if further investigations are to take place to evaluate a potential source of elevated sulfates, we recommend directing the investigation in the downstream portion of Price Canyon or in areas immediately downstream of Edna.

West Corral de Piedra also reflects a slightly different chemistry, with a higher relative magnesium concentration, perhaps reflecting upwelling of deeper water associated with the Edna fault zone and/or a greater influence of ground water emanating from the magnesium-rich, ultrabasic serpentinite which make up more of its watershed than those of the other tributaries. The general chemistry of lower Pismo Creek at low flow reflects a mixture of these waters, and other sources as well, and may change from year to year, depending upon rainfall and the recency of recharge.

Finally, Balance summarized the maintenance of low flows essential for aquatic biota in the Pismo Creek/Edna Area watershed.

Streams lose water to the ground in alluvial reaches (especially the youngest alluvium), and gain water as they flow through the Edna fault zone, the 'downstream end' of the larger valley-floor alluvial units upstream of Price Canyon. Recharge efforts in the central portion of the valley are likely to increase rates of ground-water discharge to Pismo Creek at the Edna Fault Zone.

September low flows are estimated to have ranged from 0 to 7.5 cfs since 1968. This is equal to approximately 0 to 0.20 cfs per square mile.

Previous-winter rainfall alone is not a reliable predictor of low flows in the watershed. The number of years since a 'recharge event' (a wetter-than-normal year) may be a major factor in predicting baseflow rates.

Canada Verde appears to have relatively persistent baseflow and a higher quality of wetlands. This is perhaps an indication that the Paso Robles formation – which outcrops widely in this watershed -- is able to recharge and release more water than younger Quaternary alluvium. Maintenance or enhancement of ground-water recharge throughout the watershed, but particularly in the Canada Verde watershed, should be encouraged to maintain baseflows downstream in Pismo Creek.

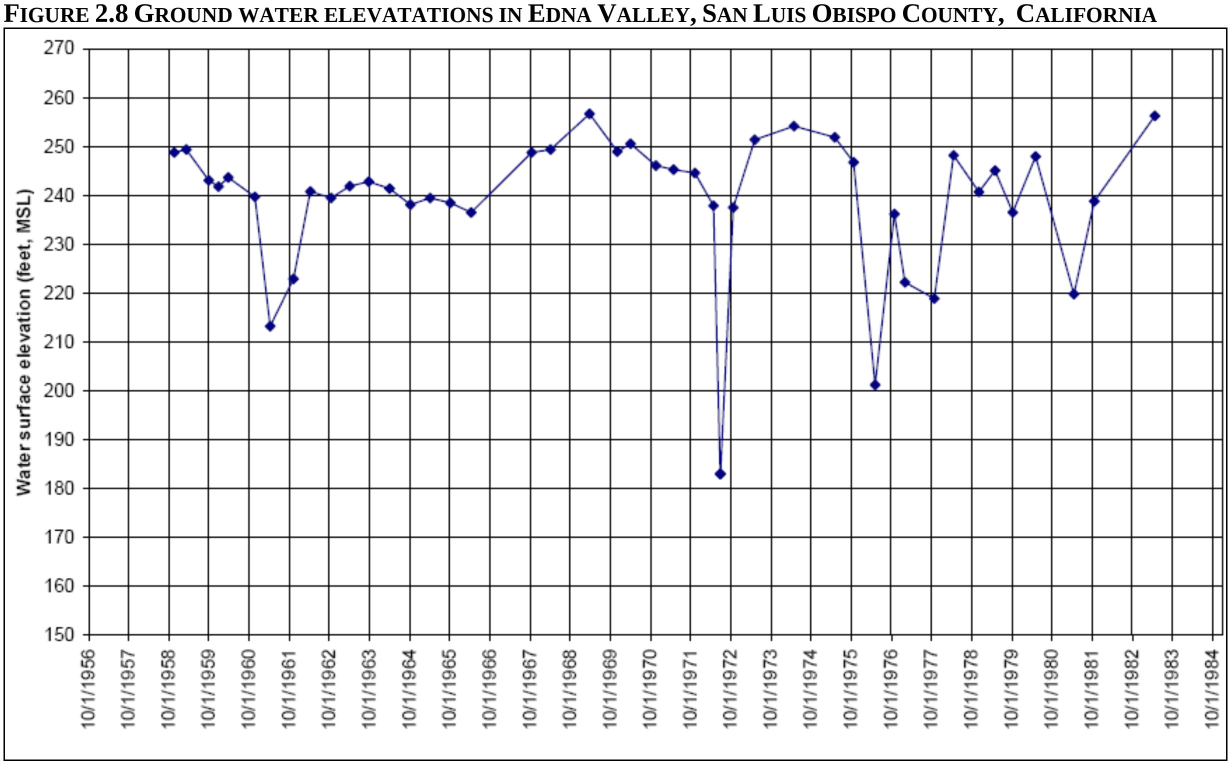
Groundwater

Although wells produce limited amounts of water from fracture zones in rocks of the Franciscan Formation, generally these rocks are considered to be non-water bearing. The Paso Robles Formation and the alluvium are the principal water bearing units in the area. Most domestic wells tap only the alluvium while deeper irrigation wells may tap both units. The aquifer system is called the Upper Pismo Ground Water Basin. The Paso Robles Formation, however, extends to the north and forms a subsurface connection between the Upper Pismo Ground Water Basin and the San Luis Ground Water Basin. Recharge to the Upper Pismo Ground Water Basin is supplied by seepage from streams, deep percolation of direct precipitation, deep percolation of applied water and septic tank effluent, and subsurface inflows from Edna Basin and the San Luis Range (DWR, 2002). Ground water is discharged by pumping, evapotranspiration, effluent discharge to streams, and possibly inter-basin underflow (State Water Resources Control Board, 1990).

The following groundwater information is excerpted from the Hydrology and Geology Assessment of Pismo Creek (Balance Hydrologics, 2008). Figures identified in the excerpt can be found in Appendix B.

> *Cleath (1978) described the ground water geology of the San Luis Obispo area and concluded that economically significant ground-water resources in the Pismo watershed are limited to alluvium and the underlying Paso Robles formation in Edna Valley. Subsequent work by the California Department of Water Resources (Maisner and Tompkins, 2002) has also highlighted the Squire Member of the Pismo formation as an important ground-water resource. Within the Pismo watershed, this unit is primarily found in the middle portion of the Canada Verde watershed, as well as near the mouth of Price Canyon, in the hills just east of Price House.*
>
> *Long-term ground-water monitoring data collected in Edna Valley is presented in Figure 6 for the period 1957 through 1993* (Figure 2.4). *The long-term record shows several extreme years when ground-water levels fell to significantly low elevations. These low water-table conditions are associated with drought years, or years with significantly below-average rainfall. It might be noted that, in each and every case, water levels recovered rapidly during the first wet year following a significant ground-water level decline, suggesting that the recharge functions of the watershed were operating effectively during the monitoring period. Long-term water-level measurements are no longer being made by the California Department of Water Resources.*

FIGURE 2.8 GROUND WATER ELEVATATIONS IN EDNA VALLEY, SAN LUIS OBISPO COUNTY, CALIFORNIA



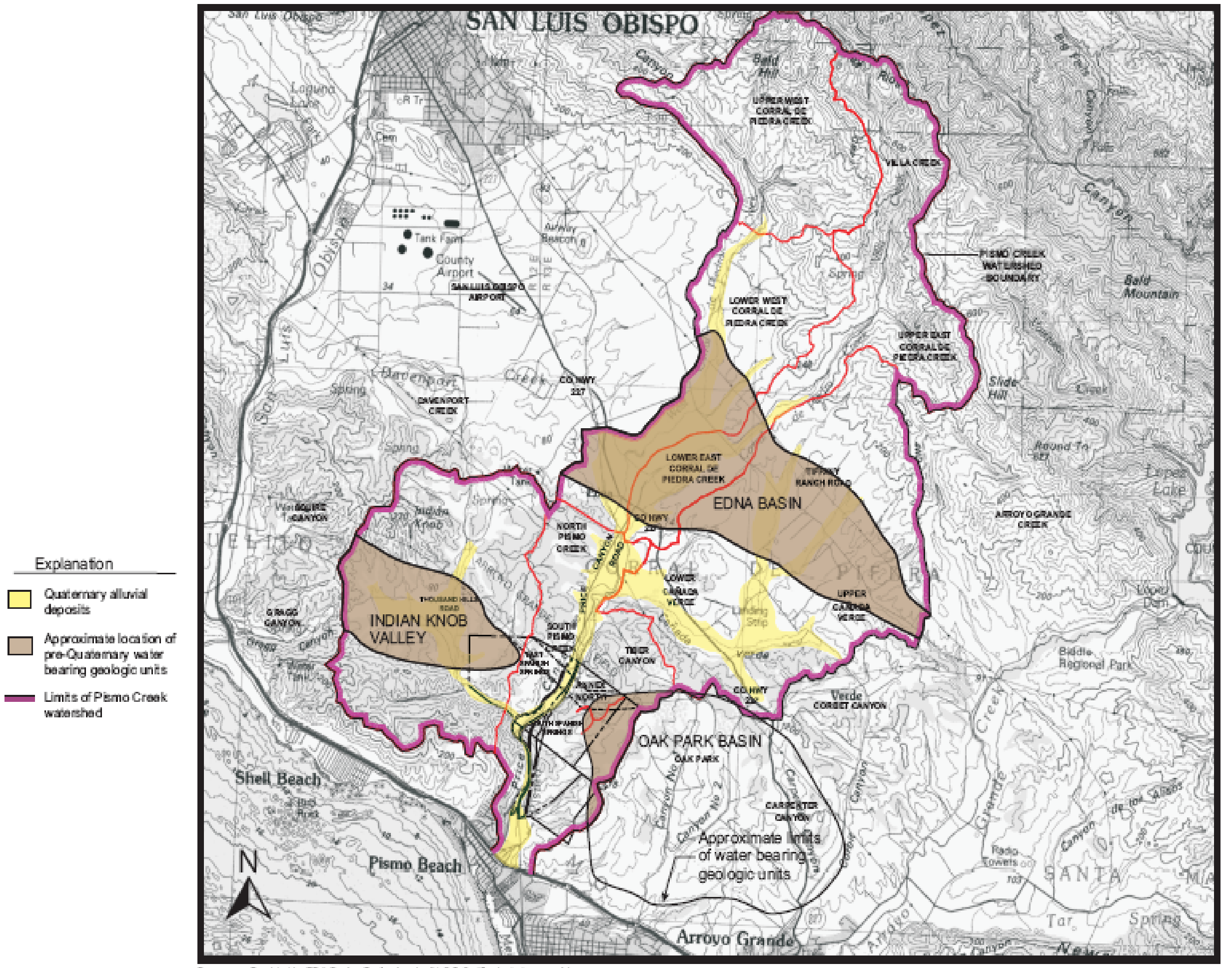
Source: Balance Hydrologics, 2008. ***Table 6. Data provided by the California Department of Water Resources for well number 31S13E19H001M located near Biddle Ranch Road at Edna Road.***

The following groundwater information is excerpted from a Cleath and Associates letter to David Watson, King Ventures, regarding the hydrology of the Pismo Creek Watershed from the Preliminary

Project Description and Constraints Assessment for Price Canyon Master Plan, Pismo Beach (December, 2007).

> *Ground water primarily occurs within coarse-grained sedimentary beds of Pliocene to Recent age. The sedimentary deposits have been deformed by tectonic activity into folds and faulted structures that isolate water bearing sedimentary beds into separate areas. Published geologic maps and ground water studies have been referred to in defining the extent of these ground water bearing sedimentary basin areas. These publications include California Division of Mines and Geology Map Sheet 24, California Department of Water Resources Bulletin 18, and recent environmental studies of the Oak Park area related to the Los Robles project.*
>
> *There are three areas where low salinity ground water may be found: (1) the Edna Valley ground water basin, (2) the Indian Knob Valley, and (3) the Oak Park area to the east of the Price Canyon.*
>
> *The Edna Valley ground water basin is located upstream of the Los Osos Valley/Edna fault zone in the Pismo Creek watershed. The basin is comprised of clay and gravel beds to a depth of up to 150 feet and marine sand and fossiliferous sands to up to 500 feet depth. These non-marine and marine beds thin to the northeast to less than 100 feet thick near Orcutt Road. When the aquifers of Edna Valley are fully saturated, overflow occurs at the fault, which acts as a barrier to subsurface flow, and into the alluvium of Price Canyon. Flow from Price Canyon can benefit from this overflow but cannot contribute to recharge within the up stream Edna Valley ground water basin.*
>
> *The water-bearing beds within Indian Knob Valley include the Gragg and non-bituminous Edna members of the Pismo formation. These beds have been folded into the Pismo syncline that plunges to the west into the San Luis Obispo Creek watershed. The Gragg member is more permeable than the Edna member but both have sufficient permeability to provide potentially greater than 50 gallons per minutes from a well. Springs issue out of these two members of the Pismo Formation and contribute to the flow in the tributary to Pismo Creek and associated alluvial deposits.*
>
> *Price Canyon alluvium as shown on the map varies in thickness and width based on the geologic units that have been eroded by Pismo Creek. Following erosion of the canyon, sediment has been deposited in the canyon from the upstream areas. The alluvial deposits are up to 65 feet thick and are comprised of basal sand and gravel deposits that are overlain by finer sediments-clay and silt. The ground water in Price Canyon alluvium is recharged from underlying saturated sedimentary beds and from percolation of stream flow.*
>
> *In summary, Price Canyon alluvium receives recharge from overflow of the ground water reservoirs in Edna Valley and the Indian Knob Valley. Spring flow issues out of a couple of springs in the upper reaches of draws that drain to Price Canyon.*

FIGURE 2.9 HYDROLOGIC AREAS OF PISMO CREEK WATERSHED



Source: Cleath & Associates, 2007

Morphology

A levee, faced with soil sediment, was constructed along the south over bank of Pismo Creek between river miles 0.8 and 0.5 to protect the wastewater treatment plant. According to a 1997 Federal Emergency Management Agency (FEMA) report, the top of the levee is 26 feet wide and does not confine 100-year flood flows, and could be been washed out during an event of that magnitude. At the time of the 1997 FEMA study there were no other flood-control measures on any of the tributaries to Pismo Creek and no major flood-control projects were being proposed. While not designed as a flood control mechanism, the private dam on West Corral de Piedra may function to hold storm water from upper West Corral de Piedra.

Flooding of infrastructure does occur in areas where the flood plain has been developed. According to one landowner:

> *I have lived adjacent to East Corral de Piedra since 1994. During that time, East Corral de Piedra has escaped its banks, resulting in minor flooding, several times. The most significant events were during the winter of 1994/95, 1997/98, and 2004/05. Peak flows occurred during the months of December and January. East Corral de Piedra escapes its banks upstream of the*

existing intersection of Twin Creeks Way and Mira Cielo Drive. The floodwaters sheet flow over Twin Creeks Way and through adjacent fields. While the existing Highway 227 bridge over East Corral de Piedra and creek banks in the immediate vicinity have sufficient capacity, the floodwaters that escape the creek banks upstream are unable to return to the creek before hitting Highway 227 and result in flooding of the State Highway at its intersection with Twin Creeks Way. From 2001 through 2003 there was no surface flow in Corral de Piedra near the Highway 227 Bridge.

Biology

Fish and other wildlife species are present in these creeks, including two federally listed species: Steelhead trout and California red-legged frog. Steelhead trout population numbers in the watershed are unknown. A literature search was the primary research undertaken to provide a list of species likely to occur in the watershed (see Appendix C). In addition, the Draft Pismo Creek Steelhead Trout Snorkeling and Visual Survey (Cleveland, 2008) provides some direct data as does the Pismo Creek Habitat Assessment (Nelson, 2005). The bulk of the section includes results of the Pismo Creek Habitat Assessment conducted by the California Department of Fish and Game. This includes Level IV Habitat Typing within the main stem and West Corral de Piedras Creek during the summer of 2005.

Steelhead trout

...we must constantly keep in mind that variation, i.e., deviation from the norm is one of the most marked characteristics of animal life. And of the vertebrates, the trouts are among the most variable of all. Further, of the trouts, the steelhead is one of the most variable forms.

-Leo Shapovalov and Alan Taft, 1954

Steelhead trout (*Oncorhynchus mykiss*) within the geographic area of the South-Central California Coast Evolutionary Significant Unit (ESU) were listed as a threatened species, pursuant to the federal Endangered Species Act (ESA) on August 18, 1997 (Federal Register, 62: 43937). The listing became a driver for increased attention in the region to recovery strategies for the species.

Life Cycle and Habitat of Steelhead

Steelhead trout, *Oncorhynchus mykiss*, are anadromous fish, that is, they live in the ocean but migrate into streams to spawn. Adult fish typically migrate into coastal streams from December to April after rains increase stream flows. Adult female fish prepare a redd (i.e., nest) in clean gravel and cobble substrate. Suitable spawning substrate is clean (i.e., containing little or no fine sediment) and ranges in size from that of pea to apple sized gravel/cobble. Mating occurs over the redd where the eggs are deposited; a male fish or multiple males fertilize the eggs; and the female covers the fertilized eggs with gravels and cobbles which allows for safe incubation. Redds will be constructed where cool oxygenated water flows through the redd, such as a pool tail crest. Unlike salmon, steelhead adults do not automatically die after spawning, and can return during multiple years to spawn in their natal stream. Spawned-out fish typically move downstream after spawning and return to the ocean.

FIGURE 2.10 HISTORIC PHOTO OF STEELHEAD FROM WEST CORRAL DE PIEDRA CREEK

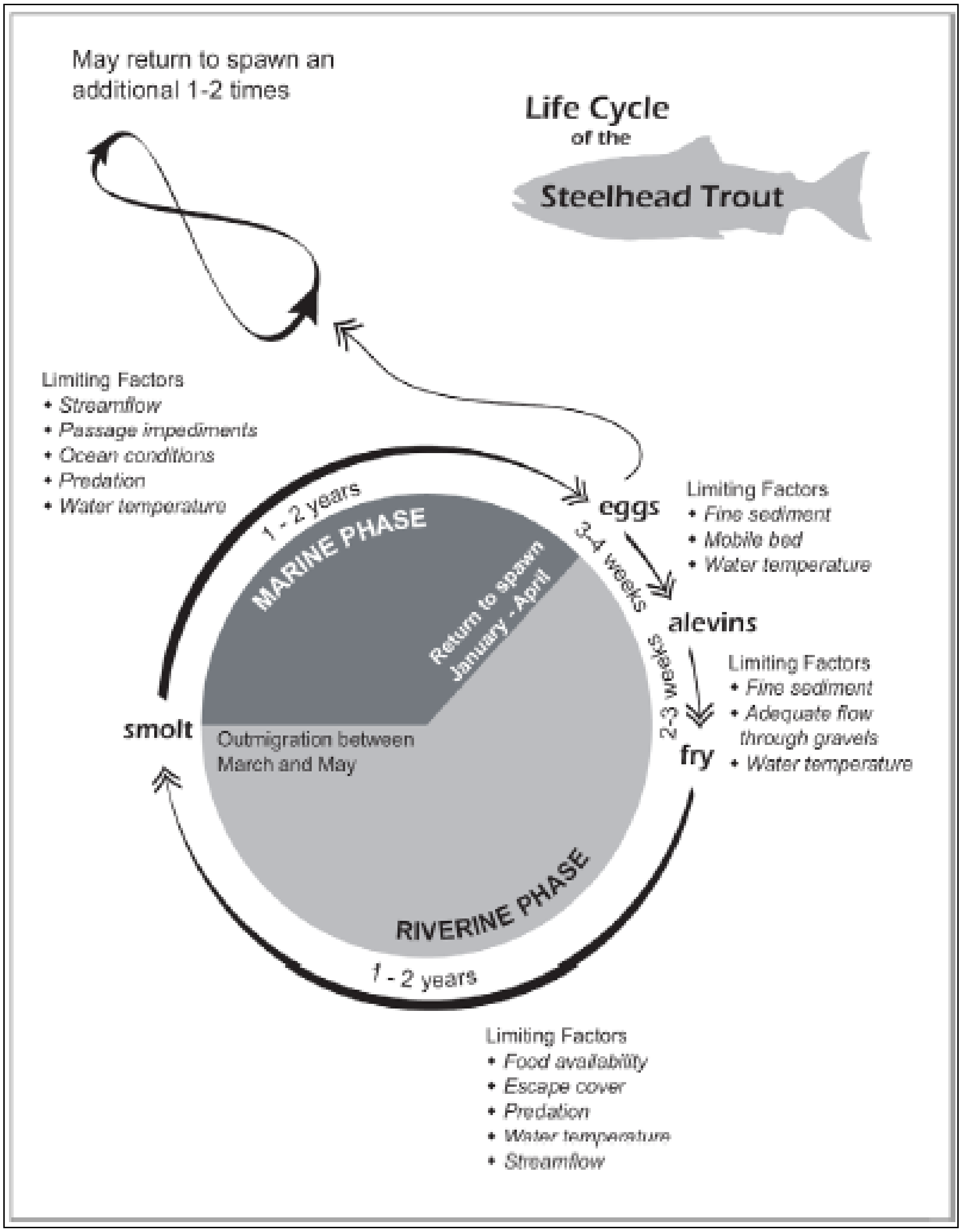
Source: Doris Righetti (Dixon)

The eggs typically hatch in the redd after approximately three to four weeks. However, the fry do not emerge from the redd until approximately two to three weeks later at which time they move to quiet water along stream margins. Environmental conditions, such as water temperature, play a large role in the timing of these events. Juveniles typically spend up to three years in freshwater, eventually moving from stream margins into riffles where they feed on drifting invertebrates. The best steelhead habitat features cool, clear, fast-flowing water which delivers invertebrate food in the drift. In addition, riparian vegetation, undercut banks, large and small woody debris, and large cobbles and boulders contribute to invertebrate production. When water temperature increases, fish may utilize pools, taking refuge in the cool, oxygenated water of the pool depths.

