

**DRAFT 4**  
*City of Goleta, California*  
May 2004  
**BACKGROUND REPORT NO. 24**

**Hydrology and Water Quality**

## **INTRODUCTION**

This background report describes the hydrological characteristics of the City of Goleta. The City of Goleta's hydrological features consist of creeks and associated flood plains, ponds, wetlands, and the Ocean.

While this report provides an overview of these resources, other reports examine particular areas or issues in the City in greater depth. These reports include Ellwood Mesa Open Space Plan and the related Environmental Impact Report: Comstock Homes Development and Ellwood Mesa Open Space Plan, March 2004, Goleta Slough Ecosystem Management Plan, December 1997, and Water Quality Analysis Report, County of Santa Barbara, December 2003.

## **PLANNING IMPLICATIONS**

Since hydrological features shape the land forms of an area, these features contribute to the physical character of the community. Hydrological forces create these land forms through processes such as erosion and flooding. These processes in turn pose constraints and hazards for use and development.

Water, as the basis for all life, creates the environment for the community's biological resources and ecology. Modification of the hydrological system, either by physical alteration or by change in water quality, will affect these biological systems. The potential of adverse impacts associated with development is an important constraint on how land might be used, developed or managed. Water and its quality affects other aspects of the quality of life since water is the basis of many recreational activities.

