Chapter 3
Safety

Introduction

This report presents background information for the preparation of the Yolo County General Plan Safety Element. Topics addressed in this report are:

- Geologic Hazards,
- Flooding Hazards,
- Wildland and Urban Fire Hazards, and
- Hazardous Materials.

Geologic Hazards

Introduction

This section describes general geologic conditions and seismic and geologic hazards in Yolo County (county). Specific topics include the following:

- general description of the county's topography and geology,
- locations of active faults within and near the county and the potential for earthquake-induced groundshaking and liquefaction, and
- landslide, subsidence, and other geologic hazards.

Sources of Information

Information reviewed in support of preparing this chapter was derived from regional geologic reports, maps, and websites of the California Division of Mines and Geology, the California Geological Survey (formerly the California Division of Mines and Geology), and U.S. Geological Survey; the Soil Survey of Yolo County, California; and the 1983 county general plan.

Key Terms

- **Active Fault:** For the purpose of fault zonation under the Alquist-Priolo Earthquake Fault Zoning Act, the California Geological Survey (CGS) defines "active" faults as those that show evidence of surface displacement during the Holocene Epoch (i.e., within the last 11,000 years).
- **Alquist-Priolo Fault Zone:** A zone delineated around active or potentially active earthquake faults that may rupture at the surface.
- **Blind Thrust Fault:** A shallow-dipping fault in which the fault plane is not revealed as a trace at the earth's surface.
- **Cretaceous:** A geologic period that extended from 135 to 65 million years before present.
- **Expansive Soil:** Soil, as defined by the Uniform Building Code (UBC), that is subject to expansion and contraction as a result of changes in moisture content. Expansive soils can damage structural foundations, pavements, and underground utilities, if not properly engineered.
- **Liquefaction:** The sudden, temporary loss of soil strength caused by groundshaking in soils saturated by groundwater. Although sandy soils are most prone to liquefaction, other unconsolidated soils may also be subject to liquefaction. Liquefaction can cause damage to the foundation of buildings and to underground utilities as a result of differing degrees of ground settlement.
- **Lateral Spreading:** A secondary effect of liquefaction, the horizontal movement or spreading of soil toward an open face such as a stream bank, the open side of a fill embankment, or the side of a levee.
- **Magnitude:** Earthquake magnitude is measured by the Richter scale, indicated as a series of Arabic numbers with no theoretical maximum. The greater the energy released from the fault movement, the higher the magnitude of the quake. Magnitude increases logarithmically on the Richter scale; thus an earthquake of magnitude 7.0 is thirty times stronger than one of magnitude 6.0. Earthquake energy is most intense at the point of fault slippage.
- **Potentially Active Fault:** As defined by CGS in accordance with the Alquist-Priolo Earthquake Fault Zoning Act, a fault that shows evidence of displacement within the Pleistocene Epoch (i.e., between 11,000 and 1.6 million years ago).
- **Quaternary:** A geologic epoch beginning approximately 1.6 million years before present.
- **Seiche:** An oscillation (i.e., wave) of a body of water in an enclosed or semi-enclosed basin caused by an earthquake or other trigger. Seiches of a significant height can inundate developed areas, threatening public safety and structures.

Geologic Hazard-Related Regulations

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act, which was signed into law by the California State Legislature in 1972, requires the State Geologist to delineate all active fault traces in the state, and to delineate appropriately wide Earthquake Fault Zones around these fault traces. The purpose of this and other requirements of the Alquist-Priolo Act is to prevent the construction of habitable structures near active faults without first conducting detailed fault-rupture hazard investigations (Hart and Bryant 1997). In the event that a site contains a known active fault, habitable structures must be set back a minimum of 50 feet from the trace (California Department of Mines and Geology 1997).

Seismic Hazards Mapping Act

Like the Alquist-Priolo Act, the Seismic Hazards Mapping Act of 1990 (PRC Sec. 2690–2699.6) is intended to reduce damage resulting from earthquakes. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong groundshaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act: the state is charged with identifying and mapping areas at risk of strong groundshaking, liquefaction, landslides, and other corollary hazards, and cities and counties are required to regulate development within mapped Seismic Hazard Zones.

Under the Seismic Hazards Mapping Act, permit review is the primary mechanism for local regulation of development. Specifically, cities and counties are prohibited from issuing development permits for sites within Seismic Hazard Zones until appropriate site-specific geologic and/or geotechnical investigations have been carried out and measures to reduce potential damage have been incorporated into the development plans.

To date, seismic hazard maps have been prepared for parts of the San Francisco Bay Area and in the Los Angeles area; no such maps are presently available for the county.

California Building Standards Code

The State of California's minimum standards for structural design and construction are given in the California Building Standards Code (CBSC) (California Code of Regulations, Title 24). The CBSC is based on the UBC, which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis), and has been modified for California conditions with numerous, more detailed and/or more stringent regulations.