Juvenile steelhead can migrate out to sea when they are one to three years old, depending on the productivity (e.g., food abundance) and temperature of the stream, and how fast they grow. They typically spend some time smolting in an estuary/lagoon environment. During this time their color changes from spotted to silver, and their gills adjust to salt water. Once they have smolted, they migrate into the ocean where they will spend one to two years feeding and growing before returning to their natal stream to spawn.

The life cycle of steelhead varies by individual. The typical life cycle will favor anadromy, with rearing in freshwater for one to three years, migrating to the ocean for adult growth, then returning to the natal creek for reproduction. There is the potential for some juveniles to remain as residents of the creek, but the majority will out-migrate when conditions allow. Nomenclature of steelhead versus Rainbow trout by CDFG and NOAA Fisheries is based on location. If the fish are in a coastal stream below a permanent passage barrier, they are classified as steelhead. If they are upstream of a permanent migration passage barrier, they are classified as Rainbow trout. Genetic differences between fish upstream and downstream of migration barriers are being investigated by NOAA Fisheries biologists at the Santa Cruz, CA lab.

FIGURE 2.11 LIFE CYCLE OF THE STEELHEAD TROUT



Steelhead Habitat Criteria

Steelhead trout populations had been defined by Evolutionary Significant Units (ESU) which is based on genetic and life history data. NOAA Fisheries is now also referring to Distinct Population Segments (DPSs) to define populations. Steelhead in the Pismo Creek watershed are part of the South-Central California Coastal ESU (SCCC ESU), which extends from the Pajaro River (boundary of Santa Cruz and Monterey counties) in the north, to Point Conception (Santa Barbara County) in the south. These fish have evolved under environmental conditions typical to this area. As a result, habitat conditions such as quantity and timing of rainfall, water temperature, and climate, differ significantly from habitat conditions found further north or further south of this ESU.

Depth of Water

Steelhead prefer to spawn in an average depth of approximately 14 inches with a range of 6 – 24 inches. Fry prefer water approximately eight inches deep and can be found in water from 2 to 14 inches deep. Parr prefer depths of approximately 10 inches but can be found in water from 10 to 20 inches deep (Bovee, 1978). Migration of steelhead has been reported to require a minimum of seven inches of water. Stream conditions seem to be a more significant factor to migration potential. Excessive stream velocities and barriers, which limit swimming and jumping efficacy, are more significant in hindering or blocking migration (Barnhart, 1986).

Velocity of Flow

Steelhead spawn in water velocities ranging from 1.0 to 3.6 feet per second but prefer velocities on average of 2.0 feet per second (Bovee, 1978). The ability of an adult to negotiate different velocities is a function of size. A larger fish can overcome and spawn in higher velocities than can a smaller size fish.

Substrate

Substrate has the most significant impact on the ability of steelhead to spawn successfully. If there is not enough coarse gravel, the eggs will not survive. Good inter-gravel flow is required to bring fresh, clean water to sustain the developing eggs and increase the survival of the hatch. Substrates ranging in size from 0.2 to 4.0 inches in diameter are typically preferable. The eggs will suffocate if the gravel becomes clogged with fine sediment. Permeability of the gravel needs to be high to ensure survival of the eggs and should contain less than 5% sand and silt. Fry and juvenile steelhead generally prefer cobble/rubble, which is slightly larger than substrate typically used by adults for spawning (Bovee, 1978).

Water Temperature

While Steelhead trout are relatively resilient, temperature remains critical to their survival. Genetic differences between steelhead runs appears to account for differing abilities of fish along the west coast to survive in a wide range of temperature regimes. Optimal water temperatures expressed as degrees Fahrenheit for various life stages of steelhead are as follows: adult migration 46-52 degrees, spawning 39-52 degrees, incubation and emergence 48-52 degrees, fry and juvenile rearing 45-60 degrees, and smoltification less than 57 degrees. Some steelhead runs are known to exist in relatively higher temperature regimes, some of which exceed the preferred ranges for considerable lengths of time (e.g. steelhead in south coastal streams) (McEwen, 1996). At high temperatures, steelhead survive oxygen concentrations as low as 1.5-2.0 milligrams per liter (mg/l) for brief periods, though concentrations close to saturation are normally required for growth. At dissolved oxygen levels of <5-6 mg/l, stress can begin to effect fish and other organisms. Saturation is a measure of quantity of dissolved oxygen in water at a given temperature. Cold water can hold more dissolved oxygen than warm water. Water at 28 degrees centigrade, for example, will be 100 percent saturated with 8 mg/l dissolved oxygen. Water at 8 degrees centigrade can hold up to 12 parts per million dissolved oxygen before it is referred to as 100 percent saturated. Fish activity is reduced as oxygen concentration drops, even at low temperatures (Moyle, 2002).

Steelhead Fisheries Status

Steelhead trout were listed under the Endangered Species Act (ESA) in August 1997. Steelhead in the SCCC ESU are listed as threatened under the ESA. Section 3 of the ESA defines endangered species as "any species which is in danger of extinction throughout all or a significant portion of its range." Threatened species is defined as "any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

Critical Habitat

Critical Habitat and Essential Fish Habitat designations have been under development by NOAA Fisheries. Pismo Creek and all other coastal rivers and streams in the region had been designated as Critical Habitat in 2000 (NMFS, 2000). The Critical Habitat designation was, however, vacated by court order pending revision(s) to the economic analysis (NOAA Fisheries, 2002). The final ruling for Critical Habitat Designation was established on September 2, 2005, and identifies the following areas as critical habitat within the watershed:

Pismo Hydrologic Sub-area Hydrologic Unit 331026.
Outlet(s) = Pismo Creek (Lat 35.1336, Long –120.6408) upstream to endpoint(s) in: East Corral de Piedra Creek (35.2343, –120.5571);

Pismo Creek (35.1969, –120.6107);

Unnamed Tributary (35.2462, –120.5856).
(Federal Register Vol. 70, No. 170, page 52574)

Critical habitat is defined as:

(1) specific areas within the geographical area occupied by the species at the time of listing, on which are found those physical or biological features that are essential to the conservation of the listed species and that may require special management considerations or protection, and
(2) specific areas outside the geographical area occupied by the species at the time of listing that are essential for the conservation of a listed species. The regulations direct NOAA Fisheries to focus on ‘‘primary constituent elements,’’ or PCEs, in identifying these physical or biological features. Section 7(a)(2) of the ESA requires that each Federal agency shall, in consultation with and with the assistance of NMFS, ensure that any action authorized, funded or carried out by such agency is not likely to jeopardize the continued existence of an endangered or threatened salmon or steelhead ESU or result in the destruction or adverse modification of critical habitat.

In its final critical habitat designation for Pismo Creek, NOAA Fisheries states,

> *West Corral de Piedra Creek was included in the proposed designation and has also been included in the final designation for this ESU. The maps used to depict occupied stream habitat and the proposed critical habitat, however, did not properly label West Corral de Piedra Creek, hence the confusion of the commenters. We have corrected this problem in the maps depicting the final designation. The designated critical habitat in West Corral de Piedra Creek, however, does not include habitat above the Righetti Dam. Although the habitat appears to be of high quality and would likely support steelhead spawning, we are uncertain whether adult fish can pass over the dam. Accordingly, we treated the area above the Rhighetti Dam as unoccupied habitat and, since a determination that it is essential to the conservation of the ESU had not been made, we have not included it in the final designation for this ESU.* (Federal Register September 2, 2005)

Recovery planning for this ESU is underway. Recovery under the Endangered Species Act (ESA) means that listed species and their ecosystems are restored, and their future secured, so that the protections of the ESA are no longer necessary. Recovery plans provide blueprints to determine priority recovery actions for funding and implementation. Draft recovery plans were expected to be completed by June 2007 and final recovery plans by January 2008 (Federal Register Vol. 71, No. 175, page 53421) though to date only a Recovery Plan Outline has been completed.

Fisheries Status

Several assessments were reviewed and are summarized here.

Notes on the Freshwater Species of San Luis Obispo County, D. Starr Jordan, 1895.

This early documentation of fisheries in the County of San Luis Obispo includes the following:

> *Corral de Piedra Creek is a clear, cold brook with muddy bottom, full of chard, watercress, and other plants, and reduced in summer to a succession of pools. It flows into a larger stream, Pismo Creek, which in turn runs into Arroyo Grande Creek near its mouth on Pismo Beach. Here was found but one species, the stickleback, which is very common.*

In speaking directly of Arroyo Grande Creek but referencing West Corral and San Luis Obispo Creek, Jordan says, "In this stream and in the others, trout are occasionally taken and sometimes salmon enter them from the sea. Lopez Creek, a mountain tributary of Arroyo Grande is the best known trout stream in San Luis Obispo County. It is said by anglers that the brook trout exist in the mountains and the salmon trout come up from the sea and promiscuously mix with it. This seems another way of saying that the brook trout and the salmon trout are but forms or states of the same fish. The individuals which run to the sea grow larger and are more silvery in color than those which remain in the brooks." Today's terminology would indicate that Jordan's brook trout are resident rainbow trout and salmon trout are steelhead.

Stream Survey of Pismo Creek. Schuler and Tartaglia, 1972

A habitat survey was conducted by the California Department of Fish and Game wherein the fisheries were not surveyed.

Field Report, M. Seefeldt, June 26, 1974

A one day site visit was conducted to supplement fisheries information to 1972 Stream Survey. Four mainstem sites were electro-fished and six species identified including steelhead trout, riffle sculpin, speckled dace, threespine stickleback, brown bullhead and largemouth bass.

Fishes of Pismo Creek, Robert B. Rohde, 1975

Four study sites were characterized, and seine and electro-fishing sampling were conducted. A total of ten species were found including steelhead trout, speckled dace, prickly sculpin, staghorn sculpin, threespined stickleback, brown bullhead, tidewater goby, starry flounder, jacksmelt and white surfperch.

Pismo Creek Habitat Assessment, Jennifer Nelson, 2005

Native fish species positively identified during the habitat survey included fry, parr, and pre-smolt size steelhead trout and fry and adult size threespine stickleback. Non-native fish species observed were adult brown bullhead catfish.

Draft Pismo Creek Steelhead Trout Snorkel and Visual Survey, Cindy and Paul Cleveland, 2008

Six sites were surveyed for steelhead trout through snorkel and/or visual methods between February 2 and April 4, 2008. No steelhead trout were observed. Speckled dace, three-spined stickleback and a California red-legged frog were observed. Heavy silt, possible pollution and low water flows were noted as confounding variables.

FIGURE 2.12 SUMMARY OF STEELHEAD PRESENCE AND HISTORIC ACTIVITIES BY CDFG

Date	From/By	Information
1/8/58	Willie Evans	Steelhead are known to occasionally ascend upstream of dam site; West Coral de Piedra and Pismo Creek support a reasonably good run of steelhead
10/4/1962	Willie Evans	Spawning activity reported near the proposed dam site the previous winter; reported that young of the year Steelhead/Rainbow trout were common in permanent section of the stream during the summer of 1962; reported that Steelhead normally spawned in the creek upstream of the proposed dam site; documented a Steelhead/Rainbow trout population existing in the 2 miles of live stream above the dam site; stated that Steelhead/Rainbow trout were common in the one mile of stream below the damsite, flow estimated at .25 cfs; stated that spillway of proposed dam may be passable to steelhead during periods of very heavy runoff.
5/29/95	Dave Highland	Righetti fishing derby – six 18-20” steelhead caught in Reservoir
5/3/96	Dave Highland	Young of the year Steelhead/Rainbow trout caught by dip net above and below fish ladder
1/30/97	Dave Highland	8” Steelhead/Rainbow Trout seen at top of fish ladder
4/4/97	Dave Highland	Ten 6-14” and four young of the year Steelhead/Rainbow trout netted in dam spillway and channel
4/25/97	Dave Highland	1” and 6” Steelhead/Rainbow trout caught by dip net above fish ladder, young of the year observed above and below
4/17/98	Dave Highland	5” and 7” Steelhead/Rainbow trout seen in pool below falls
5/1/98	Dave Highland	Four Steelhead/Rainbow trout 4-10” seen in pool below falls
7/7/99	Dave Highland	3” young of the year Steelhead/Rainbow trout found in dewatered pool below County Bridge on Righetti Road
8/21/01	Dave Highland	Several young of the year were seen within 100 yards downstream of the fish ladder
3/22/02	Dave Highland	Reported seeing two Steelhead/Rainbow trout 4-6” in top box of fish ladder

Source: CDFG

Stream Habitat Inventory

Stream habitat consists of many variables such as habitat type (pool, flatwater, riffle), water depth, streambed embeddedness, and canopy cover. The condition of each of these variables effects salmon and macroinvertebrates. A stream habitat inventory was conducted in the summer of 2005 by Department of Fish and Game staff in accordance with the California Salmonid Stream Habitat Restoration Manual (Flosi et. al., 1998) and findings provided to the watershed group via the *Pismo Creek Habitat Assessment*. The main stem Pismo Creek and West Corral de Piedra Creeks were surveyed where access was provided by the landowner. East Corral de Piedra was not surveyed as it was dry in June 2005. The surveys included stream channel typing and habitat typing. Stream channel typing describes relatively long reaches within a creek using eight morphological characteristics (channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size). Habitat typing describes the specific pool, flatwater, and riffle habitats within a stream. Recommendations focus on stream flow management, sediment source identification, erosion control, riparian revegetation, invasive plant removal and fish barrier modification. The report and data may be used to determine the suitability of habitat restoration structures. Table 2.13 provides a summary of habitat types for the areas surveyed.

FIGURE 2.13 PERCENT HABITAT OF THE TOTAL STREAM LENGTH SURVEYED.

	Riffle Habitat	Flatwater Habitat	Pool Habitat	Dry	Average Canopy Cover
Pismo Creek	8.5%	14%	55.4%	-	59%
W.Corral de Piedra (upstream of reservoir)	8.9%	40.8%	50.3%	-	55%
W.Corral de Piedra (downstream of reservoir)	2.1%	5.3%	12.2%	60.7%	45%

A total of 5.65 miles were surveyed on Pismo Creek. It was found that approximately 8.5% of the surveyed reach was riffle habitat; 14% was flatwater habitat; and 55.4% was pool habitat. The following discussion from the report explains the relationship of survey findings to steelhead requirements.

- *Although an ideal ratio of habitat types has not been developed for steelhead, it has been found that for coho salmon, stream channels consisting of 50% pools (rearing area) and 50% riffles (food production area) had the highest densities of juvenile coho salmon compared to other percentages (Ruggles, 1966). Using this criteria for steelhead, the quantity of fast water habitat was significantly lower (8.5% for riffles and 14% for runs) compared to the "ideal" 50%.*

- *Of the 209 pool tail crests in Pismo Creek, only 92 of the pools had the appropriate substrate and a large enough area to support steelhead spawning. These areas were primarily gravel or small cobble and all were fairly embedded with fine sediment. In addition to the 92 pool tail crests, 29 glides and 63 riffles also consisted of gravel or small cobble and could be used for spawning. With the latter units however, intragravel water circulation may not be sufficient to allow large numbers of eggs or fry to survive.*

- *Although runs and riffles were limited habitat features, pool habitat was abundant with 55.4% of the channel consisting of pools. Most pools were relatively large and deep with sufficient instream cover to support high numbers of larger steelhead. However, even though* *the physical features of the pools were high quality, steelhead production may still be limited because of poor water quality and/or low food production.*

- *Canopy over Pismo Creek averaged 59% which is fairly low compared to other local watersheds. Temperatures that are too high or too low are not expected to be an issue during migration or spawning in Pismo Creek. But because of the low summer/fall stream flow, higher inland temperatures, and relatively low canopy density, summer and fall water temperatures for rearing juveniles may be a problem.*

For West Corral de Piedra, a total of 5.3 miles were surveyed, above and below the Righetti reservoir. Upstream of the reservoir 0.4 miles were surveyed with approximately 8.9% riffle habitat; 40.8% was flatwater habitat; and 50.3% was pool habitat. Habitat conditions below the reservoir were very different. Downstream of the reservoir 4.9 miles were surveyed with approximately 2.1% riffle habitat; 5.3% was flatwater habitat; 12.2% was pool habitat and 60.7% was dry. The following discussion from the report explains the relationship of survey findings to steelhead requirements.

- *Within the 4.9 miles of West Corral de Piedra downstream of the reservoir, approximately three of those miles were dry. In the 1.9 miles of wetted channel, the only habitat that could be used for rearing was that portion from the confluence with East Corral de Piedra to just downstream of Highway 227 (approximately 2,400 feet) and the 2,233 wetted portion of the channel upstream from Righetti Road Bridge. The remainder of the stream was either too warm or was going to be dry within a week of the survey.*

- *Within the 4,633 feet of stream channel that could be used for rearing, pool habitat was abundant but relatively shallow. Instream cover in those pools that could actually be used for rearing was relatively good, although the pool results section does not reflect this since all pools that were encountered (even those in the intermittent section) are included in the analysis.*

- *Riffle habitat was scarce but when the runs and the step-run are included, the area available for insect production increases substantially. Especially when considering the substrate in the runs and step-run included large cobble which can, if not embedded, produce the greatest number of aquatic insects.*

- *Spawning habitat was also abundant but many of the sites were fairly embedded (greater than 25%) with fine sediment. Both the embedded substrate and shallow pool depths indicate that larger quantities of fine substrate (i.e silt and sand) are entering the system than can be flushed.*

In addition to the lower watershed, a portion of West Corral de Piedra above the reservoir was also surveyed. This section of creek was in excellent condition with abundant young-of-the-year, age1+ and 2+ trout observed.

Recommendations from the Pismo Creek Habitat Assessment are provided in the implementation section of the plan. The complete Habitat Assessment is available in Appendix D.

Maintenance of Flow for Steelhead Habitat

As was mentioned above, maintaining adequate base flow is linked with minimum flow requirements for steelhead habitat. Instream flow studies have not yet been conducted on Pismo Creek and its tributaries and thus it is not yet understood what minimum flows would be required to maintain habitat for Steelhead. The relationship between water quantity and water quality is important to consider as when base flow decreases, water quality may also degrade.

Stream flow in Pismo Creek was very low during the stream habitat survey in 2005 even though the prior winter/spring rain season was above normal. Reduced stream flows will have a direct impact on the quantity and quality of rearing space available. With cessation of continuous stream flow, pools and some flatwater may remain, but the volume within these units would be greatly diminished, thereby decreasing rearing space and salmonid populations. In addition, riffles would be dewatered, eliminating benthic insect production and use by young-of-the-year steelhead. Pismo Creek Habitat Assessment, 2005

Water Quality

Three programs currently monitor Pismo Creek's water quality: The Regional Water Quality Control Board (RWQCB) Central Coast Ambient Monitoring Program (CCAMP), Salmon Enhancement's volunteer water quality monitoring program, and the County of San Luis Obispo Department of Environmental Health Services. The Pismo Creek Habitat Assessment (2005) and Hydrology and Geology Assessment (2008) conducted to inform this Plan also contributed water quality data. In addition, Plains Exploration and Production's (PXP) recent National Pollutant Discharge Elimination System (NPDES) permit application to the Water Board may make some data available.

Central Coast Ambient Monitoring Program (CCAMP)

The CCAMP program is the RWQCB's regionally-scaled water quality monitoring and assessment program. The purpose is to provide scientific information to Regional Board staff and the public and to protect, restore and enhance the quality of waters of central California.

CCAMP data is gathered on a five-year rotational basis. There is one data set for Pismo Creek (see Appendix E) that provides an assessment of the beneficial uses of Pismo Creek based on the Basin Plan published by the RWQCB for the Central Coast region. The majority of beneficial uses are fully supported, not assessed or not applicable. CCAMP water quality information is reviewed in detail in the Critical Issues section of this plan.

The Basin Plan identifies the following beneficial uses for Pismo Creek and Estuary (Figure 2.15).

FIGURE 2.14BENEFICIAL USES FOR PISMO CREEK AND PISMO ESTUARY

Beneficial Use	Estuary	Creek
Municipal and Domestic Supply (MUN)		X
Agricultural Supply (AGR)		X
Industrial Service Supply (IND)		X
Ground Water Recharge (GWR)	X	X
Freshwater Replenishment (FRSH)		X
Water Contact Recreation (REC-1)	X	X
Non-Contact Water Recreation (REC-2)	X	X
Commercial and Sport Fishing (COMM)	X	X
Warm Fresh Water Habitat (WARM)		X
Cold Fresh Water Habitat (COLD)	X	X
Estuarine Habitat (EST)	X	
Wildlife Habitat (WILD)	X	X
Preservation of Biological Habitats of Special Significance (BIOL)	X	X
Rare, Threatened, or Endangered Species (RARE)	X	X
Migration of Aquatic Organisms (MIGR)	X	X
Spawning, Reproduction, and/or Early Development (SPWN)	X	X
Shellfish Harvesting (SHELL)	X	

Source: Central Coast RWQCB Basin Plan, 1994

There are several parameters for which some beneficial uses are threatened or non-supporting (Figure 2.15). Threatened means that some beneficial uses are threatened while non-supporting means that some of beneficial uses are not supported. They include dissolved boron, fecal coliform, nickel in sediment, dissolved oxygen and saturated oxygen.