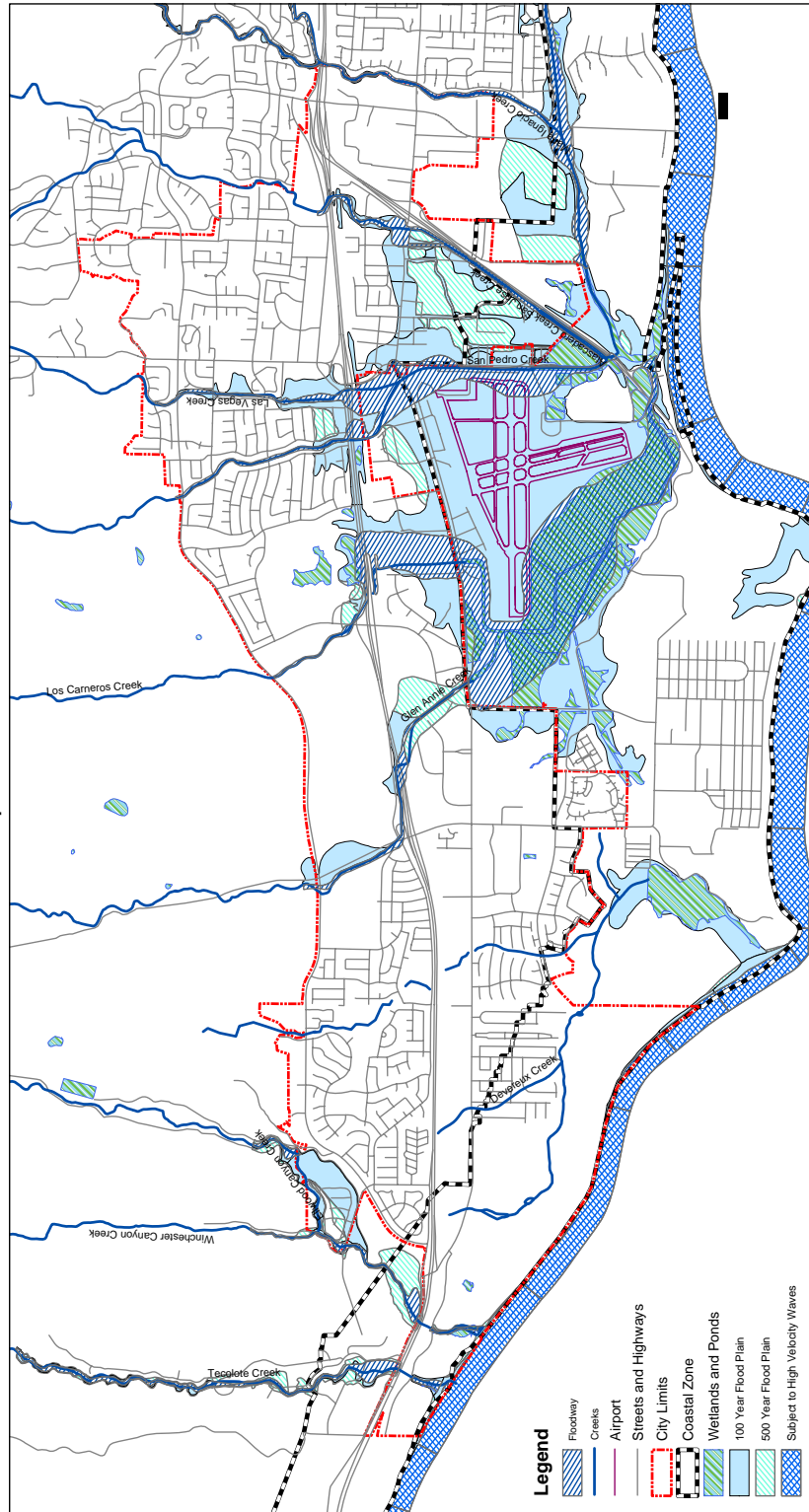
## **GENERAL TOPOGRAPHY AND DRAINAGE**

The City of Goleta is situated in the western portion of the Goleta Valley. The Goleta Valley is a broad, flat alluvial plain bordered on the south by the Pacific Ocean and on the north by the foothills and terraces of the foreland of the Santa Ynez Mountains. Much of the Valley slopes gently into Goleta Slough that the central part of the City wraps around. Many creeks drain the Valley and the foothills from the north to the south into the Ocean. At the western most end of the City two creeks, Winchester Canyon and Tecolote, drain a small portion of the City directly into the Pacific Ocean. Most of the rest area of the City is drained by creeks into two sloughs found to the south of the City; Goleta Slough and Devereux Slough. Both sloughs have large expanses of wetlands and estuarine habitats. The larger of the two, Goleta Slough is now less than half its original size, having been extensively filled for the development of the Santa Barbara Airport and other uses.

Several areas along the major creeks are flood prone and the map identifies those areas that have been designated by FEMA as being within the 100 year flood plain. The more notable is the flood plain associated with San Jose Creek and San Pedro/Las Vegas Creeks that include two of the City's three major commercial areas.

Map 1

City of Goleta, California  
Major Hydrological Features  
April 2004



## COAST

The City limits reach the coast only in the western half of the City. Although the City is nearly seven miles in length along Highway US 101 east to west, the City's coast line is approximately two and half miles long. The rest of the City is separated from the Ocean by the community of Isla Vista, the University of California at Santa Barbara and the Santa Barbara Airport.



Coastal Bluffs with Old Wooden Bulkhead



Lowland Area in the Western Portion of City

Most of the coastline is a mesa consisting of a high bluff, 40 to 85 feet above sea level. The only lowland areas abutting the beach are found at the western end of the Golf course property (south of the Veneco Plant) and the eastern Bacara parcel where Tecolote and Winchester Creeks have cut paths to the sea.

The bedrock of this mesa is primarily composed of Monterey shale. The

weaker rocks in this formation are easily eroded by coastal wave action, wind erosion, and rainfall. The erosive processes are enhanced by surface water runoff, saturated soils. Human activity has also contributed to the erosion.

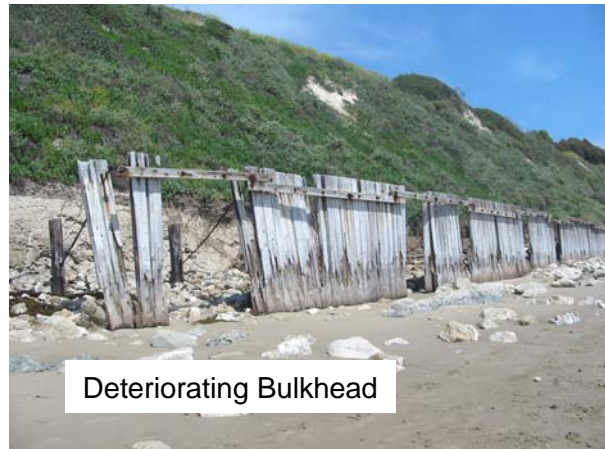
Coastal wave action continually erodes and deposit sands all along the coastline, changing the characteristics of the beaches on a regular basis. Storms and high tides erode the base of cliffs causing the bluffs to gradually recede. Protective wooden and



Access Point Showing Erosion

rock structures have in the past been erected at the base of the bluff to protect the land from these coastal processes. Most of the wooden structures have now deteriorated providing little protection.

The sea level is currently rising. Sea levels have risen approximately 6 inches in the last 100 years and continue to rise at a rate of 1.8 mm per year. Continuation of this rise in sea level would likely result in increased rates of sea cliff erosion and retreat, loss of beaches and



Deteriorating Bulkhead

higher flood and tsunami hazards along the lower areas of the coast.



Past Mining Activity in Coastal Area.

While much of this area appears to be relatively undeveloped, it has in the past been the site of intense human activity in the form of extensive oil drilling. Today most of the oil excavation and processing activity has left the area, however remnants of these prior activities remain behind.

These remnants include abandoned oil wells, deteriorating bulkheads, scattered ruins of structures and roads as well as two piers south of Sandpiper golf course. Most of



Off Shore Oil Mining

present day oil and gas mining occurs offshore with gas and oil piped to the Veneco Facility for processing.



Veneco Plant

Human activity today consists of a wide variety of passive recreational activity, walking and hiking, beach



combing, sunbathing, bird watching and nature appreciation (especially associated with the Monarch Butterflies that winter in the Eucalyptus Groves on the Mesa), as well as other activities. More active recreational activity consists of surfing, surf fishing, bike riding, running, horse riding and similar activities that do not involve developed facilities. Developed active recreation consists of golfing at Sandpiper golf course and recreational facilities such as guest

tennis courts at the Baccara Resort. Only five separate legal parcels of land abut the coast.