The CBSC requires that "classification of the soil at each building site … be determined when required by the building official" and that "the classification … be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity shall be shown on the (building) plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including but not limited to excavation, grading, and earthwork construction; fill placement and embankment construction; construction on expansive soils; foundation investigations; and liquefaction potential and soil strength loss.

Topography and Geology

Elevations in the county range from slightly above sea level in the southeastern corner of the county to more than 3,000 feet in the Coast Ranges.

The county is partly located in the Great Valley geomorphic province and partly in the Coast Ranges geomorphic province of California, both described below.

The Great Valley part of the county consists of gently sloping to level alluvial areas and composes roughly 70% of the land area. Geologic units in this part generally consist of Quaternary alluvium and Quaternary basin deposits and the Quaternary Modesto and Riverbank Formations, both of which consist of older alluvium. Projecting into the valley area northwest of Woodland are the Dunnigan Hills. These consist of dissected and rolling terraces of the Tehama Formation (non-marine sandstone, siltstone, and volcaniclastic rocks) (Wagner et al. 1981).

The Coast Ranges part of the county consists of moderately sloping to very steep uplands and terraces and is characterized by parallel ridges and valleys that trend slightly west of north (Andrews 1972). The rocks in the Coast Ranges part consist of a number of Quaternary and Cretaceous geologic formations, including upturned marine sandstones, shales, mudstones, and conglomerates, with some volcaniclastic rocks (Wagner and Bortugno 1982). A small area of ultramafic rocks, one of which may be serpentinite, occurs along Little Blue Ridge, west of Rumsey (Churchill and Hill 2000).

Seismic Hazards

Surface Fault Rupture

The only fault in the county that has been identified by the California Division of Mines and Geology (1997) to be subject to surface rupture (i.e., is in an Alquist-Priolo zone) is the Hunting Creek Fault (sometimes referred to as the Hunting Creek-Berryessa Fault) (Figure Geo-1). The fault is located in a sparsely inhabited part of the extreme northwestern corner of the county. Only a very short section of the fault occurs in the county; most of the trace extends through Lake and Napa counties. The Hunting Creek Fault is a right-lateral fault and has an average slip rate of 6 mm per year. Its maximum expected Richter magnitude is 6.9 (California Geological Survey 2003).

Other Faults and Groundshaking

Except for the Hunting Creek Fault, the only other active or potentially fault in the county is the Dunnigan Hills Fault, which extends west of Interstate 5 between the town of Dunnigan and northwest of the town of Yolo (Figure Geo-1). The fault has shown displacement during the Holocene (i.e., the last 10,000 years), but not during historic times (Jennings 1994). This fault is considered potentially active, but is not within an Alquist-Priolo Earthquake Fault Zone (California Division of Mines and Geology 1997), and therefore is not subject to surface rupture.

A number of faults (e.g., Capay, Sweitzer, and West Valley faults) occur in the western part of the county (Figure Geo-1), but these show displacement more than 1.6 million years ago. Accordingly, these faults are generally considered inactive. No known faults are located in any of the major inhabited areas of the county.

The Midland Fault, which is not shown on the Fault Map of California (Jennings 1994) (upon which Figure Geo-1 is based), is depicted on a larger-scale regional geologic map from 1981 (Wagner et al. 1981). On the regional map, the Midland Fault extends only a short distance into the county near Winters. The 1892 Vacaville-Winters earthquake (discussed below) was once attributed to the Midland Fault. The quake is now regarded by the California Department of Conservation (2004) to have originated from a segment of a complex zone of blind thrust faults on the western side of the lower Sacramento Valley.

In addition to the Hunting Creek and Dunnigan Hills faults, major faults in the Coast Ranges and in the Sierra Nevada foothills are capable of producing groundshaking. As shown in Figure Geo-2, the county is subject to range of groundshaking levels. The April 19, 1892 Vacaville-Winters earthquake measured approximately 6.9 on the Richter scale and caused severe damage in Winters and lesser damage in Davis, Woodland, and elsewhere in the county.

In the county, the effects of groundshaking during a probable maximum intensity earthquake is likely to involve structural damage to stucco, masonry walls, and chimneys, which could expose people to falling objects and possible building collapse. The degree of such hazards is controlled by the nature of the underlying soil and rock materials, the magnitude of and distance from the quake, the duration of ground motion, and the structural characteristics of the building.

Earthquake-Induced Liquefaction

No map of liquefaction hazard has been prepared on a countywide basis. The Coastal Ranges part of the county would generally have a low liquefaction hazard, except in the intermountain valleys underlain by alluvium and shallow groundwater. Liquefaction is expected to be relatively higher in the Great Valley portion, particularly along the floodplains of streams, where the sediments are generally sandier than other areas.

Liquefaction may also lead to lateral spreading. Areas most prone to lateral spreading are those that consist of fill material that has been improperly engineered, that have steep, unstable banks, and that have high groundwater tables. The banks along the Deep Water Ship Channel and Turning Basin in West Sacramento may have such a condition. Damage caused by liquefaction and lateral spreading is generally most severe when liquefaction occurs within 15 to 20 feet of the ground surface.