FIGURE 2.15 THREATENED OR NON-SUPPORTING BENEFICIAL USES FOR PISMO CREEK

Analyte	Beneficial Use	Status
Boron, dissolved	Irrigated agriculture	Non-supporting
Coliform, fecal	Contact recreation	Non-supporting
Nickel in sediment		Threatened
Oxygen, Dissolved	Cold water fish habitat	Non-supporting
Oxygen, Saturation	General	Non-supporting

Source: Central Coast RWQCB Basin Plan, 1994

An impaired or threatened water body is any water body that is listed according to section 303(d) of the Clean Water Act. A water body is considered impaired if it does not attain water quality standards. Standards may be violated due to an individual pollutant, multiple pollutants, thermal pollution, or an unknown cause of impairment. A water body is considered threatened if it currently attains water quality standards but is predicted to violate standards by the time the next 303(d) list is submitted to EPA. The 303(d) list is a comprehensive public accounting of all impaired or threatened water bodies, regardless of the cause or source of the impairment or threat. (www.scorecard.org)

At this time there are no pollutants within the watershed being considered for Total Maximum Daily Load (TMDL) limits as stipulated by the Clean Water Act Section 303. A TMDL is the amount of a particular material that a waterway can absorb on a regular basis and still remain safe for the beneficial uses designated for that water body. Section 303 of the Clean Water Act requires development of a TMDL for threatened or impaired waters. The designation as threatened or impaired (commonly referred to as the "303(d) list") identifies the pollutant or stressor causing the threatened or impaired condition of each water body. A TMDL must be developed for each stressor or pollutant for each water body threatened or impaired. The Clean Water Act requires that TMDLs be incorporated into the state's water quality management plan (which consists of Regional Board Basin Plans). The Porter Cologne Water Quality Control Act, in turn, requires that Basin Plans have a program of implementation to achieve water quality objectives (Watershed Management Initiative, Central Coast RWQCB, January, 2002).

In addition to the regular rotation, a water quality sample was collected in the fall of 2007 by a RWQCB CCAMP staff member at the UPRR railroad bridge below the Price House in response to an observed algal bloom. In September 2007 the data indicated elevated ammonia (0.36 mg/L as N), orthophospahte (1.0 mg/L as P) and TDS (1600 mg/L). Nitrate was not detected in the sample and Boron was 0.70 mg/L. Bacteria had been very low during August and September. In August fecal coliform was 40 MPN and E. coli was 31 MPN. In September the Fecal was 70 MPN and E. coli was 52 MPN. Sulfur was about 350 mg/L and sulfide was not detected in the sample (Mary Adams RWQCB CCAMP staff, 11/6/07 personal communications).

FIGURE 2.16 CHART COMPARING WATER QUALITY STANDARDS TO CCAMP 2007 SAMPLING RESULTS AT UPRR BRIDGE BELOW PRICE HOUSE

Analyte	Units	Level Tested by CCAMP	Maximum Contaminant	Attention Level**	Action Level***
Ammonia as N, Total	Mg/l	0.36	NA	2.4	2.4
Orthophosphate as P	Mg/l	1.0		NA	NA
Total Dissolved Solids	Mg/l	1600	NA	480	1920
Nitrate as NO_3	Mg/l	0	45	10	NA
Boron, dissolved	Mg/l	0.70	0.75	NA	NA
Fecal coliform	MPN/100ml	40 and 70#	NA	200	400
Escherichis coli	MPN/100ml	31 and 52#	NA	235	NA
Sulfur	Mg/l	350		NA	NA
Sulfide	Mg/l	0		NA	NA

***Maximum Contaminant Level is an enforceable drinking water standards adopted either by the California Department of Health Services or the federal EPA. It is the maximum permissible level of a contaminant in drinking water.**

****Attention Level is a guideline established by the Central Coast Regional Water Quality Control Board to identify the concentration of a substance that may be of concern when exceeded. If contaminants are found at concentrations above their attention levels, measures should be taken to address the pollution.**

***** Action Level is a concentration established by environmental protection agencies for a substance that may present a health risk or affect beneficial uses when exceeded. If contaminants are found at concentrations above their action levels, measures must be taken to decrease the contamination.**

#August and September sampling

Volunteer Water Quality Monitoring

FIGURE 2.17 PHOTO OF VOLUNTEERS MONITORING

Salmon Enhancement's volunteer monitoring program engages residents and landowners in monthly testing at selected sites along the creek. The purpose is to provide public participation and awareness about water quality and a frequent quality check. The volunteer monitoring program assesses up to eight parameters using test kits based on color comparative charts. The data are not digitally derived and are not defensible in a court of law, but may be useful as a practical guide. Three sites are monitored monthly for nitrate, phosphate, pH, turbidity, dissolved oxygen, temperature, percent saturation of oxygen and velocity. One site is positioned on West Corral de Piedra, another on East Corral de Piedra, and the last is on the lower main stem of Pismo Creek.

Water quality parameters were evaluated by sampling site due to the irregularity of volunteer monitoring efforts (Appendix F). Steelhead habitat requirements, Basin Plan limits and CCAMP attention levels were used to develop conclusions on water quality health. Depth, width, velocity and conductivity were not taken with each of the samples.

Temperatures ranged from lows of 4 °C to highs of 20-22 °C. The low temperatures were consistently measured at Pacific Coast Village (PCV) and may be associated with the stream depth at this site or tidal influence. However there is no additional information on tides, depths and widths associated with these data. The high temperatures varied between sites and overall cannot be associated with the summer season. The average temperature, not including PCV, was 14.5 °C. This is within the optimal steelhead temperatures of between 13°C (55°F) and 21°C (70°F) (Moyle, 1976). However, there are samples that exceed this optimum creating stressful conditions. There is one sample on West Corral de Piedra Creek that is above the CCAMP attention level of 22 °C and almost reaches the CCAMP lethal daily maximum temperature of 26 °C for cold water habitat. A temperature data logger was installed between June and October of 2005 just downstream of a volunteer monitoring site on Ormande Road. The temperatures recorded by volunteers during that time period are within one degree of the continuous temperatures measured by the data logger. Water temperatures were also taken each day during a stream habitat typing survey conducted by Jennifer Nelson. High water temperatures ranged from 20-22 °C similar to those measured by volunteers.

Dissolved oxygen ranged from 4 to 8 mg/L. Four of the six sites regularly had dissolved oxygen levels at or above the Basin Plan's lower limit of 7 mg/L for cold water habitat. Samples at West Corral de Piedra and Bridge Creek Road fluctuated between 4 and 8 mg/L. Dissolved oxygen levels of 4 mg/L are considered the CCAMP lethal daily minimum for steelhead. Percent saturated oxygen with these same low dissolved oxygen samples were at 38%. On average percent saturated oxygen ranged between 60% and 80%.

Phosphate samples ranged from less than 1 to 4 mg/L. The CCAMP attention level is set at 0.39 mg/L. The PCV and Bridge Creek Road sites were over this level at 2 and 1 for all samples taken. Ormande Road had one sample that spiked at 4 mg/L.

Turbidity ranged from 10-80 JTU. All samples taken were over the CCAMP attention level of 10 JTU. In addition, Ormonde Road had more turbidity than Price Street. These high samples may be associated with rain events however that information has not been analyzed.

pH ranged from 4 to 9 with an average at 7.9. Most samples were at or slightly above the CCAMP attention level of 7. Ormande Road and West Corral de Piedra had low pH samples of 4 while Bridge Creek Road and Price Street had high pH levels of 8 and 9.

All nitrate samples were below 5 mg/L.

The CCAMP monitoring station on Pismo Creek is upstream of Highway 101. This is in proximity to the CCSE monitoring station at Price Street. Similar to the CCSE data, the CCAMP data identifies dissolved and saturated oxygen as creating a non-supporting beneficial use to cold water fish. Fecal coliform was also determined to exceed water quality criteria and creating a non-supporting beneficial use to recreation.

Pismo Creek Habitat Assessment

The Pismo Creek Habitat Assessment provided limited water quality information collected during the 2005 survey. In addition to temperature and stream flow measurements (see Appendix D for the complete Habitat Assessment), a brief narrative described creek conditions.

> *From stream mile 4.4 down to the lagoon, the water was a whitish gray turbid color. The greatest suspension of material was at stream mile 4.4 but above this point, the water was clear. It is unknown what impact, if any, the persistent turbidity of the water is having on steelhead distribution or abundance in the lower channel.*
>
> *In addition to the white turbid water, some land use activities adjacent to the stream may be, at the very least, causing localized problems in water quality. Intermittently, from stream mile 1.1 through 3.4, cattle are located adjacent to and within the stream channel. In addition, a few minor and one significant homeless camp are located within the riparian zone in the same vicinity. Both of these activities are affecting water quality by adding fecal matter to the stream and in the case of the latter activity, large quantities of garbage, soap, and drug paraphernalia were located within the channel or close enough to the active channel that during high flow events these things will be washed into the creek.*

The white turbid water, as well as pink color on the substrate and in the water column has been observed by Mary Adams, CCAMP water quality staff member, who has been monitoring this area from 2005 to the present. Ms. Adams indicated that it appeared the pink color was seeping from the ground under the Railroad Bridge. This area was sampled and tested for sulfur and sulfide. Results are provided in Figure

2.17. In addition, the Pismo Creek Habitat Assessment indicates other encounters with white turbid substances in the same vicinity.

> *The chronic turbidity or water discoloration observed during the survey has not been observed in other San Luis Obispo streams. We did not have the means to test the water to determine what the suspended substance was, or if the origin was natural or an artifact of a man-made activity. Until the substance can be identified and the consequences to steelhead biology determined, the discoloration is a concern that will need addressing.*

FIGURE 2.18 UNDETERMINED SUBSTANCES IN PISMO CREEK, SEPTEMBER 2007

Source: CCSE

Hydrology and Geology Assessment

The water quality data collected for the Hydrology and Geology Assessment was primarily for general minerals to correlate geologic origins of waters within the watershed and not specifically for constituent identification and measurement. However, Balance Hydrologics was commissioned by the City of Pismo Beach in the 1990's to study the potential use of Pismo Creek as a water source. The work was never completed as a result of the City's pursuance of State Water. The work was resurrected under the auspices of the SEP and included in Phase 1 of the WMP and has subsequently been integrated into *Hydrology and Geology Assessment of the Pismo Creek Watershed*. A summary of water quality findings from that report suggest a possible connection between turbid conditions and tar bearing geology:

The origin of phenols is likely in lower third of the watershed, where springs are found with elevated salinities and entrained natural gas and naturally-occurring tar-permeated sedimentary rocks are widespread.

Ocean Water Quality

The San Luis Obispo County Health Services Department monitors ocean outfall for water quality. Pertinent sample sites include the outfall of Pismo Creek at six sites north and south of the mouth at the Pacific Ocean. The agency staff posts signs when water exceeds recreational water-safety standards. Results are compiled by Heal the Bay, a Santa Monica based non-profit organization, in a weekly statewide beach report card and are available at www.healthebay.org/brc/. The summer of 2005 report indicated "San Luis Obispo County Water quality at beaches in San Luis Obispo County was again excellent, with no monitoring location receiving lower than a B grade. Twenty-one (91%) of the 23 monitored locations received A grades. Both Pismo Beach at Wadsworth Street (B) and Pismo Beach Pier (C) received the county's two non-A grades. There were no known sewage spills that led to beach closures." The May 2006 report indicates that "Dry weather water quality in San Luis Obispo County was excellent again. 100% of the monitoring locations received A or B grades for both the AB411 time period and year-round dry weather. Pismo Beach Pier slipped from last year's A to receive the county's lowest and only dry weather B."

The local Surfrider Blue Water Task Force also monitors beach water quality with a volunteer monitoring program at several sites within the outfall area of Pismo Creek. Results have indicated that dry season testing during August 2006 showed elevated rates of Total and Fecal Coliform.

The City of Pismo Beach is completing a study funded by the Clean Beaches Initiative (CBI) Prop 50 to perform DNA source tracking on water samples from the near shore environment to narrow down the potential sources of elevated total and fecal coliform south of Pismo Pier.

The primary goal of this project is to identify the biological sources of fecal contamination as well as the physical and environmental factors that influence the levels of bacteria in the ocean waters at Pismo Beach, CA. Water samples from selected locations will be tested for the presence and abundance of bacteria that occur with fecal pollution and also tested to determine fecal sources. Physical and environmental data will also be collected during sampling. The focus of the study is the beach around the Pismo Pier although samples will be taken further south along the beach where Pismo Creek enters the ocean and in the creek itself. This data will be used to recommend a remediation plan for Pismo Beach, identify reasonable water quality goals and providing suggested methods for reaching those goals. This plan will be used to apply for Proposition 84 funds to implement the remediation strategies.

The project has several secondary goals. First, this project will utilize several methods for fecal source tracking and will compare and contrast these methods, making recommendations for future use of source tracking methodology at California beaches. Perspectives on efficiency, cost and usefulness of data for remediation outcomes will be detailed. Part of this goal includes the validation of these methods with site specific samples. Second, this project includes the detection and enumeration of a set of pathogens known to cause problems in recreational waters. This project will report on correlations between pathogen incidence and Fecal Indicator Bacteria (FIB) counts as well as the sources of fecal bacteria. Risk assessments based on water quality and other applicable conditions will be presented for swimmers at Pismo Beach. The repercussions of this information on the use of traditional FIB counts for water quality will also be presented. Last, this project will develop a rapid sample preparation and testing method for detecting human fecal contamination in beach water samples. The goal is to create a non-expert *use assay which can be completed in less than one hour that uses equipment easily affordable to small beach communities in CA.*

-Determining the Sources of Fecal Contamination Causing Beach Bacterial Advisory Postings at Pismo Beach, CA. CAL POLY ENVIRONMENTAL BIOTECHNOLOGY INSTITUTE Cal Poly Environmental Biotechnology Institute, July 3, 2007

Cultural and Archeological Resources

The watershed is rich in cultural resources from historical periods detailed in the history section above. In some cases cultural and archeological resources are found along stream banks and within floodplain areas. The locations of these resources have implications for the planning and management of future watershed projects, specifically for during the CEQA process. The following is a sampling of heritage studies from relevant environmental impact studies/reports.

PXP Phase IV Development Plan

On November 26, 1992, R.O. Gibson of Gibson’s Archaeological Consulting conducted an archival records search of an area 1/4 mile around the 200-foot project area and Phase I surface survey of 200 acres as part of the Phase III development plan proposed by Shell Western Exploration and Petroleum. The Phase I survey involved evaluation of all slopes less than 30 percent, and low sandstone rock outcrops were examined for the presence of bedrock mortars. Previously recorded archaeological sites in the project vicinity were mapped and survey boundaries defined. A report of results was prepared that summarized the previous surveys (Gibson 1992). The current Phase IV project area includes about 65 acres that were not previously surveyed. This area is between two areas done for the 1992 survey area. The 1992 archival records search at the Central Coastal Information Center at the University of California at Santa Barbara was conducted for a 1/4 mile area around the 264-acre project area. This yielded information on:

- Previously surveyed tracts within or near the project;
- Previously recorded sites within or near the project;
- Characteristics of previously recorded properties; and,
- Dates of previous survey and excavation programs and technical reports.

The Information Center reported that since 1977, three previous surveys had been conducted, Robert Hoover (1977, 1978) and W.B. Sawyer (1989) and had identified three prehistoric archaeological sites (SLO-353, SLO-652, and SLO-1266) and one historic archaeological site, the Corral de Piedra (Stone Corral). Site records were updated for the Hoover sites: SLO-353 and SLO 652. These two sites are part of the same site that has been divided by Price Canyon Road. In addition, the road construction, prior to 1964, unearthed three Chumash burials.

SLO-353 is a prehistoric site, located east of Price Canyon Road and first recorded in 1963 by H.L. and L.D. Wadhams. It was re-recorded in 1969 by Charles Dills and again in 1977 by Robert Hoover. The site measures approximately 200 meters east-west and 150 meters north-south. The site contains a concentration of weathered small shellfish fragments consisting of at least nine species from both sandy beach and rocky coast environments (probably Pismo Beach and Shell Beach areas). Ground stone and chipped stone tools and debitage (by-products from stone tool manufacture) were present in low to medium densities. One projectile point (arrowhead) may be stemmed form, suggesting a Middle period occupation perhaps 1,000 to 2,500 years ago. At the lower eastern part of the site is a 15 by 20 meter sandstone rock outcrop that contains at least 18 bedrock mortars. A second small outcrop has two additional mortars.

SLO-652 is located west of Price Canyon Road and would have originally been connected to SLO-353 before the road was cut. This site was first recorded by Charles Dills in 1972 and measures about 150 meters East-West and 200 meters North-South. The northern 1/3 of the site contains a concentration of weathered shellfish fragments (same species as SLO-353) in a dark gray to black sandy soil. The other 2/3 of the site consists of trace to low densities of chipped stone materials with rare shell fragments. One larger and three smaller low bedrock outcrops contain mortar depressions that are, overall, deeper than the outcrop at SLO-353 but fewer in number. The main shell concentration is located just north of the larger rock outcrop. In 1977 Robert Hoover directed subsurface testing at SLO-652. Two 1 by 1 meter test units were excavated and 200 soil samples were collected for pH analysis. The test units recovered burnt rock, chert flakes and cores, boiling stones, small shell fragments and bone. Projectile and biface knife fragments suggest occupation during the Middle period for both sites (1,000 to 3,000 years old).

SLO-1266 is a small prehistoric site recorded in 1989 by W. B. Sawyer. It is located just north of Tiber Canyon Road and consists of a gentle sloping terrace measuring 50 by 100 meters. Noted were a concentration of chert flakes with rare shell fragments (same at the other two sites), burnt rock and some bedrock mortars. No new information was gathered in the 1992 survey.

Tar Seeps were recorded in two locations near Price Canyon Road but no prehistoric cultural materials were noted in either location. These seeps were probably visited by Chumash, prehistorically and were utilized during the Mission Period as recorded by the Spanish missionaries. ‘Pismo’ is from the Chumash word ‘Pismu’, which was the name of a Chumash village near the tar seeps in Price Canyon. Historic/Modern Materials were recorded during the survey of a 32-acre area (Gibson 1992:11). The materials were near existing wells # 150, # 151, and # 157 and consisted of fragments of Pismo clam and some glass. One chert flake was noted but was sharp and it was unclear if it was prehistoric or mechanically broken natural chert. No chert flakes, burnt rock or species of shellfish were noted in this area. It was concluded the shell fragments were historic or modern, probably dating to post World War II.

Land Use and Ownership

Land uses are an important factor influencing the physical conditions of the watershed, as well as an indicator of the types of non-point source pollutants in the watershed. A detailed look at the connections between land use and water quality is provided in Appendix G. The watershed is primarily in private ownership with public ownership at and near the mouth of Pismo Creek by the State of California, Department of Parks and Recreation and the City of Pismo Beach respectively. Designated land use and development patterns are managed by the County and the City through their General Plans and land use ordinances.

Land Uses

Agriculture

Agriculture makes up a significant part of the Pismo Creek Watershed (77 percent) including row crops, rangeland, vineyards, and orchards. There is expected to be minimal expansion of agriculture throughout the watershed, excluding tributary East Corral de Piedra, which may be developed for vineyard expansion. Much of the agricultural land has been, and continues to be, developed for urban use. Potential agricultural impacts to water quality include erosion and sedimentation, pesticide run-off, well contamination, surface water pollution, water diversion and human waste deposition.

Mining

There is one oil extraction operation in the watershed, adjacent to the creek that is currently expanding to include additional exploration/drilling sites. In addition, this operation is exploring disposition of water from the expanded operation. The expansion is referred to as the Phase IV Development Plan project and is located in Price Canyon approximately 3 miles northeast of the City of Pismo Beach in San Luis Obispo County, California. The proposed project is in the Arroyo Grande oil field and is located east and west of Price Canyon Road near its intersection with Ormonde Road, midway between Highway 101 and Highway 227. The project involves two phases: (1) Construction, and (2) Operations. The primary components of the proposed project are construction of 95 producer wells, 30 injector wells, modification of 31 existing well pads and construction of 4 new well pads, and construction of 3 steam generators. The Subsequent Environmental Impact Report (2008), found that water quality, hydrology and biological impacts were significant, but able to be mitigated.

Housing and Urban/Rural Development

The Pismo Creek Watershed includes several small communities with populations of around 14,000 including the City of Pismo Beach and the unincorporated areas within Price Canyon and in the Edna Valley. Urban and residential land uses comprise approximately 23 percent of the watershed.

Recently, there has been an increase in residential and commercial development in the watershed with the conversion of open space and agricultural lands. More development is anticipated along Highway 227 near Los Ranchos/Edna Village area and near the Pismo Beach city limits. According to the San Luis Obispo Inland Area Plan, modest infill within the existing committed urban/suburban area is provided, and future expansion of the Los Ranchos/Edna Village reserve line may be appropriate to include an additional 300 acres of Residential Rural south of the Rolling Hills development. The City of Pismo Beach's Sphere of Influence (SOI) is determined by the Local Agency Formation Commission (LAFCO) and includes areas in Price Canyon. If all properties in the City's 2002 SOI were fully developed, the land use potential would be a total of 487 residential units, and in Price Canyon at least 149 residential units (LAFCO, 2002). These numbers do not take into account development on the King North Ranch.

A large development project has been proposed by King Ventures for Price Canyon. Potential development impacts include increased impervious surfaces which in turn can lead to increases in polluted run-off entering the creek, higher volumes of water reaching the creek and increased potential for flooding. Due to the early stage of the project, there is an ideal situation for the integration of water and watershed issues into the Price Canyon Master Plan.