Almost 60% of the area of the City that is formally designated as the coastal zone in the city (excluding right of ways) is in these five parcels (these parcels consists of 75% of the area in the designated coastal zone that lies between the City's beach front and its abutting upland areas. About 40% of the coastline consists of two parcels described in detail in the Elwood Mesa Open Space Plan and supporting Environmental Impact Report.



Approximately 45% of the coastline consists of the Sand Piper Golf Course. The remaining two parcels are the Bacara Resort site. Public access is available through the Bacara Resort and at two places in the Ellwood Devereux Open Space area. The Veneco Company owns a triangular parcel surrounded by the property owned by the Golf course. This site is used for oil and gas processing of crude oil obtained from offshore. Easements through the golf course provide access for Veneco to two piers located along the beach front of the golf course.



## CREEKS

Several creeks drain the Goleta Valley and the foothills through the City of Goleta into the Ocean. Many of these creeks, including Glenn Anne Creek, Los Carneros Creek, Carneros (outside the City), San Pedro and Las Vegas Creeks, San Jose Creek and, on the eastern edge of the city Maria Ignacio and San Antonio Creeks drain into the Goleta Slough. Several smaller creeks, including Devereux Creek and El Encanto Creek



Typical Creek Beds



drain Western Goleta into Devereux Lagoon (Slough). Other creeks, including Tecolote Creek, Winchester Canyon and Ellwood Canyon Creeks cross the Valley in the western portion of the City and drain directly into the Ocean,.

The creeks that drain into Goleta Slough drain an area of 45 square miles. Large amounts of sediment and debris is contained in the runoff from these areas, ultimately to be deposited in the slough.

The Devereux Slough watershed is much smaller than the Goleta Slough watershed. The creeks that drain into Devereux Slough drain an area of 2,240 acres (3.5 square miles) both within and outside the City. Elevations in this watershed range from 0 to 580 feet above sea level



Typical Concrete Channel

The physical character of the creek beds in the City vary. Some creeks beds (as identified on Map 1, have been extensively modified with concrete floors and banks as means to protect adjacent properties from flood or erosion. Such concrete structures may cover all of the creek bed and banks (as shown in the accompanied picture) or may have only one bank so constructed. Similar concrete

modifications are also found at road crossings. Other creeks beds may still be relatively natural in character without extensive modification.

Many of the creek beds and tributaries have a high erosion potential, as



Severely Eroded Gully



Similar Gully with Vegetation

illustrated in the attached photographs. Such erosion not only damages adjacent areas, posing as a constraint to its use and development. Such erosion also



increases sedimentation in the creek beds and sloughs. Vegetative cover does serve to reduce the rate and extent of this erosion.

## FLOOD AREAS AND HAZARDS

There are 640 (about one square mile) acres within the FEMA designated 100 year flood plain within the City of Goleta. This is approximately 12% of the entire area of the City. 168 of these acres (about one quarter of the entire amount are in the Old Town area east of Fairview. About 2.9 million square feet of buildings (as measured by building footprints) are located in these designated areas.

Most of the developed area subject to flooding is along creeks flowing into Goleta Slough. The natural and engineered drainage systems cannot contain periods of high runoff through five major creeks in this area.

Maria Ygnacia Creek drains a watershed of 4,535 acres capable of producing 100 year flood volumes of 8,000 cubic feet per second, flooding about 14 acres in the City along the creek's banks. A larger area adjacent to the City is also within this creek's 100 year flood plain. Most of this latter area is in the property commonly known as the Paterson Agricultural Block. San Jose Creek drains a 5,503 acre watershed capable of generating a 100 year flood of 5,400 cubic feet per second.

The San Jose Creek flood plain covers most of Old Town encompassing about 186 acres. A small flood area is found along the old San Jose Creek bed that runs diagonally through the Old Town area south of Hollister. This historic channel during flood periods carries overflow from the main San Jose channel. The area between this channel and the rest of the San Jose flood plain is subject to a 500 year flood by FEMA. San Pedro Creek drains a 4,555 acre watershed capable of producing a 100 year flood of 6,100 cubic feet per second. Carneros Creek drains a 2,667 acre watershed capable of producing a 100 year flood of 3,600 cubic feet per second.