Landslides

Landslides are commonly triggered by unusually high rainfall and the resulting soil saturation, by earthquakes, or a combination of these conditions. The general term "landslide" may include a wide range of slope failures, including but not limited to rock falls, deep failure of slopes, earthflows, and shallow debris flows. Some landslides occur as a result of human activities, such as timber harvest, undermining a slope, and improper drainage water management.

Steep slopes underlain by Cretaceous rocks along Cache Creek are susceptible to landsliding and numerous large and small landslide have been mapped in this area (Manson 1990). However, except for the communities of Guinda, Capay, Rumsey, and Brooks, landslides are generally not a significant hazard to life or property in the county. Most of the areas subject to landsliding are in agricultural use or are otherwise undeveloped (County of Yolo 1983).

Subsidence

Subsidence is the lowering of the land-surface elevation. The mechanism for subsidence in Yolo County is generally restricted to groundwater removal and subsequent consolidation of silty and clayey sediments (Yolo County Water Resources Association 2004). The primary hazards associated with subsidence are increased pressure on levees and damage to underground utilities. Other effects of subsidence include changes in the gradients of stormwater and sanitary sewer drainage systems in which the flow is gravity-driven. The resulting gradient changes can cause the flow to reverse direction.

Precise monitoring of subsidence in the part of the county east of the Coast Ranges began in 1999. Between 1999 and 2002 (when monitoring was again conducted), the greatest amount of subsidence in the county was detected near

Davis (two inches) and Zamora (three inches). No data from 1999 were available for the southeastern "panhandle" part of the county, so no precise measurement of subsidence is available for that area (D'Onofrio and Frame 2003). The cause of the subsidence was presumably groundwater overdraft.

From previous investigations, presumably less accurate than the work described above, subsidence was reported in the Clarksburg area, the southern tip of the county, and a small area in the northeastern part of the county, all as a result of excessive groundwater removal. The subsidence varied from a few inches to several feet (County of Yolo 1983). The time period over which the subsidence occurred is unknown.

Seiche

A seiche is a wave that oscillates in lakes, bays, or gulfs from a few minutes to a few hours as a result of a seismic or atmospheric disturbance. The wave of water has the potential to destroy structures and human life.

Because the county is generally subject to only to low to moderate levels of earthquake-induced groundshaking, the hazard of a seiche is not considered high.

However, in the event that significant groundshaking does occur, the County of Yolo Emergency Plan (County of Yolo 2000) has identified four primary areas in the county in which a seiche could occur:

- Lake Berryessa, where the seiche could occur along Putah Creek,
- the Sacramento River, which could affect bordering communities,
- the Yolo Bypass when water is present in the bypass, and
- Lake Washington Harbor and the Sacramento River Deep Water Ship Channel; the Port of Sacramento and nearby communities could be affected.

Because Lake Berryessa is closest of the four areas to active faults, it is perhaps the most likely of the four to experience a seiche.

Flooding Hazards

Introduction

Flooding is a normal process of rivers, but considered a hazard when it threatens human life or damages property. Damage associated with flood events is magnified when natural river floodplains are developed and inhabited. Yolo County is susceptible to flooding by the Sacramento River and Cache Creek.

Sources of Information

Information presented in this chapter is based on printed and electronic data available from the Federal Emergency Management Agency (FEMA) and county agencies and organizations. The following documents support this section:

- The county's existing general plan (Yolo County 1983).
- The Yolo County Water Resources Association Draft Integrated Regional Water Management Plan (Yolo County WRA 2004).
- The Yolo County Flood Control and Water Conservation District's Water Management Plan (Borcalli & Associates 2000).
- A Framework for the Future: Yolo Bypass Management Strategy Prepared for the Yolo Basin Foundation (Jones & Stokes 2001).

Key Terms

- **100-Year Flood Zone:** The 100-year flood zone is the land bordering a waterway that is subject to floods more often than once, but not as frequently as twice in a century.
- **Dam Failure:** Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, or terrorism cause dam failures.
- **Floodplain:** The floodplain is a flat tract of land bordering a river, mainly in its lower reaches, and consisting of alluvium deposited by the river. It is formed by sweeping meander belts downstream, thus widening the valley. In time of flood, when the river overflows its banks, sediment is deposited along the valley banks and plains. Floodplains are usually flat and contain fertile soils, thus they are often desired locations for development.
- **Inundation:** The rising of a body of water and its overflowing onto normally dry land.
- **Inundation Area:** The area downstream of a dam that would be affected by the failure of the dam and accompanying large flood flows.

Water Resources Regulation

Federal Regulations

Federal Flood Insurance Program

Alarmed by increasing costs of disaster relief, Congress passed the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The intent of these acts was to reduce the need for large, publicly funded flood control structures and disaster relief by restricting development on floodplains.