FIGURE 2.19 MAP OF LAND OWNERSHIP IN WATERSHED

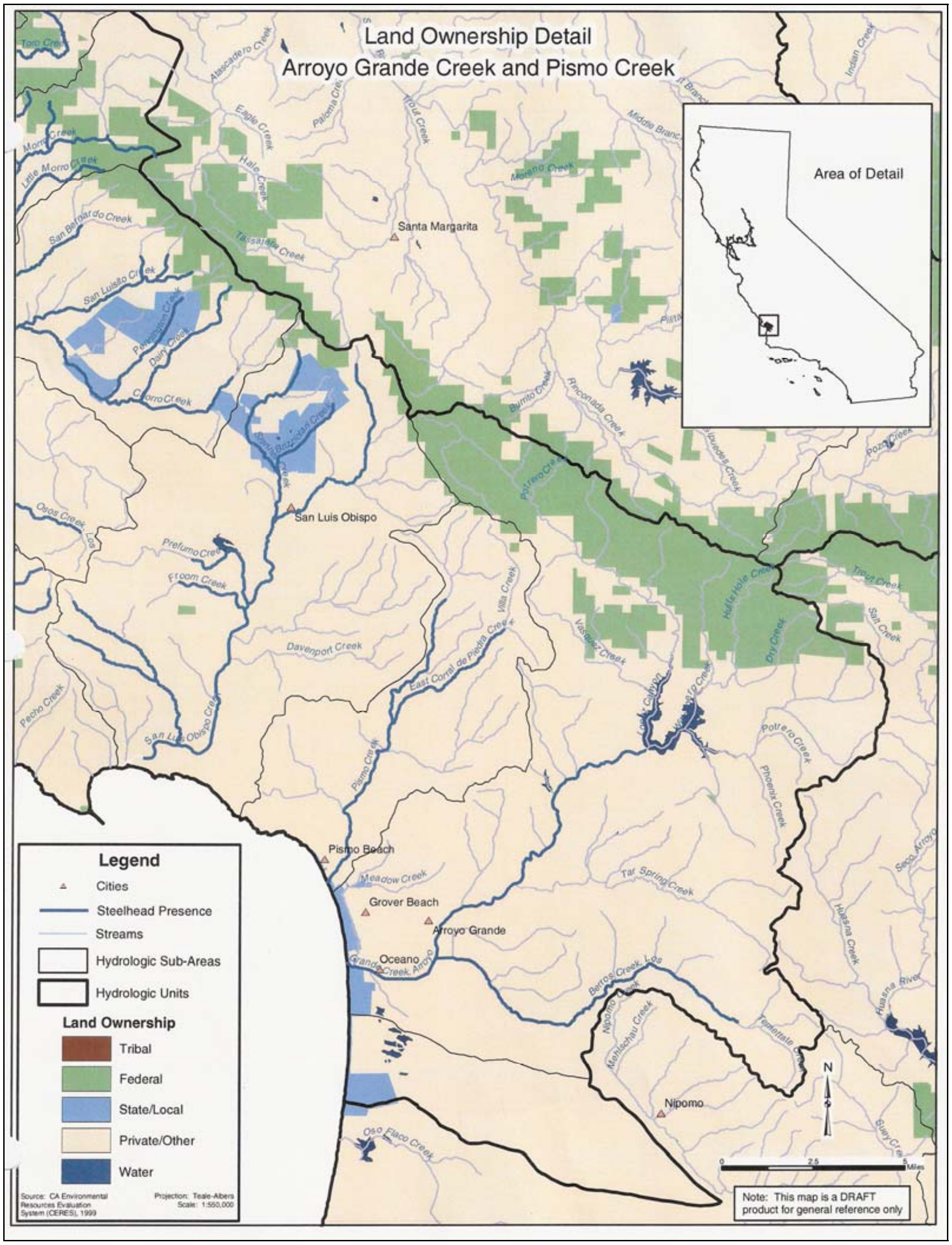
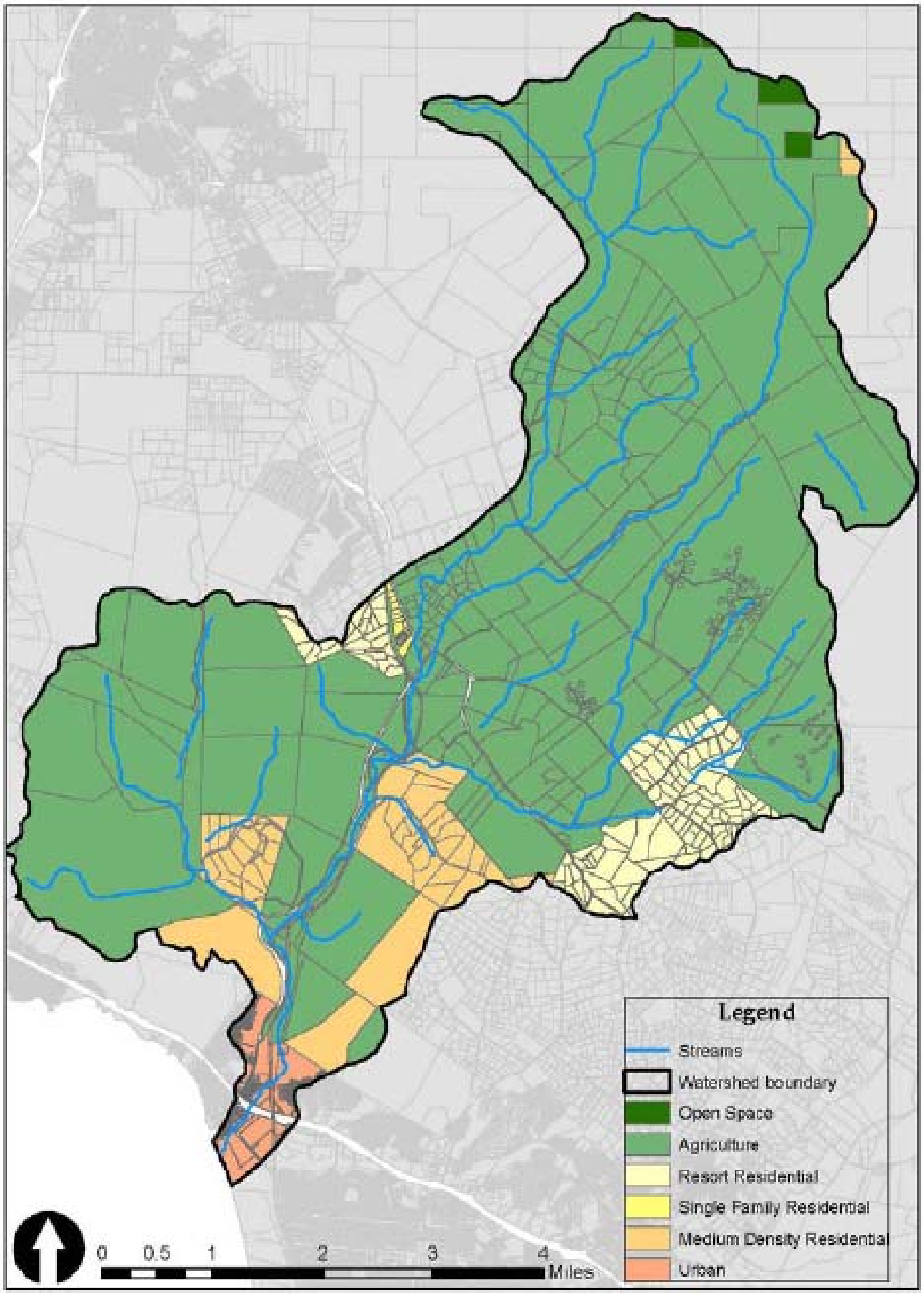


FIGURE 2.20 MAP OF LAND USE IN THE WATERSHED



Source: Smith, 2008

Wastewater Treatment

There is a wastewater treatment plant adjacent to the creek that discharges water into the ocean at the South County Sanitation District's Oceano wastewater treatment plant's off-shore outfall line. The City of Pismo Beach has recently completed upgrading the plant which is intended to service the community to include build-out.

Recreation

Pismo Creek estuary empties into the ocean at the north end of Pismo State Beach, just south of the City operated section of Pismo Beach. This area is currently open year round to surfers, pedestrians, sport anglers and other recreationalists. It is anticipated that this will remain the same. There are also many small pocket, shore-line parks within the watershed managed by the City of Pismo Beach for passive recreation and beach access. Price House is a city owned and volunteer managed historic property immediately adjacent to the creek within the floodplain. It is being managed as a historic site with plans to showcase living history for the public. The Juan de Anza Trail also runs through the watershed. As development proceeds within the watershed, county and city planning functions may add to recreational amenities. For example, the Pismo Creek Recreation Trail will be implemented, in part, in association with proposed public improvements associated with Las Ventanas del Mar, the Highland Drive project, and will include an offer to dedicate a 25' wide path that generally follows the existing road leading from the railroad underpass and along Pismo Creek to the Price Historic Park. This 25' wide offer will be improved by the applicant as a pedestrian and bicycle path in accordance with the improvement standards in the Pismo Creek Trail Plan. The alignment of this trail through the property generally follows the suggested route identified in the Pismo Creek Recreational Path Study Report commissioned by the City in February, 2004. This Report was prepared with the intent to identify the best route for a path linking Pismo Beach to State Route 227 in Edna. It also closely follows the path of the historic Juan Bautista de Anza Trail as discussed in the Price Historic Park Master Plan. To minimize stream and near-stream impacts, this Recreational Path should be outside the riparian corridor.

Sport fishing activities within the watershed are assumed to be limited due to limited access and prohibition of take due to listed species status except at the beach. At such time that sustainable sport fishing becomes possible when recovery of listed species is accomplished and species are de-listed, it would be useful to address recreational development of sport fishing access in conjunction with city and county planning functions. Other passive recreational uses such as bird-watching, hiking and horse-back riding are also assumed to be limited due to limited access.

Transportation Corridors

In locations where a transportation corridor crosses the creek, a bridge or culvert is installed to ensure that the water crossing will not interrupt traffic. Crossings often result in a constriction of the creek and can present a barrier to fish passage. Scour often occurs during high flows requiring placement of Rock Slope Protection (RSP) to protect the bridge or culvert.

Railroad

Currently the Union Pacific Railroad crosses Pismo Creek just downstream of the confluence of the West Corral de Piedra Creek and East Corral de Piedra Creek tributaries. A fish ladder was constructed immediately downstream of the railroad bridge over Pismo Creek to facilitate fish passage, however, the fish ladder itself is considered a partial barrier to fish passage. The rail corridor also parallels Pismo Creek through Price Canyon.

Roads

There are numerous State, local, and private roads throughout the Pismo Watershed.

State Highways

Highway 1 is a two lane north-south route connecting the small coastal communities along the California Coast. Highway 1 crosses the Pismo Lagoon (Bridge # 49-10) near the mouth of Pismo Creek (Post Mile 15.27).

Highway 101 is a major four lane (two lanes in each direction) north-south route connecting the major population centers of Los Angeles and San Francisco. Highway 101 crosses Pismo Creek on (Bridge #49-15) near the eastern boundary of the City of Pismo Beach (Post Mile 16.39).

Highway 227 is a two lane north-south route connecting the city of San Luis Obispo at its northern end with the City of Arroyo Grande at the southern end. Highway 227 traverses the Edna Valley and crosses the West Corral de Piedra Creek (Bridge # 49-204; Post Mile R7.33); East Corral de Piedra Creek (Bridge # 49-103; Post Mile 7.12), and East Fork Pismo Creek or Canada Verde Creek (Bridge # 49-112; Post Mile 5.26).

County Roads

Price Canyon Road is a two lane east-west route between Highway 101 in Pismo Beach and Highway 227 in Edna Valley. Price Canyon Road crosses West Corral de Piedra Creek immediately upstream of its convergence with East Corral de Piedra.

Ormonde Road is a two lane north-south rural route between Price Canyon Road and Noyes Road in the City of Arroyo Grande. Ormande Road crosses Pismo Creek approximately 1 mile downstream of the Union Pacific Railroad crossing.

Orcutt Road is a two lane north-south rural route along the Santa Lucia foothills between Broad Street in the City of San Luis Obispo and Lopez Drive in the City of Arroyo Grande. Orcutt Road crosses West Corral de Piedra, a minor tributary to West Corral de Piedra, and East Corral de Piedra Creeks.

Corbett Canyon Road is a two-lane north-south rural route between Highway 227 in Edna Valley and Highway 227 in Arroyo Grande. Corbett Canyon Road crosses Canada Verde Creek near its head waters.

City Roads

Cypress Street crosses the Pismo Lagoon with a bridge immediately downstream of the Highway 1 Bridge. The Cypress Street Bridge is currently only used for pedestrian access across Pismo Creek.

Highway 101 (2 lanes in each direction) crosses Pismo Creek on the west end, from north to south. Highway 227 (2 lanes) crosses the East and West Corral de Piedra Creek tributaries, from north to south. Orcutt Road crosses the East and West Corral de Piedra Creek tributaries on the east Highway 1 crosses Pismo Creek lagoon near the mouth of Pismo Creek along the coast. There are paved roads in residential and business areas with various types of drains and culverts and crossings that lead into Pismo Creek and its tributaries. There is also a network of unpaved dirt roads on private and public land, utilized for agriculture, fire access and general access. It is anticipated that more roads will be built with further urban development of the watershed. No new highways are anticipated. A revised Highway 101 over pass and entry/exit ramps and extension of Price Street over lower Pismo Creek had been planned but is now on hold. Price Canyon Road runs along the creek. Bike lanes are planned for Price Canyon in the future. Union Pacific Railroad crosses Pismo Creek downstream of the confluence of West and East Corral de Piedra.

Social and Economic Demographics

Population dynamics can give insight into the location, density and demographic profile of future growth in an area. Increased population size influences the availability of services, the quality of life, and the impact on water, air and soil resources. In areas with low population size and increased development pressure, it is important to consider future growth estimates in order to appropriately tailor growth management and natural resource management strategies. In addition, demographic information can be used to guide public outreach, and to target specific subpopulations during project implementation.

The Pismo Creek Watershed is home to 13,827 people, with 8,500 of those within the city limits of Pismo Beach. The demographics of the Pismo Creek Watershed can be attributed to many of the watershed's features, including the high cost of living, low population fluctuations, and low minority population. The City of Pismo Beach is the only urbanized region in the watershed and is eight square miles in area. Pismo Beach has a fairly constant population with a change of less than 100 people between the years 2000 and 2004.

Age

Compared to the California population, Pismo Beach has similar numbers of 30-54 year olds (36.9% in CA). However unlike the California statistics, the city has a low percentage of 18-29 year olds (10.7% in Pismo Beach compared to 17.4% in California). It also contains a relatively high percentage of 55-69 year old persons (17.5% in Pismo Beach compared to 10.6% in California). The large number of middle aged person (41-54 years) and 5-18 year olds suggests that the majority of people in the watershed are in older families, while the low average of persons in a household (compared to the 3.43 state average) suggests that there is also a large percentage of older couples (2000 Census). The median age within the city is higher than that of the rural areas of the watershed (46.6 years compared to 42.0 in the rural areas). This trend suggests that there is a higher percentage of older people within the city than in the rural areas (2000 Census). In San Luis Obispo County as a whole the age demographics are as follows: the largest age bracket is 30-54 years old (37.4%), followed by over 70 years old (15.7%) and 5-18 years old (14.6%). The average household size within San Luis Obispo County is 2.5 people.

Race

The race demographics for the watershed indicate that the majority of the population is Caucasian, representing 88.6%. Latinos represent 6.3% of the total population in the watershed. The remaining races each represent less than 2%, including African American, American Indian, Pacific Islander, and Asian. Compared to the national percentage of Caucasians not including Latinos (69%) and the state average (47%), City of Pismo Beach shows a lack of ethnic diversity with a high concentration of Caucasians (2000 Census).

The economic base for Pismo Beach is primarily tourist shops, restaurants, and equipment stores. These service industries provide employment to some people in the community however the cost of living exceeds the possible income from these positions. Many of the working population commute to the larger City of San Luis Obispo for more employment opportunities and for higher pay. The average time spent commuting to work is 21.1 minutes and is equal to the time necessary to reach most neighboring cities from rural areas (SLO County Integrated Regional Water Management Plan, 2005).

According to the Long Range Socio-Economic Projections Draft by the San Luis Obispo Council of Governments, the city of Pismo Beach has a projected medium population of 10,600 by the year 2030.

Chapter 3 Critical Issues

During the initial stages of the Pismo Creek/Edna Area Watershed Forum, community members, landowners and various other stakeholders identified critical issues from their perspectives through preliminary watershed assessments, by using Central Coast Ambient Monitoring Program (CCAMP) data and observations of land use, and comparisons between historical and current conditions of the creek and adjacent uplands. Support for critical issues identified is included in this section.

Water Quality

Surface water

Temperature

Water temperature is related to the amount of riparian canopy cover available to provide shade and prevent stream flows from heating. A reduction of riparian canopy and vegetation has occurred along the stream corridors in the Pismo Creek watershed. Private property land use changes and lack of setback standards have encouraged maximum use of the land thereby reducing riparian buffers in the watershed. With decreased canopy, increased water temperatures lead to decreased dissolved oxygen, which poses a hazard to the health of fisheries in the watershed.

The RWQCB Basin Plan indicates both a warm and cold beneficial use for Pismo Creek. For both designations, the water quality objective is that temperature shall not be increased by more than 5 degrees F above natural receiving water temperature.

Water temperature at the CCAMP monitoring site near Highway 1 indicates that temperature standards were at the upper limits for steelhead (a cold water species) during the summer months of the monitoring period in 2005 (Appendix E).

According to the Pismo Creek Habitat Assessment,

> *In addition to the physical features (habitat types) of the stream channel, the riparian vegetation is also critical to fish distribution and abundance. The riparian zone serves many functions for fish including insect production, recruitment of woody material for pool formation and cover, filtering sediment, and cooling the water temperature. In the case of the latter, that vegetation that hangs over the stream channel or is away from the stream channel but tall enough to provide shade on the water, is of particular importance. Near the coast, the maritime influence helps keep water temperatures cooler but further east, the shade on the stream is imperative for keeping the water temperatures cooler.*
>
> *Canopy, climate, and stream flow regulate water temperatures. And water temperature affects all metabolic and reproductive activities of steelhead including the ability to capture and assimilate food, growth, oxygen extraction, egg survival, swimming ability, and the virulence of pathogens (Tebo, 1974). Temperatures that are too high or too low are not expected to be an issue during*

migration or spawning in Pismo Creek. But because of the low summer/fall stream flow, higher inland temperatures, and relatively low canopy density, summer and fall water temperatures for rearing juveniles may be a problem.

Optimum and lethal temperature requirements for different life stages have been developed for steelhead, but the criteria are for northern or eastern streams and do not accurately reflect conditions in central California. Criteria that have been developed by Bell (1986) determined preferred temperatures for steelhead rearing to be between 50°F and 55° with an upper lethal temperature of 75.2°F. Looking at both the logger data and the temperature data collected while habitat typing, water temperatures were never within the preferred range and came close to documented upper lethal on a few days. Steelhead are surviving in temperatures other than what is documented but it is unknown at what cost.

Until biologically tested and valid water temperature requirements for the Central California coastal streams can be generated, the temperature data collected during this survey will serve as baseline data without conclusive judgments.

The relative lack of canopy in the lagoon reach of the creek provides insight into algal bloom activity and low dissolved oxygen levels. The following chart from the CCAMP website illustrates the measure of percent algal cover relative to the water quality criteria value (crit.) used for screening purposes (Figure 3.2). Both algal measurements exceed the criteria value.

FIGURE 3.1 CCAMP SAMPLING RESULTS FOR PERCENT ALGAL COVER

Analyte	Max	Min	Mean	GeoMean	Samples	Hits	First	Last	Crit.	Ref.	Qual.
% algal Cover, filamentous	80	0	10.8	3.5	48	3	4/1/2001	11/1/2006	40	Rose, C., CCRWQCB, 2006	
% algal Cover, periphyton	100		47	29	45	24	4/1/2001	11/1/2006	40	Rose, C., CCRWQCB, 2006	

Source: CCAMP

FIGURE 3.2 PISMO CREEK, UPPER LAGOON REACH SEPTEMBER 2002

Source: CCAMP Website http://www.ccamp.org/ca300/3/Sites/SitePhotos/310PIS_2002_09.htm

Nutrients and Dissolved Oxygen

The types and levels of nutrient input entering the creek from adjoining land can impact water quality and potentially affect the assemblage of living organisms in or near the creek. The level of dissolved oxygen (DO) is also critical to fish populations, particularly during the night (referred to as the diel reading for DO) when plants within the water are using oxygen as well. The problem can be heightened when canopy is lacking and algae proliferate, especially in the evenings during late summer and early fall when stream flows are low. Fish die-off regularly occurs in the lagoon during the summer and low diel (overnight) DO is considered to be a contributing factor.

Ideal levels of nitrogen for steelhead are 0-.3 mg/l. This optimal level was exceeded at one monitoring point during CCAMP monitoring near Highway 1 (Appendix E).

Ideal levels of DO for steelhead are 10 mg/L. Levels below 7 mg/L have been shown to begin stressing the fish. Less than acceptable levels of DO for steelhead are 5-6 mg/l, though they can survive with concentrations as low as 2 mg/l (Moyle, 2002).

The most recent sampling was conducted in conjunction with studies arising from Plains Exploration and Production Company's expansion to include a produced water reclamation facility. A report entitled Hydrologic, Water Quality and Biological Characterization of Pismo Creek was recently submitted to the RWQCB as part of the application for an NPDES permit. The report indicates that selenium, iron and zinc are above Basin Plan Standards at a sampling site upstream of the oilfield during wet and dry sampling events (Entrix, 2006).

The RWQCB Hydrologic Unit Assessment Draft (2003) has indicated a need to evaluate Pismo Creek for additional evidence of problems associated with selenium and to manage to reduce biostimulatory risk in lower Pismo Creek. As of March 2009, the RWQCB is considering adding several new pollutants to the 303(d) list for Pismo Creek (Mary Adams, personal communication).

As indicated above, overall water quality is relatively high for Pismo Creek and tributaries. However, sediment loads and water runoff carrying sediment and nutrients such as pesticides are of concern, and could potentially be increasing as impervious surface area increases in the watershed with additional roads, homes, oil production facilities and other development being added to the watershed.

Ocean water

Fecal and total coliform

Fecal and total coliform within the freshwater environment are not sampled by Salmon Enhancement. They are however monitored by San Luis Obispo County Surfrider Chapter and the San Luis Obispo County Health Department in the ocean water environment.

Fecal coliform bacteria are used as one indicator of fresh fecal contamination, since they are common inhabitants of the intestinal tracts of warm-blooded animals. As such, they can be an indication of contamination from livestock, domestic animals, faulty septic systems, sewer line failure, homeless encampments, etc. However, fecal coliform bacteria can also originate from natural sources, such as wildlife, marine mammals and birds. Storm water runoff can carry high concentrations of Fecal coliform.