## WATER BODIES

Water bodies in the City of Goleta are Lake Los Carneros and an array of wetlands. Lake Los Carneros, surrounded by Lake Los Carneros Preserve, is located in the central part of the City,. Lake Los Carneros is 22 acre manmade freshwater lake. The lake supports an extensive bird population and

three freshwater game fish. Originally the lake was a “duck pond” (“patera” in Spanish) at the northern reaches of Goleta Slough. The main lake has been in existence since 1890 at which time it was a small weed-choked stock pond. The dam creating this pond was raised in 1932 and again in 1947. At that time the dam’s spill elevation was 57.5 feet creating a lake as large as 51 acres. In the mid 1960s the dam’s spill level was lowered to 47.7 feet. The lake has 108 acre feet of water at the spill level of the dam. The lake has high nutrient content supporting a high biological productivity of plants and insects. A 1978 sedimentation study indicated the lake would gradually fill at current rates in about 200 years. The primary water sources are direct precipitation and surface run off with little subsurface inflows.<sup>1</sup>



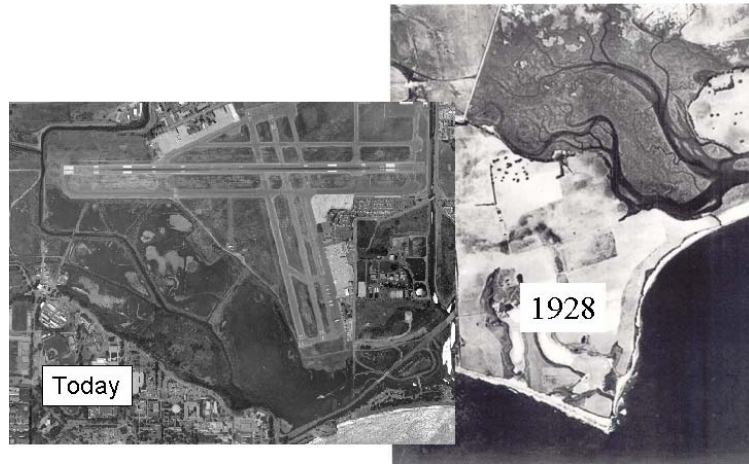
The wetlands range from large areas illustrated on Map 1 to many small wetland areas dispersed throughout the community that are too small for mapping or easy identification without field investigation. Wetlands vary in type including vernal pools,<sup>2</sup> coastal salt marshes, freshwater marshes and riverine wetlands.

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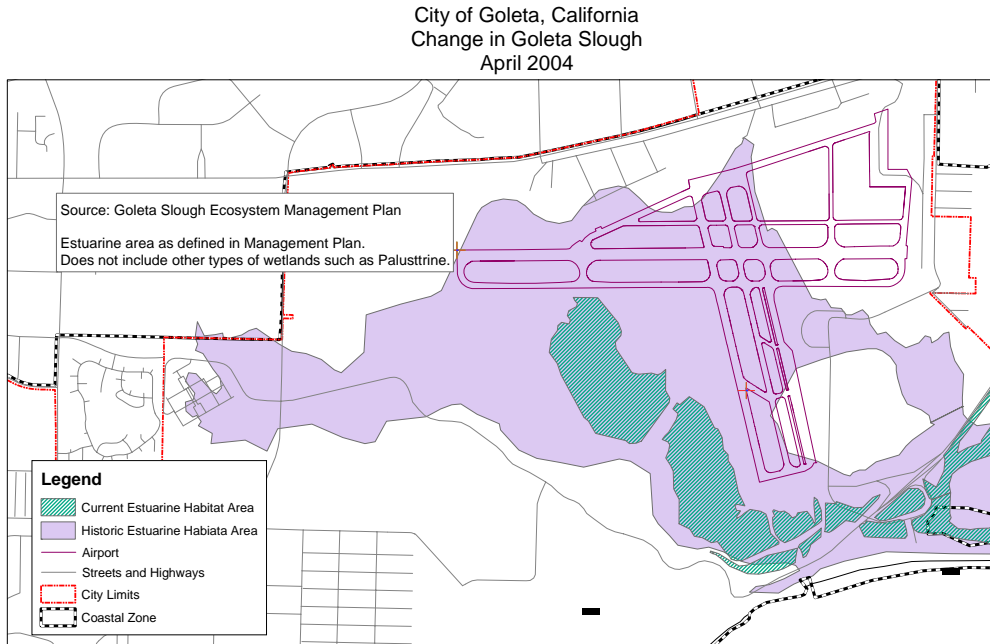
<sup>1</sup> Lake Los Carneros Natural & Historical Preserve, Penfield and Smith Engineers, Inc, and Royston Hanamoto Alley and Abey for Santa Barbara County, 1987, pages 1, 5 and 10.

<sup>2</sup> Vernal pools are topographic depressions with underlying claypan layers that prevent the water from percolating through the subsurface. Water accumulates in these pools during the winter; eventually these pools dry due to gradual subsurface drainage and evaporation remaining dry through the summer

The dominant hydrological feature of the Goleta Valley is the Goleta Slough located just outside the City limits to the south. While the slough has been heavily impacted by development and other human activity it nonetheless continues to support a rich and diverse coastal ecosystem. The extent of the modification to the slough has been extensive as illustrated on the aerial photographs of the Slough in 1928 compared to today. Map 2 compares the loss of estuarine area from historic times to today. The area mapped as estuarine is estuarine habitat as defined by the Goleta Slough Management Plan. While this area does not include all of the important wetland areas that are associated with an estuary it does identify the heart of the system. The map illustrates a loss in direct estuarine habitat from about 665 acres to 113 acres.