FEMA administers the National Flood Insurance Program to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development in floodplains. FEMA issues Flood Insurance Rate Maps (FIRMs) for communities participating in the National Flood Insurance Program. These maps delineate flood hazard zones in the community. The locations of FEMA-designated 100- and 500-year floodplains in the county are shown in Figure Flood-1.

State Regulations

Dam Inundation Mapping Requirement

The California Code of Regulations, Section 8589.5, requires that dam owners submit flood routing information, land surveys to delineate the floodplain, and a technical report to support a dam failure inundation map to the Office of Emergency Services. The technical study must contain information about dam specifications, physical conditions affected by the dam, including downstream areas and floodwater routing, and the cities, towns, and county areas which could be affected by a dam failure.

The requirements of the technical study can also include modeling of worst case breaching parameters and identification of the downstream hazard potential from partial or complete failure of the dam. The technical study and dam inundation map must be updated when a dam is enlarged.

Figure Flood-2 shows the inundation boundaries for failure of the Cache Creek Dam at Clear Lake and Monticello Dam at Lake Berryessa. In addition, failure of dams on the Sacramento, Feather, or American rivers would have the potential to inundate portions of east Yolo County. Potential for inundation of the county from dam failures are discussed further below.

Local Regulations

Yolo County Code

According to Title 8 Land Development and Zoning, Chapter 3 Flood Damage Protection of the Yolo County Code, a Flood Hazard Development Permit is required before construction or other development begins within any area of special flood hazards, as designated by FEMA. Flood Hazard Development Permits are approved under the conditions that the proposed development does not adversely affect, including cumulatively, the carrying capacity of areas where base flood elevations have been determined but a floodway has not been designated. Permits for construction within the boundaries of the Cache Creek Resources Management Plan require additional review, permits from State and

Federal agencies, and the project must meet the objectives of the Resources Management Plan.

Flooding

Flood hazards in the county can be attributed to swelling of creeks or rivers and dam failures. Areas within the 100-year floodplain in the county are residential and agricultural areas along Cache Creek, the Colusa Basin Drainage Canal, and within the 100-year floodplain of the Sacramento River, and the majority of the lower eastern portion of the county (see Figure Flood-1). The 500-year floodplain is most extensive north of the City of Woodland, the region west of the City of Davis and east of the Yolo Bypass, and through the City of West Sacramento south to Clarksburg.

Flood Management

Sacramento River

The California Flood Control Act of 1917, authorized construction of the Sacramento River Flood Control Project. A complex system of levees, weirs, bypasses, and reservoirs were built by 1958. Figure Flood-3 presents a schematic of the Sacramento Valley Flood Control System.

Federal flood control levees border the Sacramento River along the entire length of the Yolo County reach. Although none of these levees have failed in recent floods, the river channel conveys only 18% of the flow generated by a 100-year flood event in the Sacramento Valley. The remaining 82% of the flows spills into the Yolo Bypass, which conveys the water to the Delta at Rio Vista (Yolo County WRA 2004).

In response to catastrophic flooding of the Sacramento River, the Sacramento Area Flood Control Agency (SAFCA) was formed in 1989. An example of the vulnerability of the Sacramento River system to flooding occurred during the record flood of 1986 when Folsom Dam exceeded its normal flood control storage capacity and several area levees nearly collapsed under the strain of the storm. In response, the City of Sacramento, the County of Sacramento, the County of Sutter, the American River Flood Control District and Reclamation District 1000 created SAFCA through a Joint Exercise of Powers Agreement to provide the Sacramento region with increased flood protection along the American and Sacramento Rivers.

Under the Sacramento Area Flood Control Agency Act of 1990, the California Legislature has given SAFCA broad authority to finance flood control projects. SAFCA's activities are funded from development fees and annual assessments imposed on benefiting properties in three separate districts in Sacramento and Sutter Counties. SAFCA is governed by its Board of Directors.

Yolo Bypass

The Yolo Bypass is an integral part of the Sacramento River system and plays a major role in provided flood protection for the City of Sacramento. The Yolo Bypass was constructed from 1917–1924 as part of the Sacramento River Flood Control Project. It consists of a 41-mile-long swath of agricultural land bounded by levees 7,000 to 16,000 feet apart that conveys floodwater to the Sacramento-San Joaquin Delta near Rio Vista. The major inflows to the Yolo Bypass are from the Sacramento River at the Fremont and Sacramento weirs, but other local tributaries include the Colusa Basin Drain (via the Knights Landing Ridge Cut), Cache Creek, Willow Slough, and Putah Creek. The capacity of the channel increases southward from 377,000 cfs at the Fremont Weir, to 490,000 cfs south of Putah Creek. Land use within the Bypass is restricted by flood conveyance easements. Assurance that the integrity of the flood conveyance capacity is maintained is under the jurisdiction of the State Reclamation Board.