The Pismo lagoon has experienced fish die-off in the late summer and early fall. As bacteria and other microorganisms are undergoing decomposition when the lagoon is blocked by a sand-bar (a natural consequence of beach orientation, low summer/autumn freshwater flows, and low ocean wave action), dissolved oxygen is depleted and fish survival is at risk.

Water quality sampling from the aforementioned work by Entrix for PXP indicated that Fecal coliform was detected below the Basin Plan water quality objectives in two of three sampling events and above in one sampling event.

A Pismo Beach Water Quality work group has been convened by the City of Pismo Beach and is comprised of representatives of the City of Pismo Beach, Salmon Enhancement, Surfriders, Pier Watch, County Environmental Health and the Regional Water Quality Control Board. The work group is endeavoring to identify potential sources of high dry and wet weather bacteria levels, and solutions to address the bacteria, as well as establish an action plan for implementation. A DNA Source Tracking Study has been commissioned and funded by a Clean Beaches Initiative grant. Dr. Chris Kitts, Cal Poly microbiologist, is the principal investigator. Results of the study are expected in the spring of 2009.

Water Quantity

Social Impacts

The nature of our coastal climate with precipitation in the fall and winter means that water storage for use during spring and summer can only occur by holding back water with a dam creating a reservoir, either on or off-channel. The quantity of water subsequently available for in-stream uses during the dry season such as habitat for fisheries is of concern in many of California's coastal watersheds including Pismo Creek/Edna Area, as increasing development occurs and water supplies are further stretched. The system below the dam experiences a low-flow condition in the spring and summer when no new rainfall is introduced and consumption is still occurring for private wells, agricultural diversion and other uses.

In addition, urban development increases the amount of impervious surfaces, thus increasing storm water runoff that, under natural conditions, would percolate into the soil. The result is not only total increased runoff volume, but altered flow regimes, increased flow rates, and potentially increased pollutant loads.

Surface flow

Surface water of West Corral de Piedra above the dam collects into a privately-owned reservoir. By-pass flows and water spilling from the reservoir flow downstream. Surface flow may go subsurface, depending on release rates and prevailing conditions including well draw-down, in the summer and fall. Surface flow has ceased along West Corral de Piedra according to adjacent landowners during drought and non-drought years. The Department of Fish and Game Code 5937 specifies that:

> *The owner of any dam shall allow sufficient water at all times to pass through a fish way, or in the absence of a fish way, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam..*

The Hydrology and Geology Assessment provides a preliminary look at watershed-wide surface flow. It would be useful to correlate the assessment with the habitat typing conducted for the watershed to assess in stream flow needs for Steelhead trout.

Cumulative withdrawals of ground water can have also have an impact on surface flow during low flow periods. Surface flow can be depleted by the number of wells, time of pumping and rate of withdrawal from wells that are hydraulically connected to a stream. The effect can be delayed, depending on aquifer properties and distance of the well from the stream. (USGS, 2001).

The following chart summarizes main stem and West Corral de Piedra permitted diversions according to the State Water Board's California Integrated Water Quality System (CIWQS). It would be useful to establish whether all surface water is currently fully appropriated as well as establishing in stream flows needed for Steelhead to determine whether adequate flows are available to protect public trust resources. There are no known documented water rights on Canada Verde Creek. An appropriative water right is a right to take water for use on non-riparian land or to use water that would not be there under natural conditions on riparian land. A riparian water right is a right to use the natural flow of water on riparian land, which is land that touches a lake, river, stream, or creek.

FIGURE 3.3 SUMMARY OF PERMITTED DIVERSIONS

Source	Application Number	Permit Number	Water Right Type	Amount (acre feet/year)	Status
Pismo Creek	A028864		Appropriative	1448	Cancelled
E. Corral de Piedra Creek	S013147		Statement of Diversion and Use	0	Claimed
W. Corral de Piedra Creek	A017840	012887	Appropriative	500	Permitted
	A021061	014086	Appropriative	64	Permitted
	A022704	015444	Appropriative	27	Permitted
	A028883	020496	Appropriative	400	Permitted
	A031189		Appropriative	13	Pending
	S000011		Statement of Diversion and Use	0	Claimed
	S013102		Statement of Diversion and Use	0	Claimed
	S013103		Statement of Diversion and Use	0	Claimed
Total Appropriative Water Rights				**991**	**Permitted**

Under California Water Law, a property owner can claim water rights through a statement of diversion and use (usually riparian or pre-1914 right). Until the claim is used, acre feet/year is recorded as zero.
Source: State Water Board's California Integrated Water Quality System

According to the Hydrology and Geology Assessment,

> *Canada Verde appears to have relatively persistent baseflow and a higher quality of wetlands. This is perhaps an indication that the Paso Robles formation – which outcrops widely in this watershed -- is able to recharge and release more water than younger Quaternary alluvium. Maintenance or enhancement of ground-water recharge throughout the watershed, but particularly in the Canada Verde watershed, should be encouraged to maintain baseflows downstream in Pismo Creek* (Balance, 2008).

Soil types vary substantially throughout the Pismo Creek watershed. Considerable infiltration occurs, especially on soils with hydrologic classes A and B (see Figure 4). Land uses which diminish infiltration or which speed water from recharge area through furrows, gutters or ditches can add substantially to future flooding and diminish the recharge needed to sustain baseflows, especially on class A and B soils.

In 2002, a joint set of recommendations from the California Department of Fish and Game and the National Marine Fisheries Service (now NOAA-Fisheries) was presented to the State Water Resources Control Board. The guidelines provide bypass flow recommendations and measures for protecting natural hydrographs and computation of a cumulative flow impairment index to avoid cumulative impacts of multiple water projects. This set of guidelines is specifically for the counties of Napa, Marin, Sonoma and Mendocino. However, the guidelines may be a useful tool for managers in the Pismo Creek/Edna Area watershed to achieve strategies for in stream flows to protect fisheries resources.

Surface flow may also be impacted by climate change in the future. In July, 2006, Progress on Incorporating Climate Change into Management of California's Water Resources, a technical memorandum report, was released by the California Department of Water Resources. Possible effects on fish are included in section 2.9 wherein stream water temperature changes and shifts in seasonal pattern of surface-water runoff were identified as potential ecological impacts from climate change. Specifically, anticipated climate change that raises air temperatures a few degrees Celsius may be enough to raise water temperatures above the tolerance of steelhead. And in basins without snow pack, climate change could further exacerbate water supply issues.

Groundwater

According to the Hydrology and Geology Assessment,

> *DWR monitored long-term ground-water fluctuations in a single well from 1958 through 1993, showing rapid recovery of the aquifers following sharp drawdowns during sequences of dry years (see Figure 6). Maintaining or enhancing the recharge functions in Edna Valley will be important for many stormwater- and watershed-management purposes. Rapid recovery from drought-year low levels may also serve as a useful metric to track watershed health. No long-term ground-water monitoring presently occurs in the watershed* (Balance Hydrologics, 2008).

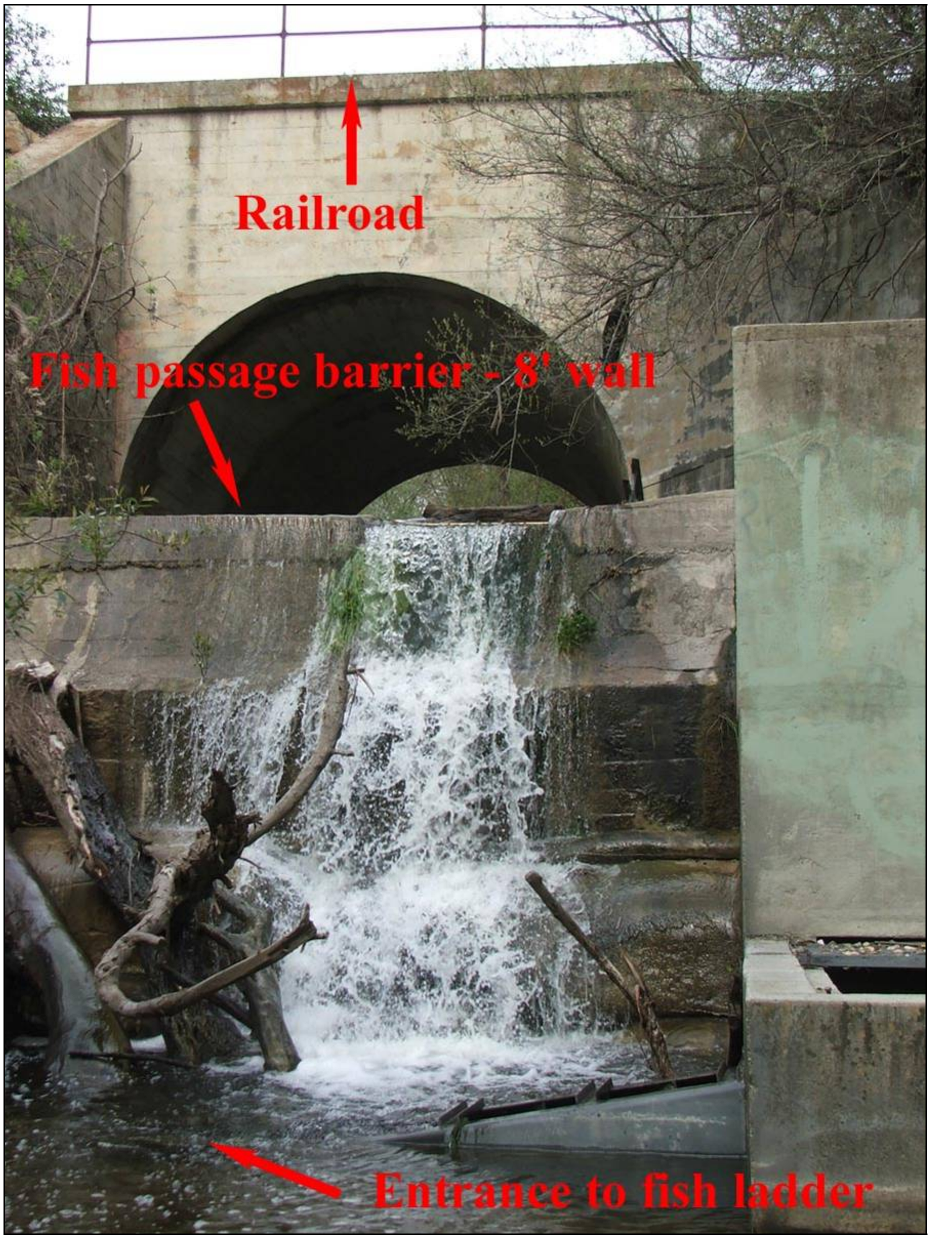
Fish Passage Barriers

The following list of potential barriers was generated by the steering committee using existing documentation (San Luis Obispo County Stream Crossing Inventory and Fish Passage Evaluation, 2005) as well as observation in the field.

<u>1. Fish Ladder at Railroad Crossing of Pismo Creek: stream mile 5.3</u>

Three step-pool Alaskan step-pass fish ladder at Union Pacific Railroad closed bottom arch culvert for bridge crossing. This barrier was ranked third highest in the County (County Barrier ID #168) (Swanson Hydrology and Geomorphology, 2004) There is an approximately 15-foot drop from the culvert apron to the base of the channel.

FIGURE 3.4 PISMO CREEK FISH BARRIER AT RAILROAD CROSSING



Source: Coastal San Luis Resource Conservation District

2. <u>Arizona Crossing of Pismo Creek: stream mile 4.6</u>
Upon publication of the Draft Plains Exploration and Production Produced Water Treatment Facility Subsequent Environmental Impact Report (2007), an additional potential barrier was identified. It appears to be a concrete Arizona type crossing that spans the entire creek, and has two large culverts, about 12 inches or more in diameter, at the base. A steering committee member had an opportunity to view the area and provided the following description during the summer of 2007.

> *The water is currently clear and flowing, I would say about 2 to 4 inches deep at its deepest on the upstream side. The stream span is about 24 to 36 inches wide up stream. The down stream side contains quite a large shaded small pond. I would suspect about 12 to 24 inches deep at its deepest, and maybe around 15 to 18 feet in diameter, before it chases away down stream.*

Figure 3.5 Pismo Creek Fish Barrier at Arizona Crossing

Source: Pismo Creek Habitat Assessment, Nelson, 2005

J. Nelson (2005) described this barrier during the course of conducting a stream survey for the CDFG and published the following in *Pismo Creek Habitat Assessment.*

> *At stream mile 4.6 (starting from the ocean) a concrete ford crossing Pismo Creek is a barrier to upstream movement of juvenile steelhead and a possible impediment to upstream adult movement at lower stream flows (Figure 2.11 above). The crossing spans the channel and is approximately 12 feet wide with a 4.3 foot jump from the surface of the water to the top of the crossing. The pool downstream of the structure is approximately five feet deep.*

3. <u>County bridge Crossing of West Corral de Piedra Creek at Righetti Road: stream mile 8.2</u>

Natural bottom culvert bridge culvert with eroding wing walls. Concrete outlet apron presents a partial barrier. This barrier is considered of moderate coastal priority according to the San Luis Obispo County Stream Crossing Inventory and Fish Passage Evaluation (2005) and described below.

> *Steep concrete apron across stream exists to protect bridge piers from scour. Adults are likely able to burst over the apron when depths become sufficient and able to swim across apron when the tailwater rises during high flows. Slope of apron creates a velocity and water depth issue for all fish limiting fish passage significantly. * If Site 91, which is downstream, is modified, then this site becomes a High Priority Coastal.*

A longer channel profile is needed to determine if a series of grade control weirs could be used to replace the concrete apron. Other options could involve the use of an over steepened rock channel section or the construction of a short concrete pool and weir fish way (need 4-wiers). (Michael Love)

FIGURE 3.6 WEST CORRAL DE PIEDRA CREEK FISH BARRIER AT COUNTY BRIDGE ON RIGHETTI ROAD

Source: CCSE

In addition, the steering committee listed the following barriers for consideration.

- Bridge Creek Road Crossing of West Corral de Piedra Creek, stream mile 9.1
- Righetti Dam spillway on West Corral de Piedra Creek, stream mile 9.8
- West Corral de Piedra Creek at Hwy 227 and Old Edna where boulders may have been placed, stream mile 5.7

A concrete stream crossing with two culverts observed on East Corral de Piedra Creek may also be a fish passage barrier (Figure 3.8).

FIGURE 3.7 WEST CORRAL DE PIEDRA FISH BARRIER AT HWY 227 BRIDGE AND EDNA

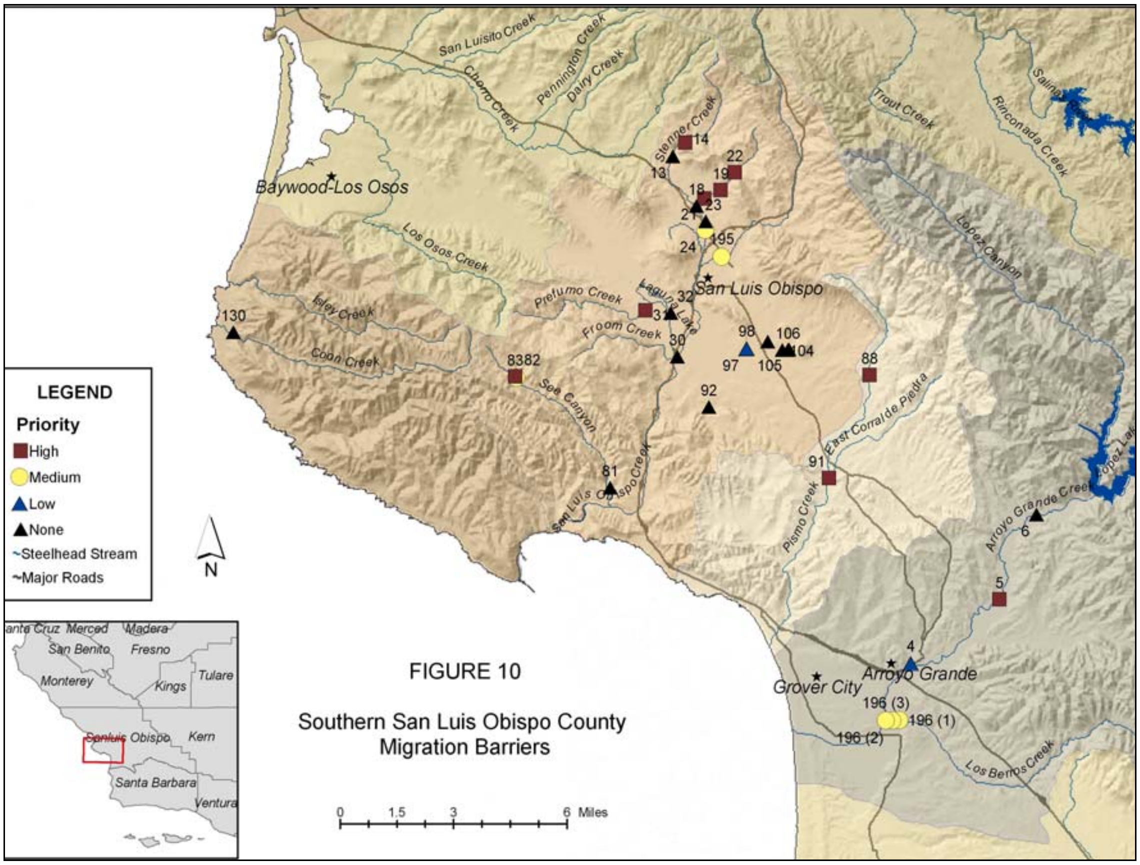
Source: CCSE

FIGURE 3.8 EAST CORRAL DE PIEDRA CREEK FISH BARRIER NEAR MORRETTI CANYON ROAD

Source: CCSE

A state-wide barrier assessment database is also available to track fish passage barrier information. The Passage Assessment Database (PAD) is an ongoing inventory of known and potential barriers to anadromous fish in California. It compiles currently available fish passage information from more than 100 data sources, and allows past and future barrier assessments to be standardized and stored in one place. The inventory is to be used to identify barriers suitable for removal or modification to restore spawning and riparian habitat for salmon and steelhead, and to enhance aquatic and riparian habitat.

FIGURE 3.9 MAP OF MIGRATION BARRIERS OF SOUTHERN SLO COUNTY



Source: San Luis Obispo County Stream Crossing Inventory and Fish Passage Evaluation

Erosion and Sedimentation

A comprehensive survey of erosion potential and sources has not been completed for the watershed. A preliminary assessment of sediment discharge was conducted by Balance Hydrologics. The assessment found that Pismo Creek transports a moderately high sediment load relative to north coastal streams, but is near the middle of the range for Central Coast watersheds, and has a low proportion of bedload and a high proportion of finer materials. Additional findings are excerpted below.

> *Suspended- and bedload sediment transport were measured during various storms in water years 1991 and 1992, either by Balance staff or by Tina Grietens and her colleagues at the City of Pismo Beach. Although the number of data points collected during that monitoring period is not sufficient*

to merit a sediment yield computation, some inferences from the data set can be drawn, and are discussed in detail in Hecht (2006). A comparison of the empirically-derived 'sediment rating curve,' the relationship between sediment transport and stream discharge, on Pismo Creek (Hecht, 2006) to other coastal California streams (Knudsen and others, 1992) revealed that suspended sediment transport in Pismo Creek is an order of magnitude or more lower than Arroyo Grande above Phoenix Creek (at a site now flooded by Lopez Lake), an incising stream. It also shows substantially greater transport at a given flow in Pismo Creek than in streams such as Coyote Creek (near Gilroy) and the Ventura River at River Oaks.

Bedload sediment is transported by the stream by bouncing, rolling, or saltating along the bed. Bedload is supported by the bed, and moves at a rate much slower than the water during storms. The proportion of bedload is important and telling because it provides: (a) a basis for comparing channels of different geomorphic and salmonid-habitat types, (b) information about the sediment-production processes operative in the watershed, (c) indications of salmonid constraints, and (d) hints about how effective efforts might be at reducing sediment delivery to the streams. A comparison of suspended and bedload sediment during the early 1990s suggests that bedload may be about 10 percent of the suspended sediment within the range of flows sampled (Hecht, 2006). This is probably indicative of the contributions from the upper portion of the watershed, upstream of the mountain front north of Orcutt Road. In fact, the streambed of East Corral de Piedra Creek is visibly much coarser than the somewhat larger West Corral de Piedra Creek, likely associated with deposition of all coarse sediment from the uppermost watershed within impoundments on the latter. In contrast, Knott (1975) reported a relatively high percentage of bedload measured in Lopez Creek near Arroyo Grande.

It is likely that the proportion of coarse sediment we observed during 1991 and 1992 is reasonably typical of long-term conditions. Considerations which might have resulted in above-normal coarse-sediment percentages are that channels in coastal California tend to transport a larger proportion of bank material immediately following droughts, likely due to release from banks stabilized by root systems weakened by protracted drought (Hecht, 1993; Schumm, 2004). Bank material tends to be coarser than typical sediment loads in most channels. Also, the storms during water years 1991 and 1992 were notably more intense than usual, another factor which tends to draw coarser material from bed and bank storage. No major wildfires, however, were reported preceding the 1990-2 sediment monitoring; wildfires in the upper watershed of East Corral de Piedra Creek may be expected to coarsen the bed and the sediment in transport for several years (or more) following a major burn.

The low proportion of bedload – and the high proportion of much finer materials – suggests that much of the sediment load of Pismo Creek might be controlled within fields or vineyards and on the slopes. While this implication is based only on the watershed-wide sediment-transport dynamics, it should be noted that use of conventional erosion-control practices is a simpler and more-implementable set of tasks than controlling in-channel erosion and incision. Hence, reducing sediment yield in the Pismo watershed is likely to be achievable, all other influences permitting. Similarly, it will be particularly important to prevent de-stabilization of channels by ongoing or future land-use activities, such that there is time and effort available to implement the known, sound measures likely to effectively reduce sediment loads.