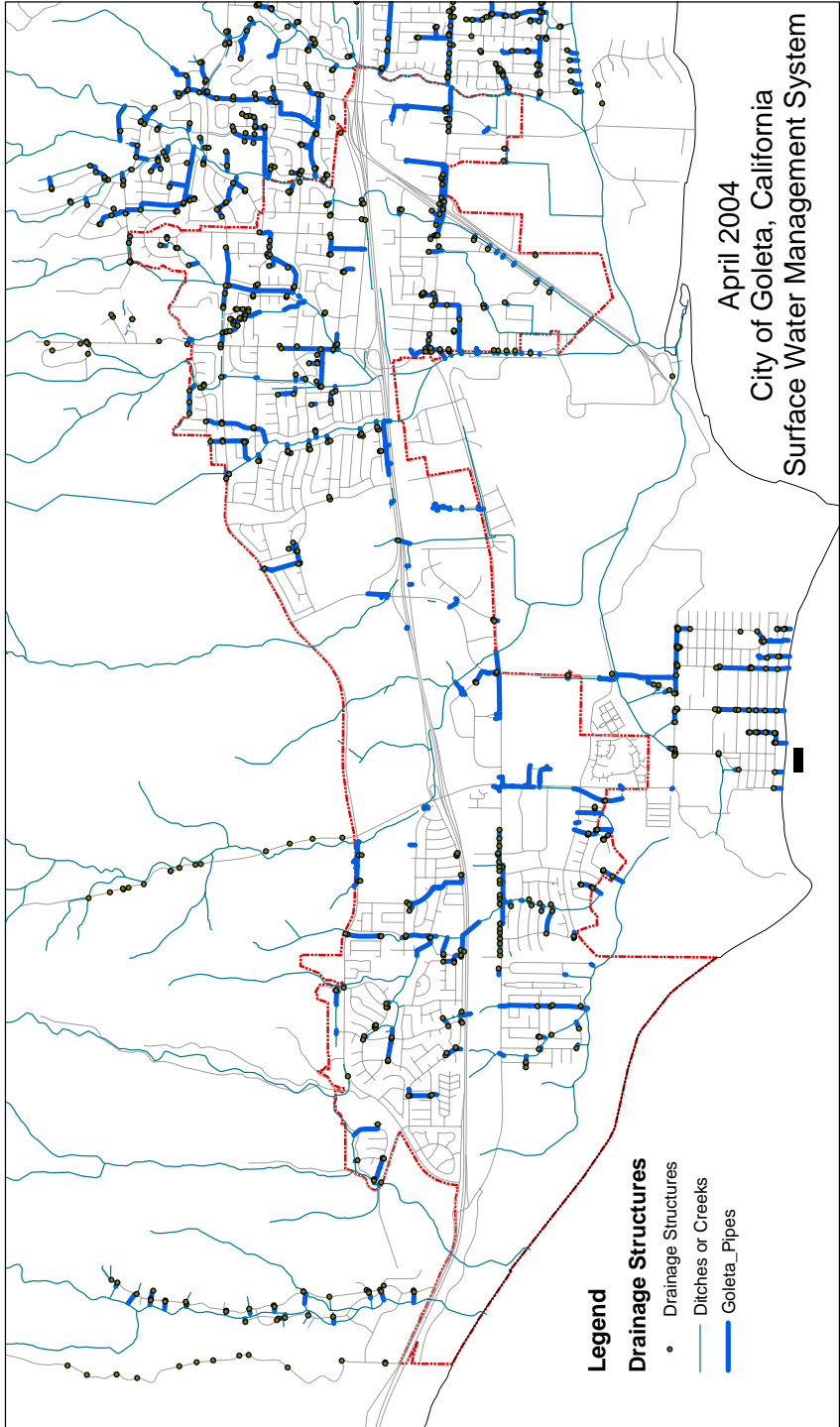


Map 2



# DRAINAGE FACILITIES

Map 3



In addition to the designated flood plain hazard areas designated on Map 1. The City of Goleta also has areas that are subject to localized drainage problems and maintains a system of drainage facilities to manage drainage. Map 3 identifies the facilities in the city associated with this program.

## **WATER QUALITY AND HEALTH OF AQUATIC SYSTEMS**

Since the late 1920s coastal development has led to a decline in coastal ecosystem health. Coastal wetlands and estuarine habitats were seen as breeding grounds for pests and as developable areas. Private and governmental actions led to the filling of wetland areas, and encroachment on and substantial modification of stream beds. The coastal sloughs and related creeks in the Goleta Valley were no exception to these processes. Past human activity created significant ecological impacts on the physical character and the health of the water systems. These actions have also impacted the quality of water along the beaches.