During non-flood periods, surface water flows from west to east through a network of channels that cross the Yolo Bypass and discharge into the Toe Drain, an artificial channel that follows the toe of the east side levee along the entire length of the Bypass. This channel begins spilling into the Bypass in some reaches with flows as little as 2,000 cfs. In winter, low flow in the northern half of the Bypass consists primarily of base flow discharges from Cache Creek and Willow Slough. In summer, flows are dominated by irrigation deliveries and return flows diverted from Cache Creek, the Knights Landing Ride Cut, and the Sacramento River, as well as discharges from the Woodland and Davis wastewater treatment plants. Together, summer flows are probably more than 100 cfs (Yolo County WRA 2004).

Cache Creek

The lower portion of the Cache Creek system is an integral component of the Sacramento River Flood Control System. The capacity in the lower reach of Cache Creek is approximately 36,000 cfs (Yolo County WRA 2004). The Cache Creek Settling Basin, located east of the City of Woodland, is essential to preserving the integrity of the flood control function of the Yolo Bypass. The Settling Basin traps a large portion of the sediment load from Cache Creek that otherwise would be deposited in the Yolo Bypass, and reduce its flood carrying capacity. A levee system extends upstream from the Settling Basin to the communities of Yolo and Woodland. These levees are significantly inadequate at providing the flood protection from the 100-year storm event. The current design capacity of the levee is 30,000 cfs, while modeled 100-year flows at Capay are estimated to be 61,000 cfs (Yolo County WRA 2004).

Willow Slough

The majority of the Willow Slough watershed lies in the valley floor where development of rural roads and housing have been constructed in the flat areas of the slough's natural broad floodplain. As a consequence, flood management has been the focus of many studies. Privately owned and managed sloughs and channels have altered drainage patterns of flooding and pose the largest threat to developed areas in the watershed. Repetitive flood damage persists in the communities of Esparto and Madison and the West Plainfield area, mostly to areas developed more than 30 years ago (Yolo County WRA 2004).

Putah Creek

Overbank flooding along lower Putah Creek has been eliminated since 1957 after construction of the Monticello Dam at Lake Berryessa and levees along the lower nine miles of the channel, and due to channel incision caused by construction of the Putah South Canal. Modeling of the 100-year storm event when Lake Berryessa is full showed that flood flows of 32,200 cfs would pass the community of Winters. For comparison, there were three floods recorded before construction of the dam that peaked from 67,200 to 81,000 cfs in the same area. Putah Creek flow decreases by 30 cfs from the Lake Solano Diversion Dam to the Yolo Bypass due to the low elevation of the valley (Yolo County WRA 2004)

Water Distribution Channels

Several water purveyors deliver water through artificial canals or modified natural waterways in the county. The Yolo County Flood Control and Water Conservation District (District), a state-designated special district that is not affiliated with the County, maintains over 175 miles of irrigation and drainage facilities, the majority of canals in the county (see Figure Flood-4). The District's network of canals transport water from the Capay Diversion on Cache Creek to irrigated lands in their service area. Most of the District's channels are earthen or unlined, except for the uppermost reaches of Moore, Winters, and West Adams canals which are lined with concrete (Borcalli & Associates 2000). The District used the canals to deliver approximately 377,600 acre-feet of water from Cache Creek during 1989 for irrigation. Information on current District deliveries was unavailable as of the date of this document.

In addition, private landowners construct and maintain ditches for conveying irrigation water and tailwater on their lands. These canals range from major, engineered arteries to small ditches excavated with bulldozers. Many of the channels used to convey irrigation water in the summer also convey rainfall runoff in the winter. This includes the lower end of Putah Creek and several sloughs in the west central part of the county. In most cases, flow control structures are removed after the irrigation season and before the onset of winter rains to maximize channel capacity for high flows. This includes, for example, removing the flashboards at check dams, deflating the inflatable Capay Dam, and removing earth impoundments. In spite of these steps, flooding along some of these canals and channels is fairly common.

Flood-Prone Areas

Flood-prone areas in the county lie within floodplains of the Sacramento River, the Colusa Basin Drainage canal, Cache Creek, Willow Slough, and Putah Creek. The following discussion addresses potential hazards from 100- and 500-year storm events on floodplains within the county.

Sacramento River Floodplain

The area along the county's west and southwest border, including the Yolo Bypass, lies in the 100- and 500-year floodplain of the Sacramento River. Flood flows from the upper Sacramento River are directed to the Yolo Bypass, which is managed to contain flows from a 100-year storm event.

The City of West Sacramento, the Town of Clarksburg, and an area west of the City of Davis are unprotected from a 500-year event. The State of California, the U.S. Army Corps of Engineers (ACOE), and the West Sacramento Reclamation Districts 537 and 900 managed construction of a new levee system to provide protection from potential 350- to 400-year floods. The new levee system was completed in 2000. For this reason, the City of West Sacramento is designated Zone X, protected from a 100-year storm event by levees, according to FEMA. This is the highest level of flood protection among flood plain areas in the Sacramento Valley (City of West Sacramento 2004). Clarksburg is protected from the 100-year storm event by levees along the Sacramento River and Elk Slough. However, the community is not protected from the 500-year event.