Flood Management

Floodplains when inundated serve many functions and provide important habitats for a variety of fish and wildlife. Floodplain wetlands act as nutrient and sediment sinks, which can improve water quality in streams. They also provide storage that can decrease the magnitude of floods downstream, which can benefit fish and landowners in riparian areas. In addition, streams that are actively connected to their floodplains are less prone to severe down cutting and erosion. Therefore, it is important to incorporate protection of these benefits of floodplains within the watershed. However, floodplains have been developed within the watershed and continue to be with the recent addition of a vineyard upstream of the Price House Historical Park. It would be useful to consider establishing set-back regulations within the watershed with stakeholder input to protect water quality as population increases and more demands are placed on land within the watershed.

FIGURE 3.10 PISMO CREEK FLOODING DOWNSTREAM OF PRICE HOUSE AND THE UPRR BRIDGE

Source: Central Coast Salmon Enhancement, January 2005

Chapter 4 Implementation

Recommended Management Actions and Projects

The following set of recommended actions and projects has been developed based on landowner input provided on an individual basis, through discussion at the steering committee level and TAC level, from the Hydrologic and Geologic Assessment and the Pismo Creek Habitat Assessment, and projects previously identified by CDFG personnel. Projects are grouped on the basis of critical issues brought forth by stakeholders during discussion at the steering committee level as well as at community-wide forums. As recommended projects are linked with parties interested in implementation, a set of five criteria will be used to evaluate and prioritize projects. The criteria evaluate 1) benefits and costs, 2) multiple types of benefit, 3) long-lasting benefit, 4) likelihood of success and 5) meeting the needs of critical issues.

Conduct Steelhead Habitat Restoration

Salmon Enhancement will continue to follow the National Oceanic and Atmospheric Administration South-Central California Coast Technical Recovery Team's progress for Phase I Recovery. In addition, the following data gaps could be addressed:

- Information regarding steelhead population trends through long-term monitoring
- Hatching success and juvenile survival rate of steelhead
- Sampling to identify predatory fish species within Pismo Creek

Fish Passage Projects

Fish passage projects can restore connections between currently isolated areas of the creek. Recommended fish passage projects from highest to lowest priority include:

(1) Remove Fish Ladder at Union Pacific Railroad Bridge on Pismo Creek

Salmon Enhancement and the CSLRCD have received funding to design a modification to the fish ladder. The design is scheduled to be complete by the end of 2008.

(2) Remove/ modify Arizona Crossing of Pismo Creek

(3) Remove/modify County Bridge Crossing of West Corral de Piedra Creek on Righetti Road

(4) Remove/modify Bridge Creek Road Crossing of West Corral de Piedra Creek

(5) Modify Righetti Dam and Concrete Step-pool Ladder

(6) Modify bedrock at Hwy 227 and Edna Store on West Corral de Piedra

(7) Remove East Corral de Piedra Creek Debris Dams

Pismo Creek Habitat Assessment Recommendations

The following recommendations are from the Pismo Creek Habitat Assessment (WCDP is West Corral de Piedra and PC is Pismo Creek Main Stem; numbering refers to recommendation from the Assessment report and does not imply priority order).

1) Protect stream flow from diversions by finding ways to work effectively with the reservoir operator to ensure minimum flow requirements are instituted. It would be imperative to assure that the flow be dedicated to the stream as opposed to other downstream riparian users. (From Recommendations WCDP 1 and PC 4)

2) It is recommended that an In-stream Flow Incremental Method (IFIM) or other appropriate study be conducted to determine the optimal flow to maximize rearing habitat and provide for fish passage. (From Recommendation WCPD 1) In addition, it is recommended that a few winter "walk through" surveys be conducted on West Coral de Piedra to assure that there is continuous flow that is at least one foot deep up to the reservoir. (From Recommendation WCDP 2)

3) It is recommended that, where possible, tall, sprawling native trees that are used in more arid conditions be planted along the stream banks in the area from Highway 227 up to Righetti Road Bridge. (From Recommendation WCDP 3)

4) It is recommended that an aggressive program be directed to remove Arundo, Himalayan blackberry and the other non-native vegetation. It is realized that in some cases, the non-native species are desired by the landowners, however in most cases it is believed that the non-natives colonized on their own and it would be these plants that are targeted for removal. (From Recommendation WCDP 4 and PC 6)

5) Remediate those sources of sediment already identified on mainstem Pismo Creek. Cattle exclusionary fencing and controlled cattle access to Pismo Creek would greatly reduce sediment generated from the trail system and the resting areas the cattle use near the creek. In some cases, grading back stream banks in addition to planting may be needed to assure success. (From Recommendation WCDP 5 and PC)

6) Conduct a watershed wide sediment assessment to identify and prioritize sediment sources. Once prioritized sources have been identified, the sites should be corrected as opportunities arise. (From Recommendation WCPD 6 and PC 2)

7) Conduct water quality testing to identify the substance causing the turbidity in lower Pismo Creek. Once identified, determine the effect it may have on steelhead survival or distribution and take appropriate action to locate and control the source. (From Recommendation PC 1)

8) Two impediments were identified in Pismo Creek. The crossing under the railroad is scheduled to be modified and will be monitored once the modifications have occurred for effective passage. The concrete ford identified lower in the watershed may be an impediment for adult steelhead migration under some flows and is an absolute barrier for juvenile steelhead that may need to migrate upstream. If the landowner is willing, the concrete ford should be removed and the crossing replaced with a railroad flatcar bridge or other appropriate structure. (From Recommendation PC 5)

9) In order to determine fish composition, distribution and baseline abundance of juvenile steelhead, quantitative fish sampling should occur in the fall. (From Recommendation PC 7)

Conduct Invasive/Exotics Mapping and Develop Control Plan

Exotic species seed sources can enter the watershed from adjoining lands. It would be useful to coordinate with county, regional, state and federal weed eradication programs to ensure the watershed is included in a coordinated effort. Exotic species of concern within the watershed include Arundo, Cape Ivy, Pampas Grass, Vinca and Castor Bean.

Assess Debris Racks for Floodplain Protection and Flood Management

Assess the watershed for debris racks and determine priority for management. For example, the following was contributed by a steering committee member:

> *East Corral de Piedra is in need of debris management and some vegetation management from the Orcutt Road Bridge to the 227 bridge. There are numerous large debris racks in the channel that are slowly moving downstream towards the 227 bridge. The debris racks divert the creek flow, decrease creek capacity, and result in erosion of the creek bank. If the debris is unable to pass the 227 bridge, it could result in substantial flooding and possible damage to the bridge.* -Landowner

Improve Water Quality

Several water quality issues were identified by stakeholders of the planning process. Among the most critical were sediment from erosion, elevated levels of bacteria, and low levels of dissolved oxygen. The committee recommends the following projects to improve water quality.

Control Erosion to Reduce Sediment

In general, dams alter sediment flows, both for the reservoirs behind them and the streams below, silting up the former while starving the latter. Sediment capture behind dams cuts off sand, silt and gravel supplies to downstream reaches and can cause a condition referred to as “hungry water” whereby the water exiting the impoundment has energy to erode and destabilize downstream reaches. Resultant bank and streambed erosion can both degrade the channel habitat and isolate floodplain and riparian wetlands from the channel during rejuvenating high flows (Baron, 2004).

Salmon Enhancement will continue to work with landowners and agencies to refine a plan to stabilize banks on private property using SEP funds matched with private landowner resources as well as outside sources such as US Fish and Wildlife Partners in Conservation.

The road system throughout the watershed could be inventoried to identify areas where sediment is entering the creek in order to modify structures or initiate BMPs to reduce inputs. This would lead to reduced sedimentation to the system which could, in turn, reduce the level of embeddedness of gravels in the creek bed and improve water quality.

Determining bank erosion sites and areas where the channel is incised will assist in planning projects that can stabilize banks and minimize further incising. This would address areas that are potentially contributing to increased sedimentation.

As bank stabilization plans are devised, it is recommended that non-structural solutions such as securing riparian buffers or restoring stable channel geometry, using re-vegetation and bioengineered methods are investigated instead of hard bank protection structures.

It would be useful to use aerial maps followed up with ground-truthing to generate a list of sites that appear to be experiencing bank erosion. The sites could be catalogued by number to provide confidentiality to landowners.

FIGURE 4.1 BANK STABILIZATION PROJECT ON WEST CORRAL DE PIEDRA CREEK

Reduce Bacteria

Reductions of bacteria entering the creek can be achieved by reducing livestock use of the creek for watering. A low cost approach is to provide off-stream sources for watering livestock. A second approach is to fence livestock from the creek. Combining off-stream watering for livestock with bank stabilization planning can provide an additive improvement by addressing areas in the creek where livestock may be destabilizing banks and contributing to erosion and sedimentation. During the development of this report projects to reduce high bacteria loads are being planned including riparian fencing to exclude livestock and removing homeless encampments.

In addition to upslope efforts, restoring wetland functions and improving circulation of the Pismo lagoon could improve bacteria levels in that area. Increasing freshwater flows to the lagoon, can increase the lagoon’s capacity to assimilate pollutants, resulting in improved water quality and protecting the beneficial uses for wildlife within the lagoon and in adjacent nearshore coastal waters. Leveraging restoration planning while addressing increased visitor services through improved access and interpretive improvements could increase the attractiveness of lagoon restoration to a variety of potential funders. Specifically, restoring the lagoon to a more natural state would serve to reduce temperature, increase dissolved oxygen and address algae growth and fish kill in late summer, early fall.

Monitor Water Quality for Selenium and Biostimulatory Risk

The report, Hydrologic, Water Quality and Biological Characterization of Pismo Creek indicates that selenium, iron and zinc are above Basin Plan standards at a sampling site upstream of the oilfield during wet and dry sampling events (Entrix, 2006). Additional monitoring should be conducted to assess the persistence of elevated levels of these analytes.

Monitor Water Quality - Recommendations from the Hydrology and Geology Assessment

General:

Information presently available for Pismo Creek and its tributaries is noticeably less than for most other watersheds of similar size in San Luis Obispo and northern Santa Barbara Counties. This study and related efforts through CCSE are an initial attempt to provide basic information readily available in most other areas of the region, such as watershed geology, streamflow, general water quality, and sources of baseflow. Efforts to collect additional primary observations and historical information in these arenas will be particularly valuable, and can support meaningful future watershed planning. At a minimum, we recommend:

1. *Establishing a comprehensive ground-water monitoring program in Edna Valley, in which wells are monitored bi-annually in the early spring and later summer.*

2. *Establishing a water-quality monitoring program in Price Canyon, including standard field parameters, general minerals, and constituents (such as phenols) related to the naturally-occurring hydrocarbons in the watershed which are thought deleterious to key aquatic species.*

3. *Stream and sediment gauging and continuous water-quality monitoring (specific conductance, pH, and temperature) should be an integral component of a water quality monitoring program in Price Canyon, and would further document the persistence of low flows and sediment transport dynamics in the watershed. If feasible, additional gages on West Corral de Piedra and Canada Verde would provide further insight as to the relative baseflow contribution provided by each of these tributaries.*

Results of water-quality sampling for general minerals indicates that waters emanate from varying geologic sources within the watershed, and that distinct signatures are probably characteristic of a number of geologic units. As additional general mineral ('major ion') analyses are performed, the fingerprints of the individual geologic sources will become better known in the Pismo Creek watershed, as they are known in the Santa Ynez and other Santa Barbara County watersheds, and to a lesser extent in the Arroyo Grande watershed (c.f., Maisner and Thompson, 2002), In the Pismo Creek watershed, specific conductance-to-discharge relationships and major ion ratios can be important means of (a) understanding recharge processes, (b) evaluating the effectiveness of runoff control, and (c) evaluating sources of baseflow.

Promote Low Impact Development Principles to Reduce Sources of Runoff

Healthy, functioning watersheds naturally filter pollutants and moderate water quality by slowing surface runoff and allowing the infiltration of water into soils. Agriculture and construction activities compact soils causing erosion and runoff which in turn decreases surface water quality and alters hydrologic flows. Other land uses such as residential and commercial also produce pollution, runoff and erosion issues. Managing the causes of erosion and sedimentation such as surface runoff provides long term benefits. The implementation of low impact development (LID), redevelopment and retrofits can reduce surface runoff and protect water quality. This Best Management Practice minimizes impervious cover and maximizes groundwater recharge. In turn, the sources of runoff and potential erosion and sedimentation are reduced. A description of these practices and resources can be found on the RWQCB's LID website: http://www.waterboards.ca.gov/centralcoast/stormwater/low%20impact%20devel/lid_index.htm.

Individual property owners, developers and municipalities can promote and implement LID principles. Landowners may comment on the Draft County ordinances developed through the County Stormwater Management Program. They should also consider implementation with unit pavers for patios and walkways, driveway paving only under car wheels, dry wells connected to roof downspouts, vegetation at the dripline of roof, and concave lawns that also serve as infiltration basins. Developers should attend educational trainings and consider implementation with narrow residential streets, shared driveways, pervious overflow parking, notched curbs, swales, and playfield/infiltration basin. Municipalities should consider adopting policies and standards in line with LID principles. Cities should also partner with appropriate entities to provide annual educational training for private contractors and county maintenance and road crews to include instruction on the use of Low Impact Development (LID) and management practices for road and construction projects. The Cities and Counties may conduct community outreach regarding newly revised County Storm water Management Programs. These programs are to include more frequent, comprehensive grading/storm water inspections and enhanced enforcement of violations as provided for in revised County ordinances and new inspection programs scheduled to be implemented between 2010 and 2011.

Monitor Water Quantity

Develop Water Conservation Plan

Water conservation best management practices, public involvement and education, water conservation plans and agricultural water conservation could be investigated and implemented within the watershed. Researching groundwater-surface interactions would be helpful in gaining insight into subsurface flows and groundwater pumping below the dam and identify the benefit of pumping schedules to address perennial in-stream flow. This would address whether and how the private dam is affecting in-stream flows for Steelhead trout.

Install Stream Gauge

Installation of a stream gauge upstream of the City of Pismo Beach was conditioned by the SLO County Planning Commission on the PXP Produced Water Treatment Facility. In addition, a gauge is being considered as an SEP project sited at a site as yet determined. SLO County Public Works Department has expressed interest in linking these gages to the county-wide system to enable access to all interested parties.

Conduct Instream Flow Study

A lack of instream flow data and a continuing concern for flow as a critical issue facing the creek leads to the need for a comprehensive in stream flow study. The study would inform water rights issues on the creek. The instream Flow Incremental Methodology (IFIM) is a model-based process that results in water management alternatives. IFIM is data and expertise intensive requiring a legal and institutional analysis modeling and habitat modeling.

Promote Policy Planning and Education

All proposed development projects within the watershed have implications for potential impacts to critical issues facing Pismo Creek. Given the standards for development within the City of Pismo Beach and County of San Luis Obispo, it would be prudent to work with municipalities to fashion measures that will protect and enhance the watershed as the human population continues to grow and the watershed is developed, increasing impervious surfaces and subsequent run-off which in turn impacts the creek environment.

Promote Land Use Planning for Watershed Health

CCSE will continue to work with local jurisdictions to generate concepts that improve local ordinances, regulations and resolutions to protect and restore watershed health.

The following are policy and regulation recommendations from *Regional Land Use Planning for Water Quality in the Pismo Creek Watershed: Recommendations on Policy and Regulation* were developed as a Master's Professional Project (Smith, 2008). Recommendations were directed to the County of San Luis Obispo and the City of Pismo Beach. The goal of the document was to inform decision-makers in the Pismo Creek watershed of the connections between land use and water quality, and potential policy and regulatory solutions to improve and protect water resources. A suggested prioritization for implementation is also provided. The complexity and importance of the recommendation to watershed and water quality protection were considered during prioritization. Overall, the "common" recommendations rank higher in priority than any of those provided specific to the County or City. The complete document with recommendation rationale is found in Appendix G.

FIGURE 4.2 SUMMARY OF LAND USE PLANNING RECOMMENDATIONS

	Recommendations	Responsible Department(s)	Priority
COMMON 1	A memorandum of understanding (MOU) be adopted by the County and City to protect the Pismo Creek watershed and near shore ocean water	County Planning and Building (long-range), City Planning and other partners	2
COMMON 2	The Ahwahnee Water Principles be adopted as General Plan language	County Planning and Building (long-range) and City Planning	1
COMMON 3	Policies and regulations should be amended to reflect applicable findings of the Code and Ordinance Worksheet	County Planning and Building, County Public Works and City Planning, City Building, City Public Works, City Engineering	3
COUNTY 1	A set of watershed level policies be adopted to support groundwater recharge and filtration, biological processes, and natural flood mitigation, while ensuring high-quality water.	County Planning and Building (long-range)	1
COUNTY 2	Develop watershed-based overlay zoning that utilizes percent impervious cover to protect and restore watersheds	County Planning and Building (long-range) and County Public Works	4

	Recommendations	Responsible Department(s)	Priority
COUNTY 3	Policy on Agriculture with Stream Corridors be developed that defines standards and setbacks on private lands with stream corridors through the review of discretionary permits and the acquisition of creek setback areas	County Planning and Building	3
COUNTY 4	Amend language on Sensitive Resource Areas, streams and riparian vegetation in the Inland Land Use Ordinance	County Planning and Building	2
CITY 1	Interim stormwater management regulations be developed for new development and redevelopment prior to NPDES Phase II implementation	City Planning, City Building, City Public Works, and City Engineering	1
CITY 2	A Standards Manual be developed to guide developers in implementing BMPs for construction and post-construction runoff control	City Planning, City Building, City Public Works, and City Engineering	4
CITY 3	Policy and regulation be developed that requires new development and redevelopment to use stormwater control techniques	City Planning, City Building, City Public Works, and City Engineering	3
CITY 4	Policies on Pismo Creek Protection and riparian habitat be amended to include restoration and acquisition of the stream corridor	City Planning	2
CITY 5	Stormwater regulations adopted through NPDES Phase II permitting require the treatment of runoff through a dry weather urban runoff recycling facility	City Planning, City Public Works, and City Engineering	5

Source: Smith, 2008

Continue Community Education

The steering committee recommends continued outreach and education to better ensure that private property and public safety is protected. Outreach materials such as brochures and maps could be created to address the following:

- Respecting private property boundaries
- Erosion prevention and best management practices
- Trails for public use
- Annual Creek Day Clean up efforts
- Homeless camps and use of creek as outdoor privy

FIGURE 4.3 HOMELESS ENCAMPMENT

Homeless encampments have thus far been addressed by working directly with private landowners who have taken it upon themselves to clean up areas impacted by the homeless population in the watershed. We will continue to work with landowners to provide volunteer support to remove encampments from public and private property.