### *Beach and Ocean Water Quality*

Scientific research has demonstrated a link between storm water runoff and high levels of bacteria in creeks and ocean water. Exposure to such bacteria can pose a health risk to humans. In 1995, County Environmental Health Services began testing local beaches for bacteria. The tests found that several local beaches had high levels of both fecal and total coliform bacteria. Such bacteria can cause skin rashes, sinus infections, and other adverse health affects. Figure 1 compares the testing at 19 beaches on the south coast.<sup>3</sup>

Two of the beaches shown on Figure 1 are in the Goleta Area. Goleta Beach is located just south of Goleta Slough at the Slough's outfall. Sands Beach is at Coal Oil Point just east of the Elwood Mesa. As illustrated on Figure 1 the average water quality on Goleta area beaches was generally better than other beaches to both the east and west of the City.

Bacteria levels vary from time to time. Figure 2 compares the percent of time bacteria counts exceeded standards on Goleta Area beaches compared to the average for all 19 beaches. As noted over the entire period, water quality has been better on Goleta Beaches than the average. However, since the average bacterial count has declined substantially, the average is now comparable to the beaches in Goleta.

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<sup>3</sup> Information presented here is from the Santa Barbara County Public Health Department's Ocean Monitoring program at "<http://www.sbcpd.org/ehs/ocean.htm>."

Figure 1

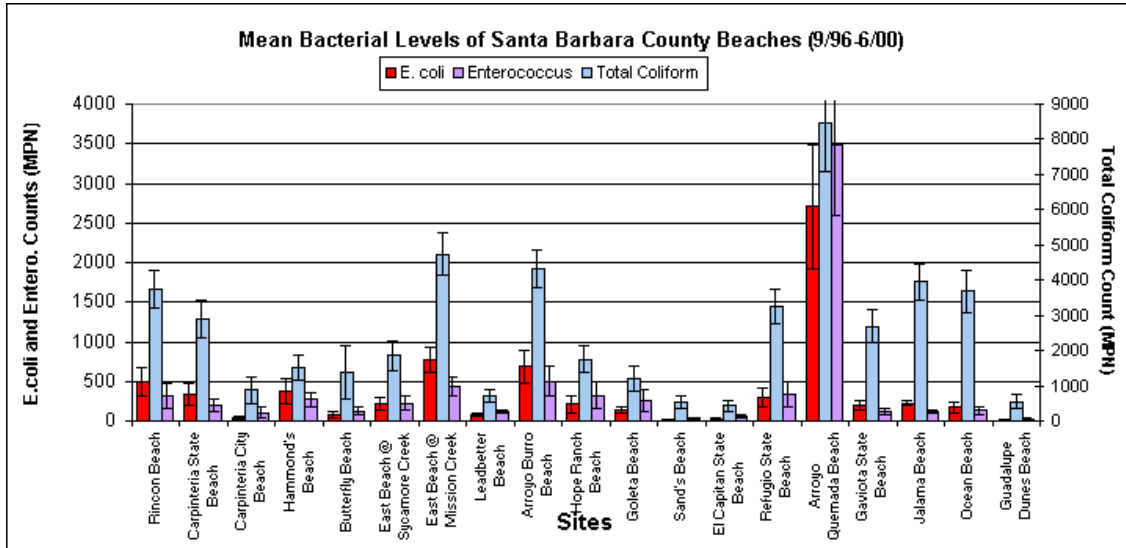
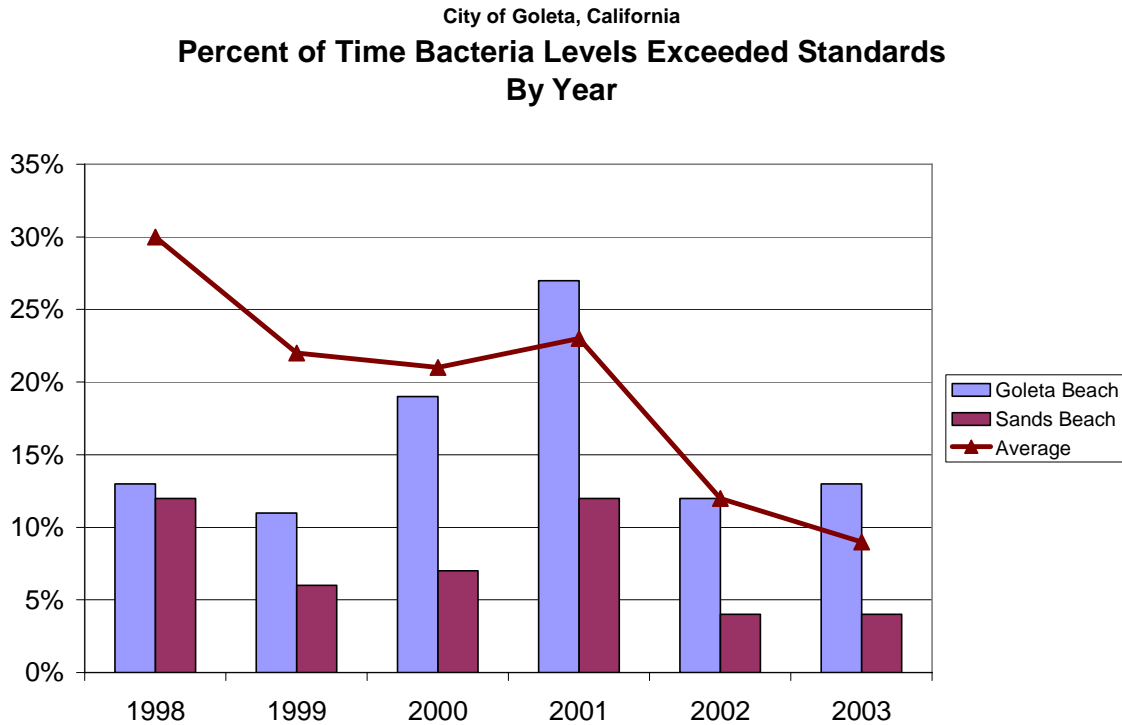