Colusa Basin Drain Floodplain

The Colusa Basin Drain captures irrigation return and storm waters from 32 ephemeral streams, 7 of which lie within the county and the remainder originate farther north. Waters from agricultural fields flow through the drain and south to the Sacramento River or the Yolo Bypass, through the Knights Landing Ridge Cut. The Ridge Cut was designed to provide a gravity outlet for floodwater, but not to protect against flooding. The Ridge Cut consists of two excavated channels and has a discharge capacity of approximately 15,000 to 20,000 cfs. When floodwaters in the Sacramento River elevate, floodwaters from the Colusa Basin Drain are directed through the Ridge Cut to the Yolo Bypass. When the Sacramento River is at high stage, however, the capacity of the Colusa Basin Drain is greatly reduced. Groundwater overdraft in this area of the county has caused the land to subside—thus, agricultural fields flood during large storm events. No flood protection is available for areas where land has subsided. The town of Knights Landing is protected from the 100-year storm event by levees along the Sacramento River, Colusa Basin Drain, and the Ridge Cut. The community is not, however, protected from the 500-year event.

Cache Creek Floodplain

Flooding along the lower reach of Cache Creek, the portion within the county, occurs along the main channel and from tributary areas to the north of the channel. The area within the 100-year floodplain of lower Cache Creek is not protected because the State intended to build dams in the upper watershed to provide flood storage for the Cache Creek watershed. These dams were never built, thus the area is under-protected. A levee system does exist, from Cache Creek's mouth at the Sacramento River to three miles upstream of the Town of Yolo. This levee system was designed to convey 30,000 cfs flows from Cache Creek to the Cache Creek Settling Basin, which prevents sediment and debris from entering the Yolo Bypass. Communities partly located within the 100-year floodplain of Cache Creek are Rumsey, Guinda, Capay, Yolo, and Woodland.

The ACOE is actively investigating opportunities to increase flood protection in the county, particularly in the area surrounding the City of Woodland. In 1983, a portion of the levee on Cache Creek was breached and a large area of the City of Woodland flooded. Consequently, in 2002, FEMA updated the FIRM map of the Woodland area to show the potential for 34% of the City to be inundated by a 100-year flood event on Lower Cache Creek (City of Woodland 2004).

Willow Slough Floodplain

The Willow Slough floodplain area encompasses the central region of the county, including parts of the towns of Esparto and Madison. County roads often flood during large storms. As roads are repaired and the land is reworked for row crops and grazing, the land is continually regraded and eroded in some places, thus altering drainage patterns and the extent of flooding. Poorly managed irrigation ditches in the area threaten to alter flood drainage patterns during large storms. Altered drainage patterns can cause increased damage to structures and agricultural fields.

Putah Creek Floodplain

The floodplain area of Putah Creek is well regulated by the Monticello Dam. However, tributaries and valley floor areas downstream of the dam collect floodwaters, thus threatening the cities of Winters and Davis. Winters is located at the foothills of the mountain ridge that borders the east edge of the county. A few tributaries that flow east and south to Putah Creek pass through Winters. Due to its location, the eastern portions of the city would receive the most damage in a 100-year storm event. The city's public works department manages a stormwater drainage network to protect against flood damage. Flood hazards in Davis generally consist of shallow flooding from surface water runoff in large rainstorms. To mitigate this impact, the City Public Works Department maintains three main channels and three detention ponds, which provide for drainage and storm water detention (City of Davis 2004). Portions of Davis, primarily in the northern section, are subject to flooding in a 100-year flood.

Dam Failure

If dams were to fail at Indian Valley Reservoir, Lake Berryessa, or those along the Sacramento, Feather, and American rivers, the majority of the City of Woodland, Winters, and Davis would be inundated by floodwaters, as shown in Figure Flood-2. If the dam at the Indian Valley Reservoir were to fail, a surge of floodwaters would flow south and east through the Cache Creek watershed and to the Yolo Bypass and Sacramento River. Flooding would cause the most damage to communities in the valley area where the floodplain becomes flat and wide. The City of Woodland would receive the most property damage from a dam failure on Cache Creek, due to the number of residents and businesses located within and surrounding the city. The Cache Creek Settling Basin, just east of the City of Woodland, would slow the floodwaters. Failure of dams in the Sacramento River watershed would not directly inundate the populous communities within the county, but would potentially damage farmland.

Failure of the Monticello Dam on Putah Creek would potentially cause more property damage than a dam failure on Cache Creek. The cities of Winters and Davis in the county would be inundated by failure of the Monticello Dam. Flood flows would spread nearly 10 miles wide as the waters flow east and south to the Yolo Bypass. Many acres of agricultural land would be inundated, as well as the UCD.