FIGURE 4.4 MATRIX OF RECOMMENDED PROJECTS

Recommendation	Project	Limiting Factors	Assessment of Condition	Management Actions	Potential Project Partners
Conduct Steelhead Habitat Restoration	Remove Union Pacific RR fish ladder at stream mile 5.3	Fish passage barrier	Existing inadequate fish ladder	-Finish designs to eliminate the need for the fish ladder	The Gas Company, Plains Exploration and Production (PXP) Union Pacific Railroad, Salmon Enhancement
	Remove Arizona Crossing at stream mile 4.6	Fish passage barrier	Crossing with two 12" culverts embedded	-Evaluate severity of barrier -Design modification if needed	PXP, Central Coast Salmon Enhancement, Pismo Creek/Edna area watershed group
	Modify County Bridge Crossing of West Corral de Piedra Creek on Righetti Road at stream mile 8.2	Fish passage barrier	Concrete lip at bridge	-Evaluate severity of barrier -Design modification if needed	Coastal San Luis RCD, Salmon Enhancement, County of San Luis Obispo
	Modify Bridge Creek Road Crossing of West Corral de Piedra Creek at stream mile 9.1	Fish passage barrier	Concrete lip at bridge	-Evaluate severity of barrier -Design modification if needed	Natural Resources Conservation Service, Coastal San Luis RCD, Salmon Enhancement
	Modify Righetti Dam and Concrete Step-pool Ladder at stream miles 9.8	Fish passage barrier	Modification is needed for adequate fish passage		Natural Resources Conservation Service, Coastal San Luis RCD, Salmon Enhancement
	Modify bedrock at Hwy 227 and Edna Store on West Corral de Piedra at stream mile 5.7	Fish passage barrier	Bedrock that has been exposed as the channel has been incised.	-Evaluate severity of barrier -Design modification if needed	Natural Resources Conservation Service, Coastal San Luis RCD, Salmon Enhancement
	Remove East Corral de Piedra Creek Debris Dams	Fish passage barrier	Un-maintained vegetation growth has created debris dams	-Removal of existing debris dams with hand crews -Annual maintenance of vegetation	Natural Resources Conservation Service, Coastal San Luis RCD, Salmon Enhancement
	PXP Steelhead Trout Monitoring Plan	Water Quality and Quantity	Unknown fisheries impacts by PXP Produced Water Treatment Facility	-Aid with monitoring plan as needed	PXP, Salmon Enhancement

Recommendation	Project	Limiting Factors	Assessment of Condition	Management Actions	Potential Project Partners
	Conduct winter flow surveys	Water Quantity	Very limited instream flow data	-Conduct winter flow surveys on West Corral de Piedra	CDFG, Central Coast Salmon Enhancement
	Riparian planting	Water Quality: Temperature	Land use has removed native riparian trees	-Identify willing landowners for riparian planting	California Conservation Corps, Coastal San Luis RCD
	Conduct fisheries surveys	Current presence/ abundance data	There are no ongoing fisheries surveys to determine distribution and abundance	-Survey fish composition, distribution and baseline abundance of juvenile steelhead in the fall	Department of Fish and Game and Central Coast Salmon Enhancement
	Conduct Invasive/Exotics Mapping and Develop Control Plan	Riparian cover	Arundo, Himalayan Blackberry and other non-natives are present	-Survey all creeks in the watershed through site surveys. -Prioritize sites for treatment	Coastal San Luis RCD, The SLO Land Conservancy, Salmon Enhancement
	Assess the watershed for debris racks	Fish Passage, Flood Reduction	Un-maintained vegetation growth has created debris dams	-Survey all creeks in watershed for debris racks -Prioritize sites for treatment	
Control Erosion to Reduce Sediment	Bank Stabilization Plan	Water Quality: Sedimentation	Creek incised, banks eroding, gravels embedded	-Survey creek for erosion sites and prioritize -Work with landowners to change management practices -Develop and distribute educational materials to landowners and managers.	Natural Resources Conservation Service, Coastal San Luis Conservation District, Salmon Enhancement, City of Pismo Beach, County of San Luis Obispo
	Road Inventory	Water Quality: Sedimentation	Creek incised, banks eroding, gravels embedded	-Survey all roads with in the watershed through aerial photos and site surveys. -Prioritize erosion sites for treatment	Natural Resources Conservation Service, Coastal San Luis Conservation District, Salmon Enhancement, City of Pismo Beach, County of San Luis Obispo

Recommendation	Project	Limiting Factors	Assessment of Condition	Management Actions	Potential Project Partners
	Preserve Floodplain	Water Quality: Sediment	Creek incised, banks eroding, gravels embedded	-Work with City to define appropriate creek setbacks in Price Canyon -Purchase intact floodplain	Natural Resources Conservation Service, Coastal San Luis Conservation District, Salmon Enhancement, City of Pismo Beach, County of San Luis Obispo
Reduce Bacteria	Riparian fencing and off-stream livestock water system	Water Quality: Bacteria	Pismo Beach advisories, Basin Plan identified fecal coliform as not supporting beneficial uses	-Identify willing landowners	
	Homeless encampment management	Water Quality: Bacteria	Pismo Beach advisories, Basin Plan identified fecal coliform as not supporting beneficial uses	-Use vegetation maintenance to discourage homeless encampments adjacent to the creek	Coastal San Luis RCD, Salmon Enhancement, City of Pismo Beach, County of San Luis Obispo
	Pismo lagoon restoration	Water Quality: Diminished Dissolved Oxygen (DO)	Low dissolved oxygen (DO), algae blooms and fish kills in low-flow summer months in lagoon beneficial uses	-Form a lagoon restoration working group -Work with landowners to encourage wetland vegetation -Develop strategy for lagoon restoration	City of Pismo Beach, State Parks, Salmon Enhancement, Coastal San Luis RCD
Monitor Water Quality	Monitor for Selenium and Biostimulatory Risk	Water Quality	Analytes are above Basin Plan standards	-	
	Groundwater monitoring program	Water Quality	Unknown interactions between groundwater and surface water		
	Water quality monitoring program	Water Quality			

Recommendation	Project	Limiting Factors	Assessment of Condition	Management Actions	Potential Project Partners
Promote Low Impact Development Principles to Reduce Sources of Runoff		Water Quality, Sedimentation		-Work with City and County to update ordinances -Work with municipalities to implement Stormwater Management Plans	City of Pismo Beach, County of San Luis Obispo, Low Impact Development Center, SLO County Partners for Water Quality
Monitor Water Quantity	Develop Water Conservation Program	Water Quality: Low flows	Visual assessment and water quality monitoring	-Work with landowners to use water conservation best management practices -Public involvement and education -Develop water conservation plans -Implement agricultural water conservation -Researching groundwater-surface interactions in advance of pumping schedules	Natural Resources Conservation Service, Coastal San Luis Conservation District, Salmon Enhancement
	Install Stream Gauge	Water Quality: Low flows	Very limited instream flow data	-Use SEP funds for installation of gauge near UPRR bridge	Natural Resources Conservation Service, Salmon Enhancement, County of San Luis Obispo, Union Pacific Railroad
	Conduct Instream Flow Study	Water Quality: Low flows	Very limited instream flow data	-Develop research proposal and interested parties	Natural Resources Conservation Service, Salmon Enhancement, City of Pismo Beach, County of San Luis Obispo

Recommendation	Project	Limiting Factors	Assessment of Condition	Management Actions	Potential Project Partners
Promote Policy Planning and Education	Promote Land Use Planning for Watershed Health	Water Quality and Quantity	Land use policies and regulations do not protect natural resources fully	-Update City council and Board of Supervisors on progressive ways to connect land use and watershed health	City of Pismo Beach, San Luis Obispo County, Salmon Enhancement
	Continue Community Education			-Develop education plan that may include brochures and maps	City of Pismo Beach, San Luis Obispo County, Salmon Enhancement, Coastal San Luis RCD

Approaches to Adopting and Implementing the Plan

> *Urban hydrology...is launching a porous-surface watershed-restoration movement that helps land absorb rainwater quickly and release it slowly...This hydrological reform is part of a broader design movement that takes unnecessary infrastructure dollars out of the ground and invests them in houses, neighborhood support systems, and landscapes.*
>
> *-Paul Hawken, L. Hunter Lovins, Amory Lovins*
>
> *In "Natural Capitalism*
>
> *http://www.owendell.com/watershed.htm*.

The implementation of the watershed management plan is completely voluntary. Implementation will be guided by the steering committee to ensure projects of community concern and support are considered and that the original intentions of the stakeholder group are upheld. In addition, efforts will be made to overlay projects recommended in this plan with other emerging plans including the Price House Master Plan, and with opportunities related to required mitigation projects in the watershed to implement priority projects. Further, this plan will make recommendations for an on-going organizational framework for coordinating management activities and projects within the watershed.

It is a goal of the Pismo Creek/Edna Area Watershed Forum steering committee that this plan maintains its roots in the public arena for ready access to public input as Salmon Enhancement continues its mission in creating a sustainable watershed management plan that will reflect all intended uses while enhancing the watershed's natural resources. To this end, the plan will become a living document responsive to changes in the watershed. The steering committee will be seeking support for the plan by regional municipalities and regulatory agencies to familiarize them with the grassroots effort to enhance and restore the watershed. The plan will be available on our web site and linked to all supporting entities' sites.

Support for the plan is being sought to increase the likelihood of garnering funds for implementation and to continue to foster a spirit of cooperation among groups working in the watershed. An informational map will be included for the public to use for educational purposes and will be integrated into Salmon Enhancement's watershed education program.

Benefits to Landowners, Land Managers, and Municipalities

Through the development of the plan, the landowners, community members, agencies and organizations working and living within the watershed have gained new perspectives about other stakeholders' needs and the resources the community depends upon. Benefits will be short-term as well as long term.

With the assistance of the information in the plan, landowners will be able to implement projects that benefit not only their own property but benefit the environment as well. Projects such as bank stabilization ensure the landowner will retain his/her "property" at the same time it is protecting habitat by reducing excess sediment inputs to the stream. Tools provided in this plan in the form of information on agency jurisdiction will facilitate project design, permitting and planning.

In addition to project design and implementation information, financial support will be developed using this plan as a basis for grant applications. Landowners will be better able to secure funding to complete projects defined in the plan. Funding opportunities are available for on the ground projects, installation of management practices and for landowners interested in easements to achieve specific objectives.

Finally, private landowners applying a set of standard conservation and water quality Best Management Practices will soon be assisted by a permit coordination program being established in cooperation by the Coastal San Luis Resource Conservation District and Sustainable Conservation, and funded by the Regional Water Quality Control Board through Guadalupe Oil Spill Restoration Funds. Landowners will be eligible to apply for project permits through one agency rather than several for the same project, thus saving time and money in the process.

Record of Watershed Activities and Project Treatments

1970's Fish ladder installed at UPRR culvert at Mile Post 250.78

1992 Robert Snyder, CDFG Fish Habitat Supervisor, Region 3 letter to Ross Swenerton, State Water Resources Control Board, Division of Water Rights, indicated that Righetti Reservoir spillway and concrete fishway on West Corral de Piedra tributary was found to conform to the recommendations made by George Heise, the Department's Hydraulic Engineer, prior to construction. The fishway was at that time, considered by the Department to be adequate for the passage of fish over the dam.

1993 CDFG used explosives to modify a series of waterfalls on the Righetti Ranch.

1994 CDFG organized and directed a fish rescue on the Righetti Ranch. A total of 271 (YOY Young of the Year) SHRT (Steelhead/Rainbow trout) and two 1+ SHRT were removed from several cut-off pools in the rapidly drying stream and placed in the reservoir immediately downstream.

Five step pools were created in the bedrock channel on the Righetti Ranch upstream of the falls that was blasted 1993. A boulder was also blasted out of the pool below the main fall to allow steelhead to more easily access the spawning areas above the reservoir. The ranch owner also added another step to the ladder over the dam.

Fish from Whale Rock Reservoir released into Righetti Reservoir

1995 Storm blew out bank close to Price Canyon Road at Fish Ladder. Willow sprigs planted to stabilize

1996 CDFG and the landowners moved 241 YOY and one 14 inch steelhead from a section of the creek that was drying up on the Righetti Ranch. They were placed in a reservoir on the creek on the Righetti Ranch.

Gravel/debris diverter walls were installed above the fish ladder at Southern Pacific's track crossing by CDFG.

1999 CDFG created new pools and enlarged previously blasted pools in rock cascades at the Righetti Ranch. Additional efforts were made to improve fish passage over bedrock cascades and flat bedrock stretches below the dam.

2000 CDFG removed concrete from the apron below the breached dam at the Schifano Ranch to improve fish passage.

2001 CDFG removed debris jam just upstream of the county bridge on Righetti Road.

2005 Pismo Creek Habitat Assessment was completed by Jennifer Nelson of CDFG.

2006 Bank stabilization and revegetation on West Corral de Piedra Creek at APN number ……

2008 Steelhead trout snorkel and visual survey completed for Pismo Creek by Cindy Cleveland.

Hydrology and Geology Assessment Report from Balance Hydrologics.

Pending Changes in the Watershed

PXP Stream Monitoring Plan

The SLO Planning Commission placed conditions on the PXP Produced Water Treatment Facility that require the company to prepare a Stream Monitoring Plan in consultation with the Pismo Creek Watershed Group.

At minimum the following provisions must be included in the Stream Monitoring Plan:
• Identification of permanent temperature monitoring stations within Pismo Creek both upstream and immediately downstream of the proposed discharge location. The upstream location shall be utilized to determine baseline stream temperature conditions of Pismo Creek;

• The monitoring stations shall consist of HOBO continuous temperature recorders or an equivalent to allow automatic stream temperature measurements at approximate 2-hour intervals;

• DO levels shall also be monitored at the designated stations on a periodic basis (to be defined in the Plan) utilizing appropriate water quality sampling equipment. If deemed necessary, additional features shall be installed to the treatment system and/or along the splash pad to increase oxygenation of the discharge water;

• The Plan shall identify the procedures and schedule for stream temperature data collection and reporting requirements which will be utilized to determine the maximum discharge water temperature from the water reclamation facility to ensure compliance with the RWQCB Basin Plan and NMFS requirements throughout the life of the project (i.e., at no time shall the temperature of receiving waters be increased by more than 5°F). This shall include modifying water temperatures accordingly throughout the year to coincide with seasonal fluctuations of Pismo Creek;

• The Plan shall include maintenance and inspection procedures to ensure that the temperature monitoring stations are periodically serviced and/or replaced, as necessary throughout the life of the project. This shall include inspections after significant storm events to ensure that the stations are not dislodged and/or damaged by storm flows and debris; and

• The Plan shall include a reporting schedule that provides quarterly monitoring reports to the County and the RWQCB. The Plan shall also contain provisions for the immediate reporting of upset conditions to the County and RWQCB.

Annexation along Price Canyon Road

The City of Pismo Beach and King Ventures Inc. are pursuing the annexation and development of nearly 1,700 acres in the Price Canyon area. The planning process will include the Price Canyon Master Plan, a Master Environmental Impact Report, City General Plan amendments and a Sphere of Influence Line amendment. This process will determine appropriate land uses, densities and development types.

The Initial Environmental Study identifies the following potential significant impacts:

☒	Aesthetics	☐	Hazards and Hazardous Materials	☒	Public Services
☒	Agriculture Resources	☒	Hydrology and Water Quality	☐	Recreation
☒	Air Quality	☒	Land Use and Planning	☒	Transportation and Traffic
☒	Biological Resources	☐	Mineral Resources	☒	Utilities and Service Systems
☒	Cultural Resources	☐	Noise	☒	Mandatory Findings of Significance
☐	Geology and Soils	☒	Population and Housing		

Source: City of Pismo Beach Council Agenda Report, February 2008

The environmental areas indicated above provide a sense of the broad scale impacts of the future development. The changes in land use associated with the development will dramatically alter the type and scale of critical issues faced in the watershed. Priority issues outlined in this watershed management plan may be overshadowed by new and unforeseen watershed concerns. It is in the interest of the Pismo Creek Steering Committee and community at large to become intimately familiar and positively involved in this planning process as alternative futures are discussed. Such involvement will ensure that knowledge of the watershed and its existing issues are incorporated into plans.

Regulatory Setting and Agencies Jurisdiction

The Pismo Creek watershed lies within many local, state and federal governmental jurisdictions. In order to work effectively to restore the watershed, it is important to understand the regulations and jurisdictions. The following gives a brief overview of these organizations and any plans each entity administers that is relevant to planning efforts in the watershed. Appendix H contains contact names, addresses and phone numbers for the agencies, which will be updated annually to account for staff changes.

Federal Agencies

United States Army Corps of Engineers (ACOE)

The Pismo Creek Watershed lies in the Los Angeles District of the South Pacific Division. The local office is located in Ventura, CA. The Congress of the United States has assigned the U.S. Army Corps of Engineers the responsibility for regulation and construction and other works in the waters of the United States. The Corps is charged with protecting our nation's harbors and navigation channels from destruction and encroachment, and with restoring and maintaining environmental quality. This is accomplished by regulating activities in three areas (1) discharge of fill or dredged materials in coastal and inland waters and wetlands; (2) construction and dredging in navigable waters of the United States; and (3) transport of dredged materials for dumping into ocean waters.

The principal regulatory mechanisms of the Army Corps that relate to watershed enhancement are the Clean Water Act, Section 404(b)(1) Guideline; Marine Protection; Research and Sanctuaries Act; Endangered Species Act; National Historic Preservation Act; Coastal Zone Management Act; National Environmental Protection Act; and others as they relate to the regulatory actions of the District.

Waters of the U.S." is defined by the Army Corps of Engineers as:

1. "all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide", and
2. "all interstate waters including interstate wetlands", and
3. "all other waters such as interstate lakes, rivers, streams (including intermittent), mudflats, sandflats, wetlands, sloughs, prairie potholes, vernal pools, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce".

United States Fish and Wildlife Service (USFWS)

The U.S. Fish and Wildlife Service is the principal federal agency for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefit of the public. The Service enforces federal wildlife protection laws such as the Endangered Species Act, and works in consultation with the Army Corps to ensure that permitted projects protect fish and wildlife. When protected species are involved, the Service prepares "Biological Opinions" on the project to assess the potential impacts and restrict potentially harmful activities.

The Pismo Creek Watershed lies in the Service's Pacific Region (Region #1). This region headquarters is located in Portland, OR and the region contains the states of Washington, Oregon, California, Idaho, Nevada, Hawaii, and the Pacific Islands.

NOAA Fisheries (formally known as National Marine Fisheries Service (NMFS))

NOAA Fisheries is a division of the National Oceanic and Atmospheric Administration (NOAA). The NOAA Fisheries strategic plan contains three goals: rebuilding and maintaining sustainable fisheries, promoting the recovery of protected species, and protecting and maintaining the health of coastal marine habitats.

The Pismo Creek Watershed is in the Southwest Region (California, Hawaii, and the Pacific Trust Territories) with headquarters, located in Long Beach, California. The region is responsible for managing fisheries in the Pacific Islands for lobster, ground fish, swordfish, and precious coral; off the coast of

California for salmon, ground fish, and anchovies; and or conducting enforcement, marine mammal and habitat programs to protect fishes, marine mammals and endangered species within the region.

Enforcement activities are carried out in cooperation with other State and Federal agencies in the Southwest Region to ensure compliance with various federal regulations relating to stewardship of fishery and protected species resources. For example, NOAA Fisheries works locally with the Army Corps permitting process by providing "Biological Opinions" on proposed projects. These opinions describe potential impacts to protected species and contain restrictions that assure protection of these species during project implementation. A second example is the jointly (with California Department of Fish and Game) established Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams, 2002. Finally, areas of the Pismo Creek watershed are considered critical habitat under the Endangered Species Act according to the Federal Register Final Rule (Vol. 70, No. 170 / Friday, September 2, 2005, page 52507) which became effective January 2, 2006. Critical habitat is defined by the Endangered Species Act (Section 3[16USC 1532{5}]) as:

> ''(i) the specific areas within the geographical area occupied by the species, at the time it is listed * * * on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species.''
>
> Areas included in this ruling include the main stem Pismo Creek, and East Corral de Piedra., and West Corral de Piedra below the dam. According to the final ruling:
>
> "Although the habitat appears to be of high quality and would likely support steelhead spawning, we are uncertain whether adult fish can pass over the dam. Accordingly, we treated the area above the Righetti Dam as unoccupied habitat and, since a determination that it is essential to the conservation of the Evolutionary Significant Unit (ESU) had not been made, we have not included it in the final designation for this ESU."

United States Environmental Protection Agency (EPA)

Founded in 1970 as an independent agency, the Environmental Protection Agency (EPA) is generally responsible for protecting human health and safeguarding the natural environment (air, water, and land) in the United States. In its mission statement, the EPA identifies as its charge, research, standard setting, monitoring and enforcement with regard to five environmental hazards: air and water pollution, solid waste disposal, radiation, and pesticides.

While presiding over the entire country, the EPA also coordinates and supports research and pollution mitigation activities by state and local governments as well as private and public groups, individuals and educational institutions. The Pismo Creek Watershed lies in the USEPA's Southwest Region (Region 9). This region contains Arizona, California, Hawaii, Nevada, and the Pacific Islands and the headquarters are in San Francisco.

State Agencies

California Department of Fish and Game (CDFG)

The Pismo Creek Watershed is in CDFG's Central Region, a region that includes Fresno, Kern, Kings, Madera, Mariposa, Merced, Monterey, San Benito, San Luis Obispo, Stanislaus, Tulare and Tuolumne counties.

The CDFG is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. To meet this responsibility, the law requires any person, state or local government agency, or public utility proposing a project that may impact a river, stream, or lake to notify the CDFG before beginning the project. If the CDFG determines that the project may adversely affect fish and wildlife resources, a Lake or Streambed Alteration Agreement (1602 Agreement) is required.

CDFG has jurisdiction over "any channel, bank or flood zone of a river, stream, lake, or their tributaries", including "rivers or streams that flow at least periodically or permanently through a bed or channel with banks that support fish or other aquatic life and watercourses having a surface or subsurface flow that support or have supported riparian vegetation".

The principal enforcement mechanism for the CDFG is the California Fish and Game Code, Section 1602. In addition, The Department of Fish and Game Code section 5937 stipulates that:

> *The owner of any dam shall allow sufficient water at all times to pass through a fish way, or in the absence of a fish way, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam. During the minimum flow of water in any river or stream, permission may be granted by the department to the owner of any dam to allow sufficient water to pass through a culvert, waste gate, or over or around the dam, to keep in good condition any fish that may be planted or exist below the dam, when, in the judgment of the department, it is impracticable or detrimental to the owner to pass the water through the fish way.*

The CDFG currently holds a California Environmental Quality Act (CEQA) mitigated negative declaration for projects conducted using CDFG fisheries enhancement funds for this area. Exclusions include projects conducted by a governmental agency and permits requirements from the Army Corps of Engineers.

The CDFG also oversees the Aquatic Bioassessment Laboratory (ABL) in Rancho Cordova. The mission of the ABL (part of DFG's Water Pollution Control Laboratory) is to support the use of biology in California's water quality management and assessment programs.

State Water Resources Control Board

The State Board's mission is to preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations.

National Pollutant Discharge Elimination System

Water pollution degrades surface waters making them unsafe for drinking, fishing, swimming, and other activities. As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. In most cases, the NPDES permit program is administered by authorized states. The State Water Resources Control Board administers the program for California.

The City of Pismo Beach is in the process of having their program approved, while the non-incorporated areas of the watershed fall under the County approved program.

State Water Board Division of Water Rights

The Division of Water Rights mission is to establish and maintain a stable system of water rights in California to best develop, conserve and utilize in the public interest the water resources of the State while protecting vested rights, water quality and the environment. Access to water rights information regarding specific applications, permits, and licenses is available through the State Board's web-site query tool.

Regional Water Quality Control Board (RWQCB)

The Regional Water Quality Control Board is the local administrative unit of the State Water Resource Control Board. The Pismo Creek Watershed is in Region 3, the Central Coast Region. The local office is in San Luis Obispo.

The mission of the RWQCB is to develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the State's waters. Each RWQCB has nine part-time members appointed by the Governor and confirmed by the State Senate. RWQCB's are responsible for developing "basin plans" for their hydrologic areas, governing requirements, issuance of waste discharge permits, enforcement actions against violators, and monitoring water quality.

The focus of the RWQCB is water quality; the Clean Water Act is the primary enforcement tool. The RWQCB also maintains the State's 303d list of impaired water bodies (section 303d of the Clean Water Act). When a water body is listed on the 303d list, regional offices prepare studies and remediation plans to bring water quality to within the State's standards.

Regional Water Quality Control Board defines its jurisdiction as:

1. anything that may "adversely affect beneficial uses of waters of the state",
2. where "beneficial uses" includes "all of the resources, services and qualities of aquatic ecosystem underground aquifers that benefit the state of California", including,
3. "Agricultural supply, wildlife habitat, recreation, groundwater recharge and municipal and domestic water supply".