Figure 2



## *Creek and Goleta Slough Water Quality*

Not only has the extent of the Goleta Slough been reduced as described above, its water quality has also been degraded. The Santa Barbara County Project Clean Water identifies Goleta Slough as being an “impaired watershed” under section 303(d) of the Clean Water Act due to the following pollutants: metals, organic enrichment/low dissolved oxygen, priority organics, sedimentation and salination. Project Clean Water also samples five sites on San Jose Creek which drains into the slough. During 2002-03 sampling immediately following a storm (“first flush” sampling) found every sample exceeding standards for bacteria, although in most cases less than in previous years. Diazinon was detected in samples taken in the middle section of San Jose Creek (in the city).<sup>4</sup>

The Project Clean Water also samples water quality at Glen Anne Golf course just north of the City and found that water leaving the golf course was high in nitrates.

Another way to evaluate water quality is to examine the ability of a water body to support biological productivity and quality. Santa Barbara County Project Clean Water has evaluated creeks on the south coast from this perspective as well as directly sampling water quality.<sup>5</sup> In a recent Santa Barbara County study, Creeks Bioassessment Program 2003, an Index of Biological Integrity (IBI) was used to evaluate water quality in area creeks from a biological perspective. The IBI measures multiple aspects of the structure of a creek’s biological community such as the biological community’s abundance, composition, richness and diversity; as well as the capacity of the community to tolerate disturbance. The results of measuring the IBI in various creeks were compared to the amount of human disturbance that has occurred in the creeks. The study confirmed past studies which noted a relationship between the amounts of disturbance on the biological quality of the creek, the higher the disturbance the lower the overall quality. These studies found that creeks in areas subject to human disturbance had impaired water quality, and lower biological diversity. In contrast these characteristics were less associated with creeks in agricultural areas and relatively undisturbed areas.<sup>6</sup>

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<sup>4</sup> Rain Year 2002/2003 Water quality Analysis Report, County of Santa Barbara, California, December 2003.

<sup>5</sup> Santa Barbara County Creeks Bioassessment Program 2003 Annual Report and Index of Biological Integrity, February 2004, prepared by: Ecology Consultants, Inc. for County of Santa Barbara Project Clean Water and City of Santa Barbara. The Bioassessment Study included several creeks that drain into Goleta Slough; San Jose Creek, Maria Ygacio Creek, San Antonio Creek, and Atascadero Creek. It also examined Tecolote Creek in the western area of the City. While the upper reaches of these creeks were classified as “undisturbed” or “moderately disturbed,” all of them were classified as “highly disturbed” when the creek passed through developed areas in or near the city.

<sup>6</sup> *Ibid*, page 2.

The study summarized the relationship between biological quality and human disturbance as:

The severity of human disturbance in local streams is dictated by the nature and intensity of surrounding land uses. As a general observation, anthropogenic impacts appear to be more pronounced in urbanized areas compared to those in rural areas. Some of the major forms of human disturbance to local streams include: (1) altered hydrology and geomorphology due to water diversions, land clearing and development, and flood control projects, (2) sedimentation of pools and riffle substrates due to increased erosion and deposition of fine sediments from agricultural fields and destabilized creek banks, (3) degraded water quality due to pollution inputs, (4) elevated stream temperatures due to loss of overhanging riparian vegetation and shade, (5) habitat fragmentation due to the construction of in-stream barriers such as dams, road crossings, bridges, and culverts, (6) introductions of invasive, non-native plants (e.g., *Arundo donax*), and wildlife (e.g., bullfrogs and crayfish), and (7) disturbances to vegetation and wildlife associated with trampling (i.e., by cattle, vehicles, bikers, hikers, etc.), noise, lighting, air pollution, and predation by domestic pets.<sup>7</sup>

San Jose Creek in the Goleta Valley was selected by the County of Santa Barbara's Project Clean Water as a pilot project for watershed planning. San Jose Creek flows from undeveloped areas in the Los Padres National Forest through agricultural areas, into residential neighborhoods, then through Goleta Old Town before flowing into Goleta Slough. San Jose Creek is typical of the South Coast's urban creeks. Some reaches of the creek host vigorous riparian plant communities and steelhead habitat, while other areas have been significantly modified by flood control measures and development. The goal of this watershed plan is to protect existing resources and identify opportunities to improve the functioning of the creek ecosystem, while protecting existing land uses and community values.<sup>8</sup>

## PLANNING IMPLICATIONS

The area's hydrology has shaped its physical character and influences its further development. The hydrological cycle, and related water quality and biological values impose physical constraints on development. These constraints range from erosion and flood hazards to the constraints associated with reducing impacts on water quality and biological resources. Some of these constraints, such as flooding, are site specific, while other constraints, such as control of pesticide use, are dispersed and can occur throughout the planning area.