Wildland and Urban Fire Hazards

Introduction

The county contains many areas where urban and non-urban landscapes adjoin. These are the areas where wildland fires are a risk. Much of the non-urban landscape is not wild, however, and this section describes the potential for wildland fire and fire risks to communities and urban areas. Specific information provided includes:

- the general wildland fire environment, including fuels and fire history.
- fire hazard policies, and how they relate to the communities in the county.
- the key issues for urban fires

Sources of Information

In preparing this report, the California Department of Forestry and Fire Protection (CDF) and USDA Forest Service Fire Perimeters was reviewed to identify areas of high fire hazard (see Figure Fire-1).

Key Terms

- **Fuels:** Fuels can be defined as both living and dead vegetation that is available to burn during a fire. The difference between vegetation type and fuel is that while a vegetation community is defined by species composition, a fuel type is determined by how a given area will burn. The manner in which a given area will respond to fire is a function of the continuity of living and dead vegetation, the height and layers of vegetation, the volume and availability of different sizes of fuels, topography, and weather conditions.
- **Wildfire:** Wildfire is an unintended fire necessitating suppression activities.
- **Wildland Fire:** Wildland fire is any fire, whether prescribed or naturally occurring, in wildland habitat.
- **Wildland-Urban Interface:** Wildland-urban interface refers to areas of intermingled wildland fuels and urban environments that are in the vicinity of fire threats. Because the interface is an ecotone (i.e., transition between two habitat types) and frequently involves disturbed soils, such areas can present severe fire hazards.

Fire Hazard Policies and Regulations

National Fire Plan

In August 2000, President Clinton directed the Secretaries of Agriculture and the Interior to develop a response to severe wildfires, reduce fire impacts on rural communities, and ensure sufficient wildland firefighting capacity in the future. Congress in turn mandated implementation of a National Fire Plan (NFP) through legislation and appropriations. The NFP addresses conditions that have evolved over many decades and cannot, consequently, be reversed in a single year; these conditions will require both a multiyear period of remediation and consistent and ongoing future management efforts. The NFP is a long-term commitment based on cooperation and communication among federal agencies, states, tribes, local governments, and other interested/affected parties.

A major component of the NFP was funding for projects designed to reduce fire risks to people and their property. A fundamental step in realizing this goal was the identification of areas that are at high risk of damage from wildfire. Federal fire managers authorized State Foresters to determine which communities were under significant risk from wildland fire on federal lands.

CDF undertook the task of generating the state's list of communities at risk. With California's extensive urban Wildland-Urban Interface situation the list of communities extends beyond just those on federal lands.

Communities listed as being at risk in the county are Esparto, Guinda, Rumsey, West Sacramento, and Winters (CA Fire Alliance 2004). Of these, only Rumsey is adjacent to federal land.

Healthy Forest Initiative

The 2002 fire season, while less extensive than the 2000 season, was nevertheless the second most extensive season in 50 years. Approximately 6.7 million acres burned in more than 68,000 fires. In August 2002, President Bush proposed the Healthy Forests Initiative (HFI) and directed federal agencies to develop administrative and legislative tools to facilitate the restoration of ecosystems to a healthy, natural condition. The HFI will also implement core components of the NFP's 10-year Comprehensive Strategy and Implementation Plan.

The Healthy Forests Restoration Act is a proposed legislative mechanism intended to implement the HFI. This act will establish procedures to expedite forest and rangeland restoration projects on USDA Forest Service and Bureau of Land Management (BLM) lands. It focuses on lands (1) near communities in the wildland urban interface, (2) in high risk municipal watersheds, (3) that provide important habitat for threatened and endangered species where catastrophic wildfire threatens the survival of the species, and (4) where insects or disease are destroying the forest and increasing the threat of catastrophic wildfire.

State Assembly Bill 337

In accordance with Assembly Bill 337 (Bates), passed in 1992, the CDF was required to identify and classify fire hazards in the Local Responsibility Areas (LRA). Though this classification was referred to in the legislation as an identification of "very high fire hazard severity zones" (VHFHSZ), it was not technically "zoning," since all land use planning decisions in the LRA are still under the local agency's jurisdiction. According to the Natural Hazard Disclosure Map for Yolo County, the western portion of the county, west of Esparto and Winters, is designated as a wildland area that may contain substantial forest fire risks and hazards. This area includes the unincorporated communities of Guinda and Rumsey. No VHFHSZs areas are in the county.

Wildfire Environment

Fuels

The county is characterized by relatively level valley floor landscape to the south and east rising to the North Coast Ranges to the north and west. These topographies affect both the available fuels, and the fire behavior. In the valley floor, agriculture, grasslands, and the built environment, dominate the fuels. In the ranges, the fuels are woodlands and chaparral.