The RWQCB becomes involved in watershed enhancement projects as part of Section 401 of the Clean Water Act (CWA). The Board works in coordination with the Army Corps of Engineers (ACOE) to issue compliance documents for this section of the CWA. The RWQCB recently modified discharge permits associated with irrigated agriculture requiring landowners and farm operators to enroll in the Conditional Ag Waiver program which requires the development and implementation of a farm water quality management plan for the reduction of water quality impacts. Plans include use of Best Management Practices among others. The RWQCB is currently enrolling landowners and farm operators in the program. Pismo Creek is to be initially included in the core-monitoring network for the implementation of the waiver.

The RWQCB is moving towards a vision for Healthy Watersheds and measurable goals that include healthy aquatic habitat, sustainably managed land and clean groundwater. The Healthy Watersheds vision will refocus staff attention on 'regional benefit' and 'leveraging' when developing, reviewing and awarding proposals for funding.

California Coastal Commission

The California Coastal Commission was established by voter initiative in 1972 (Proposition 20) and was made permanent by the Legislature in 1976 (the Coastal Act). The primary mission of the commission, as the lead agency responsible for carrying out California's federally approved coastal management program, is to plan for and regulate land and water uses in the coastal zone consistent with the policies of the Coastal Act. Commission jurisdiction in the coastal zone is broad and applies to all public and private entities and covers virtually all manner of development activities, including any division of land, a change in the intensity of use of state waters and of public access to them.

According to the Public Resources Code:

"Coastal zone" means that land and water area of the state of California from the Oregon border to the border of the Republic of Mexico set forth in Section 17 of the chapter of the Statutes of the 1975-76 Regular Session enacting this division, extending seaward to the state's outer limit of jurisdiction, including all offshore islands and extending inland generally 1,000 yard from the mean high tide line of the sea. In significant coastal estuarine, habitat, and recreational areas as it extends inland to the first major ridge line paralleling the sea or five miles from the mean high tide line of the sea, whichever one is less, and in developed urban areas the zone generally extends inland less than 1,000 yards.

The Coastal Zone in this region only extends one-mile inland from the coast. Although revisions to the Coastal Zone boundary were made in January, 2006, San Luis Obispo County and the Pismo Creek watershed were omitted from the revisions in PRC Section 30150. Therefore, the Coastal Commission affects only a small area of the Pismo Creek.

Department of Water Resources (DWR)

DWR operates and maintains the State Water Project, including the California Aqueduct, in which the City of Pismo Beach participates. The department also provides dam safety and flood control services, assists local water districts in water management and conservation activities, promotes recreational opportunities, and plans for future statewide water needs. The mission of the Division of Flood Management is to prevent loss of life and reduce property damage caused by floods, and to assist in recovery efforts following any natural disaster. DWR's Division of Planning and Local Assistance operates the Urban Streams Restoration Program. The program offers grants to assist communities in reducing damages from stream bank and watershed instability and floods while restoring the environmental and aesthetic values of streams. This program is a potential funding source for project implementation and restoration and is currently unfunded.

Local Agencies

City of Pismo Beach

The City regulates land use through the Municipal Code; the 1983 and 1998 Zoning Ordinances; the General Plan and the Stormwater Management Program. In addition, the City lies almost entirely within the coastal zone, requiring a Local Coastal Plan (LCP) that acts like regulation.

The City has integrated its Local Coastal Plan into the General Plan.The State Coastal Act which requires LCPs includes several policies to protect marine/terrestrial resources and water quality. Section 30230 of the Act requires that marine resources be protected, maintained, and, where feasible, restored. The biological productivity of coastal waters, including streams, estuaries, and wetlands, must be maintained. Requirements include controlling runoff and waste discharges to protect water quality, maintaining groundwater supplies and stream flows in order to sustain the biological productivity of coastal waters, and minimizing the alteration of riparian habitats and streams (Sections 30231 and 30240).

The City's Conservation and Open Space Element outlines the desire to maintain Pismo Creek in its natural state and to protect the creek from significant alterations (CO-21). Minimum buffer widths are set:

- For the West Bank, 100 feet/Cypress northward to City limits and 25 feet/Cypress to the ocean

- For the East Bank, 100 feet/U.S. 101 northward to City limits; 50 feet/U.S. 101 to Dolliver Street and 25 feet/Dolliver to the ocean

No new construction or vegetation removal is allowed in the buffer zone with the exception of public roadways or bridges, paths, trails, fences, flood control structures, and other similar structures deemed not to adversely affect the creek. Riparian habitat is further protected by 17.24.120. Also, grading regulations are set to prevent sedimentation or damage to off-site property and wildlife habitats (16.52.020).

The City's Stormwater Management Plan is a planning document that links land use and water quality through stormwater issues. The City is scheduled to have their NPDES Phase II Stormwater permit approved by the RWQCB in 2009.

County of San Luis Obispo

The County's Land Use Ordinance (http://www.slocounty.ca.gov/planning/General_Plan__Ordinances_and_Elements/Elements.htm) includes regulations established and adopted to protect and promote public health, safety, and welfare. Regulations are also adopted to implement the County General Plan, guide and manage the future growth of the county in accordance with those plans, and regulate land use in a manner that will encourage and support the orderly development and beneficial use of lands within the county. The County is updating a Conservation Element of the General Plan that will consolidate related Elements and have policy related to conservation and water resources. The Draft Conservation Element is scheduled public hearings in May 2009.

The County's Agriculture and Open space Element policies reflect a desire to protect streams and riparian corridors in their natural state (OSP18) and to limit development in these areas (OSP19). The policies establish a 50 foot setback from any stream bank within which no grading, paving or development is allowed. Open space preservation is based on incentives like cluster land division, agricultural preservation, and transfer of development credits. Grading regulations are provided in 22.52 of the land use ordinance.

The County defines Sensitive Resource Areas (SRA) (22.14.100) as areas with special environmental qualities or that contain unique or endangered vegetation or habitat resources. This regulation is consistent with stream protection policy and creates enforceable standards. The County identifies Pismo Creek and the Price Canyon/ Ormonde Road Oilfield as Sensitive Resources Areas (SRA).

The County's Stormwater Management Plan was adopted by the RWQCB in 2007, and is intended to comply with the mandatory requirements of the U. S. Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) Phase II Final Rule and the State Water Resources Control Board (SWRCB) Water Quality Order No. 2003-00005-DWQ, NPDES General Permit No. CAS000004, "Waste Discharge Requirements for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) General Permit (referred to as the "MS4 General Permit"). The USEPA developed the NPDES Phase II Final Rule under the authority of the Clean Water Act to reduce impacts to water quality from Stormwater pollution. The State of California adopted the MS4 General Permit on April 30, 2003 to implement the NPDES Phase II Final Rule in California. The County prepared their SWMP to meet the Federal and State NPDES Phase II regulatory requirements and to align existing stormwater management activities in the County with current Best Management Practices (BMPs). Working cooperatively with other agencies and with public participation and involvement, the County will use their SWMP to achieve the intent of the regulation in the most cost effective and comprehensive manner. The County permit provides a timeline for implementation over the next five years (2007-2012). Preventing stormwater pollution of our water bodies is a duty shared by the Federal, State, County, and other local governments along with each and every resident of San Luis

Obispo County. The County's Stormwater Management Program can be found at http://www.slocounty.ca.gov/PW/Stormwater/SWMP.htm

In an effort to provide a regional effort to address storm water pollution, the County administers a program called SLO County Partners for Water Quality. The Partners is an inter-agency coalition that includes the County, all seven incorporated cities, Nipomo, Los Osos, Templeton, Oceano, Cambria, Cal Poly and Caltrans.

Resource Agencies – Non-Regulatory

Within the watershed there are numerous agencies and organizations conducting activities many of which serve as a resource for landowners. Listed below are some of these organizations along with their scope of work.

Federal Agencies

Natural Resources Conservation Service (NRCS)

The Natural Resources Conservation Service (NRCS) provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

The Programs Deputy Area mission in NRCS is to manage natural resource conservation programs. These programs provide environmental, societal, financial, and technical benefits that include both on-site benefits and off-site benefits. Program benefits include many, but are not limited to, many of the following aspects:

- Sustaining and improving agricultural productivity.
- Cleaner, safer, and more dependable water supplies.
- Reduced damages caused by floods and other natural disasters.
- Enhanced natural resource bases that support continuing economic development, recreation, and other purposes.
- Grants and technical support are available to landowners interested in improving the environment with projects on their property.

State Agencies

California Department of Parks and Recreation (State Parks)

The mouth of Pismo Creek empties into the Pacific Ocean as it passes through Pismo State Beach. Both Pismo State Beach and the adjacent Oceano Dunes State Vehicular Recreation Area are managed by the Off Highway Motor Vehicle Recreation Division of the California Department of Parks and Recreation.

California Department of Transportation (Caltrans)

Several State Highway corridors cross the Pismo Creek Watershed. Caltrans maintains these facilities including existing bridges over West Corral de Piedra, East Corral de Piedra, and Pismo Creek. Any activity within the State Highway right of way will require an Encroachment Permit from Caltrans District 5 in San Luis Obispo.

California Coastal Conservancy

The Coastal Conservancy, while not a regulatory agency, is a state agency that works with the people of California to preserve, improve, and restore public access and natural resources along the coast and around San Francisco Bay.

Local Agencies

Coastal San Luis Resource Conservation District (CSLRCD)

Resource Conservation Districts (RCDs) are local units of government organized by local residents under State law (Division 9 of the California Public Resources Code), and have a long-standing partnership with the NRCS. The Coastal San Luis Resource Conservation District (CSLRCD) is considered a legal subdivision of the State of California. Under state law, the CSLRCD is responsible for soil and water conservation work within its boundaries. The Directors of the Coastal San Luis RCD are appointed by the County Board of Supervisors, and they are not compensated for their work. The Board of Directors can make legal agreements with county, state and federal governments for work in the district. Associate directors may be appointed by the CSLRCD to assist in special areas of interest. Consultants and other individuals with special expertise may be called upon to achieve conservation goals. A characteristic unique to Resource Conservation Districts is their ability to work directly with landowners on private lands. The CSLRCD's work is funded via grants from federal, state and local agencies.

The CSL RCD has worked with the SLO County Agriculture Commissioner's office to set up an alternative review program for Level Three agricultural grading projects within the district, which includes the entire Arroyo Grande Creek watershed. Applicants for County agricultural grading permits may elect instead to use alternative review, inspection, and sign-off through the CSL RCD, rather than go through the County permit process, if their project fits the criteria of a Level Three project (as defined in County Land Use Ordinance, Title 22, Grading and Drainage: 22.52.050.C.2.c.). Level Three eligible projects include many standard agricultural grading projects on a natural grade of over 30 percent, or which involve runoff management systems or construction of stock ponds, or are otherwise not exempt from permit requirements under Levels One and Two.

Central Coast Salmon Enhancement

Salmon Enhancement is a nonprofit, tax-exempt, volunteer corporation dedicated to the enhancement and restoration of the Central Coast Salmonid fishery, and local creek and watersheds. Salmon Enhancement is also devoted to educating the community on the ecology and economy of these resources. Salmon Enhancement operates a Chinook salmon enhancement program in Avila Bay, watershed restoration efforts, Trout in the Classroom educational program, and partners with local and regional groups in creek clean up efforts.

Relationship to Other Existing Plans

In an effort to coordinate resources and avoid duplication of efforts, CCSE has actively participated as allowed in the development and review of plans that affect the watershed. CCSE and the Arroyo Grande Watershed Forum members will continue to monitor the progress of these plans and their implementation as it affects the activities of this management plan.

San Luis Obispo County Fish Passage Design Plan

The State Coastal Conservancy funded the Land Conservancy of San Luis Obispo County to prepare engineering designs, environmental documentation, and permit applications for fish passage improvements in San Luis Obispo coastal streams (State Coastal Conservancy staff recommendation, January 29, 2004). The plan identifies two priority barriers in the Pismo Creek watershed; the fish ladder at the railroad crossing of Pismo Creek and the Righetti Dam on West Corral de Piedra Creek.

Central Coast Region Basin Plan (1994), California Regional Water Quality Control Board
The goal of the Central Coast Region Basin Plan is to show how the quality of the surface and ground waters in the Central Coast Region should be managed to provide the highest water quality reasonably possible. The plan lists the various water uses and describes the water quality level that must be maintained to allow those uses. The Regional Board implements the Basin Plan by issuing and enforcing waste discharge requirements to individuals, communities, or businesses whose waste discharges can affect water quality. The Basin Plan is implemented by encouraging water users to improve the quality of their water supplies. Public works or other projects that affect water quality are reviewed and their impacts identified. The Central Coast Regional Board has jurisdiction over a 300-mile long by 40-mile wide section of California's central coast. Its geographic area encompasses all of Santa Cruz, San Benito, Monterey, San Luis Obispo, and Santa Barbara Counties.

The Pismo Creek Watershed Management Plan clearly addresses aquatic habitat, land management and groundwater issues at the watershed scale.

Storm Water Management Plans – National Pollution Discharge Elimination System (NPDES)
The County of San Luis Obispo and the City of Pismo Beach have each prepared Storm Water Management Plans as required under NPDES Phase II permitting http://www.epa.gov/npdes/. Stormwater Management Plans serve as a framework for identifying, assigning, and implementing control measures and Best Management Practices (BMPs) intended to reduce the discharge of pollutants and protect downstream water quality. These BMPs affect the activities of developers, business owners and landowners in terms of water and stormwater.

The County Stormwater Management Program encompasses the designated unincorporated urbanized areas of San Luis Obispo County and can be found at
http://www.slocounty.ca.gov/PW/Stormwater/SWMP.htm

The City Stormwater Management Program is being reviewed by the RWQCB and is expected to be adopted in 2009.

San Luis Obispo Integrated Regional Water Management Plan (2005), San Luis Obispo County
The San Luis Obispo Integrated Regional Water Management Plan identifies five water management planning objectives which include water supply, water quality protection and improvement, ecosystem preservation and restoration, groundwater monitoring and management and flood management.

The Pismo Creek watershed falls in the Five Cities Water Planning Area. Immediate-term implementation priorities in the watershed include the County Conservation Element and Agriculture and Open Space Element and a Low Impact Development Program.

City of Pismo Beach General Plan

The City's General Plan is the blueprint for land use and development within city limits. Planning areas are used to focus land use and design standards. The watershed contains portions of the Commercial Core (LU-K), Pismo Creek (LU-L), Pismo Heights (LU-P), Pacific Estates (LU-N-3), Pismo Oaks (LU-N), Industrial (LU-I), and Price Canyon (LU-R) Neighborhood Planning Areas. Adjacent to Pismo Creek are the Commercial Core, Pismo Creek, Pacific States and Price Canyon Planning Areas.

Policies found in the General Plan are guiding principles and not legal regulations.

Conservation and Open Space Element

The Conservation and Open Space Element of the General Plan contains several policies on creek protection. Policy on Pismo Creek protection (CO-21) (a) defines riparian buffers as 25 to 100 feet depending on the location, (c) requires new development to dedicate the buffer in an easement, (b, d and e) limits development, (f) limits impacts, (g) does not allow channeling and (h) requires a resource assessment and protection plan. Policy on riparian habitat (CO-14) requires a biotic resources management plan that shows that no significant disruption of riparian vegetation will occur and that grouping of trees will be preserved. Policy on creek protection limits channel activity, requires revegetation and restoration, prohibits alteration of existing drainage patterns and requires runoff plan (CO-28). The City also requires soil conservation measures (CO-30), prohibits construction on erodible soils and has detailed grading requirements (CO-31 and 16.52.020).

Additional policies that affect future development and resource protection along natural drainages like Pismo Creek are found in the Land Use Element, the Parks and Recreation Element, the Design Element and the Circulation Element.

San Luis Obispo General Plan
The following are summaries of General Plan policies that are relevant to the Pismo Creek watershed. The summaries are broken down by element.

Land Use Element (Inland Framework for Planning)
The Land Use Element contains policies and procedures that apply to the unincorporated area outside the coastal zone, and defines how the Land Use Element is used together with the Land Use Ordinance and other adopted plans. The Element also explains the criteria used in applying land use categories and combining designations to the land, and the operation of the Resource Management System. Combining designations are special map categories that identify areas of unique resources or potential hazards that necessitate more careful project review.

Conservation Element
The Conservation and Open Space Element outlines policies to protect and preserve natural resources. The Element is in the process of an update initiated in 2006. The draft plan is in a public comment period with Planning Commission hearings in February 2009 and Board of Supervisors hearings scheduled for August 2009. There is an existing Conservation Element included in the "Environment Plan" from 1974.

Agriculture and Open Space Element
The Agriculture and Open Space Element outlines policies for the development and management of agricultural and open space lands within the County’s jurisdiction, and is focused on “wisely managing and protecting these important land resources in San Luis Obispo County.” Recognizing the value of agriculture to the economy and character of the county as a whole, the goals of the plan are to support agricultural production, conserve and protect agricultural lands and resources, and encourage public education and participation in their management. Open Space contributes in large part to the quality of life enjoyed in San Luis Obispo County; the County’s goals are to identify, protect, and manage the existing open space by preventing urban sprawl and encouraging public education and participation in the decision making process. The protection of open space is considered essential to the preservation of the rural nature and lifestyles that characterize the county.

Additional planning documents relevant to the watershed include the San Luis Bay Inland Area Plan, the San Luis Bay Coastal Area Plan, the San Luis Obispo Area Plan, and the Los Ranchos Edna Village Specific Plan.

Chapter 5 Conclusion

A coordinated and agreed upon course of action has been outlined with the completion of this plan by the stakeholders listed in the acknowledgement section of this document. Additional stakeholders will be approached to participate as implementation of the recommended projects continues with the direction of the steering committee.

Although preliminary assessment of the creek for water quality indicates that water quality is generally good, the critical issues of bacteria levels in fresh and ocean water, sediment and erosion, and low flows should be further studied and simultaneously managed for improvement. The hydrologic dynamics of Pismo Creek regarding water quantity during the dry season has large implications for the issues surrounding water quality. However, more information needs to be gathered to make solid connections between cause and effect. In addition, the closely related near-shore ocean environment should be assessed for connections to the watershed. Immediate treatments for bacteria and sediment will reduce the likelihood of the eventual Total Maximum Daily Load listing of the creek.

As development continues to be considered in the watershed, the following questions for watershed management are posed to guide the next phase of planning for sustainable watershed management.

- Is Pismo Creek fully appropriated? What tools can be used to protect in-stream flow for Steelhead trout?
- What role do Low Impact Development programs have to reduce run off and maintain base flow?
- What role does storm water have in maintaining base, peak and attractant flows?
- How can watershed management be achieved through private and public partnerships so that in stream flow is protected?

The often times conflicting pressures of environmental regulation and private property rights are tantamount to address as water resources get stretched in times of drought and perhaps prolonged climate change induced changes in an already arid coastal watershed.

Through the development of the plan, landowners, community members, agencies and organizations working and living within the watershed have gained new perspectives about other stakeholders' needs and the resources the community depends upon. The participatory nature of this planning process ensures that projects of community concern and support are considered and that the original intentions of the watershed stakeholder group are upheld.

Landowners and land managers can use the information on agency jurisdiction and restoration recommendations to implement projects that benefit not only their own property but the environment as well. Municipalities associated with the watershed will be called upon to consider the information within the plan to take regulatory, policy and/or project action for the benefit of their communities. To strengthen and increase the documents utilization, the steering committee will seek support from regional municipalities and regulatory agencies in an effort to familiarize them with the grassroots effort to enhance and restore the watershed.

Financial support for watershed actions will be developed using this plan as a basis for grant applications. Landowners and municipalities will be better able to secure funding to complete projects defined in the plan. Funding opportunities may be available for on the ground projects, installation of management practices and for landowners interested in easements to achieve specific objectives.

Acknowledgements

The Pismo Creek/Edna Area Watershed Management Plan developed in two phases. Phase 1 was made possible with funding provided by the City of Pismo Beach arising from a settlement of violation order number R3-2005-0009 resulting from action against the City by the Regional Water Quality Control Board finalized on March 24, 2005. Subsequent to the settlement, Salmon Enhancement entered into a Supplemental Environmental Project (SEP) contract with the City, which has contributed expertise, guidance, access to documents and much assistance in making this document possible. Phase 2 was made possible with funding provided by the California Department of Fish and Game, Fisheries Restoration Grant Program.

The plan was prepared by Stephnie Wald with grateful assistance of Nicole Smith and staff intern, Sarah Diringer for research and editorial assistance as well as formatting the document for publication. The preparation of Phase 1 of the plan was supervised by Connie O'Henley and Greg Ray, City of Pismo Beach, and Phase 2 by Sarah Paddack, Central Coast Salmon Enhancement, and Margaret Paul, California Department of Fish and Game. Community input came from dozens of residents and landowners who attended watershed tours and watershed forum meetings. Additional community support came from individuals and businesses which provided meeting places at no cost. The backbone of the plan is the Steering Committee comprised of the following people who contributed valuable information and assistance and are acknowledged below.

Charles Amian
Pismo Coast Village RV Resort

Mark Barnett
Natural Resource Conservation Service

Dan Dixon
Property Owner

Dennis Doberneck
California State Parks

Ronnie Glick
California State Parks

Dave Highland
California Department of Fish and Game

Jay Jamison
Pismo Coast Village RV Resort

Robb Tibstra
California Department of Fish and Game

Gene and Sally Kruger
Property Owner

Nancy LaGrille
California State Parks

Sorrel Marks
Regional Water Quality Control Board

Howard Mankins
Property Owner

Judie and Frank Martinez
Property Owners

Joanne Miller
Plains Exploration and Production

Margaret Paul
California Department of Fish and Game

Greg Ray
City of Pismo Beach

Gary Ruggerone
Property Owner and Cal Trans

Julie Thomas
Coastal San Luis Resource Conservation District

Ted Ehring
City of Pismo Beach City Council

Stephnie Wald
Central Coast Salmon Enhancement

Jean-Pierre Wolff
Property Owner

Rick Ziel
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Deb Bowdey and Dave Watson
King Ventures

Steve Dittman, Frank Lindsay, Effie McDermott
Friends of Price House

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