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<sup>7</sup> Ibid., page 4.

<sup>8</sup> County of Santa Barbara at "[http://www.countyofsb.org/project\\_cleanwater/sanjose.htm](http://www.countyofsb.org/project_cleanwater/sanjose.htm)."



The area's hydrological features also are a resource that supports significant human activities closely related to the area's quality of life. These include passive and active recreational activities on or in the water or adjacent lands.

The implications of various land uses and human activity on water quality and hydrology have been thoroughly identified in the initial work of developing the San Jose Creek Water Shed Plan by Santa Barbara County.<sup>9</sup> The implications identified in that work (referred to as "issues" by the study) is adapted below to describe the planning implications associated with the hydrological system, water quality and its related biological values:<sup>10</sup>

### Water Quality

- **Conversion of open or agriculture areas to residential uses or other development:** Increased buildings and related paving increases amounts and rates of runoff carrying associated pollutants.
- **Pesticide use along creek:** Pesticides can runoff from adjacent land uses or are sprayed on creek-side vegetation for flood control purposes.
- **Fertilizer use among homeowners:** Fertilizers can promote excessive growth of plants. When these plants die, oxygen is consumed in the decomposition process which creates harmful conditions for other organisms.
- **Pet Waste:** Pet waste that washes into creeks and the ocean causes high bacterial levels, leading to beach closures.
- **Septic System Use:** Faulty or poorly maintained septic systems can allow bacteria and other pollutants to migrate into creek and ocean water.
- **Dredging in Goleta Slough:** Where it empties into Goleta slough, the creek mouth is dredged each spring for flood control purposes. Dredging stirs up sediments that can release pollutants into the creek and slough, and into the ocean.
- **Leaking Underground Fuel Tanks (LUFT):** Materials from leaking tanks can migrate into groundwater and creeks.

### Habitat Changes

- **Introduction of invasive plant species, such as Castor bean, Arundo, Cape Ivy:** Some non-native plants are invasive and crowd out native plants that are adapted to stream conditions and serve valuable functions such as uptake of pollutants, stabilizing banks, and providing shade and habitat for other native plant and animal species.
- **Introduction of invasive animals such as bullfrogs:** Invasive animals pose predatory threats to native species that have not evolved survival

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<sup>9</sup> [http://www.countyofsb.org/project\\_cleanwater/sanjose.htm#IssueAreas](http://www.countyofsb.org/project_cleanwater/sanjose.htm#IssueAreas)

<sup>10</sup> The County planning study list also includes various planned and potential actions that help mitigate these impacts.

strategies to protect against the introduced predators. This can lead to other predator-prey affects within the food chain.

- **Barriers to endangered Southern Steelhead - i.e. concrete channels, old agricultural dams, and road crossings:** The Southern Steelhead is an anadromous species of salmonid fish (born in freshwater, can live in ocean, returning to freshwater to spawn) that is on the endangered species list. Once common in Santa Barbara County streams, the fish have decreased reproduction capability due to numerous migration barriers along the route to upstream spawning areas of local streams and rivers.

## Land Use

- **Sedimentation/erosion from avocado orchards, roads, etc.:** Development near or within the stream channel can destabilize banks and increase the sediment load of the creek.
- **Increased impervious areas created by urban development:** Urban development increases the amount of runoff that goes into creeks during storms.
- **Land use in upper watershed/bank failures:** Land in the upper watershed tends to be very steep, and certain land uses may contribute to slope failure/instability.

## Hydrology

- **Surface water diversions:** Water is sometimes diverted for irrigation, reducing the amount of water available for animals and vegetation.
- **Alluvial wells:** Alluvial wells pull water out of the loose sediments (alluvium) deposited by running water. This tends to lower the water level in the creek, as more water percolates into the space created by pumping.
- **Recharge and banking water in aquifers beneath creek to facilitate perennial flows:** When ground water basins in a watershed are full, more flow is available in creeks as less water percolates into the basin. During wet periods, the Goleta Water District decreases ground water pumping, which is beneficial to San Jose Creek. During dry periods, however, ground water will become the primary water supply and adversely affect flows in the creek.
- **Runoff from roads:** Roads and other paved surfaces can increase peak runoff to the creek as well as contributing pollutants.
- **Beach nourishment:** Beach sand is replaced by sediments carried to the ocean by creeks and rivers. In stream structures like debris basins, which are used to prevent flooding, capture this sediment and prevent it from reaching the beach.