The lack of topography and complex fuels in the valley floor leads to very little severe fire behavior; rather it is dominated by smaller fires lasting short periods of time. Agricultural lands have a managed water supply; this alters the fuel moistures and live fuels such that they are not directly affected by the season or weather. Additionally the fuels are discontinuous, broken by numerous roads and fuel type changes which slow the rate of fire spread.

Rugged topography creates a landscape where fires can spread rapidly upslope, and there is limited access for suppression equipment. Therefore fires in the ranges can be much larger and last through many burning periods. The chaparral and woodland habitat has native vegetation that is adapted to a more frequent fire regime. Historically, fire would have been more prevalent in the ranges and these volatile fuels increase quickly if not cleared on a regular basis.

Fire History

In the last 50 years, there have been approximately 55 fires greater than 100 acres in the county. All of these fires have occurred in the western third of the county. The largest fire, the Sixteen fire, occurred in 1999, and originated outside of the county. The Sixteen Fire burned over 37,000 acres throughout the area. In 1972, the Pocket Gulch fire burned 10,000 acres of the hills around the Capay Valley. There is only one fire on record that is known to have been caused by natural ignition (lightning); the causes of the remainder were either human ignition, or unknown (California Department of Forestry and Fire Protection and USDA Forest Service, 2004).

Urban Fire Hazard

Many of the communities in the county have sections of older buildings that can create difficulties with urban fire incidents. These buildings frequently have inadequate fire detection and abatement systems. Additionally, the water systems in older section of towns may not provide recommended levels of water flow for some types of fire incidents. Towns where this is specifically identified include Esparto, Winters, and West Sacramento. The same is also true in many of the smaller rural areas. Title 7 of the Yolo County Code requires the installation of an automatic fire sprinkler system in new residential and certain commercial buildings. The sprinkler systems help offset the potential delayed response times of fire departments. All of the rural fire districts in Yolo County are staffed totally by volunteers; this can increase the response time over that of a dedicated station.

Hazardous Materials

Introduction

Hazardous materials are substances that pose a significant present or potential hazard to human health and safety or the environment if released. Because of their quantity, concentration, or physical, chemical or infectious characteristics, hazardous wastes may cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness.

Hazardous wastes include products commonly used in residences and businesses. Hazardous wastes may also pose a substantial present or potential hazard to human health and safety or the environment when improperly treated, stored, transported, or disposed of, or otherwise improperly managed.

Sources of Information

Information on hazardous materials and hazardous wastes was collected from the Central Valley Regional Water Quality Control Board's website (http://www.swrcb.ca.gov/), the state Department of Toxic Substances Control website (http://www.dtsc.ca.gov/), the Yolo County Heath Department website (http://www.yolocounty.org/org/health/) the Yolo County Emergency Plan (County of Yolo 2000a), and the Yolo County Open Space & Recreation Element Background Report (County of Yolo 2000b).

Key Terms

- **Hazardous Material:** Defined by the California Department of Toxic Substances Control (DTSC) as a material that poses a significant present or potential hazard to human health and safety or the environment if released because of its quantity, concentration, or physical or chemical characteristics (26 CCR 25501). Common hazardous materials include petroleum hydrocarbons, pesticides, volatile organic chemicals (VOCs), and certain metals.
- **Hazardous Waste:** Defined by the DTSC as a waste substance that can pose a substantial or potential hazard to human health or the environment when improperly managed. Hazardous waste possesses at least one of these four characteristics: ignitability, corrosivity, reactivity or toxicity; or appears on special U.S. Environmental Protection Agency (EPA) lists.

Hazardous Materials and Hazardous Wastes Regulations

Various federal and state agencies exercise regulatory authority over the use, generation, transport, and disposal of hazardous materials and hazardous wastes. The primary federal regulatory agency is the EPA. The primary California state agency with similar authority and responsibility is the California Environmental Protection Agency, which may delegate enforcement authority to other local agencies with which it has agreements. Federal regulations applicable to hazardous substances are contained primarily in CFR Titles 29 (*Labor*), 40 (*Protection of Environment*), and 49 (*Transportation*). State regulations are contained in CCR Title 13 (*Motor Vehicles*), Title 19 (*Public Safety*), Title 22 (*Social Security*), and Title 26 (*Toxics*).

Federal Regulations

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also called the Superfund Act) (42 USC Sec. 9601 *et seq*.) is intended to protect the public and the environment from the effects of prior hazardous waste disposal and new hazardous material spills. Under CERCLA, EPA has the authority to seek the parties responsible for hazardous materials releases and to assure their cooperation in site remediation. CERCLA also provides federal funding (the "Superfund") for the remediation of hazardous materials contamination. The Superfund Amendments and Reauthorization Act (SARA) of 1986 (PL-99-499) amends some provisions of CERCLA and provides for a Community Right-to-Know program.

EPA has the authority to implement CERCLA in all 50 states and all United States territories, using a variety of enforcement tools, including orders, consent decrees, and other small party settlements. Identification, monitoring, and remediation of Superfund sites are usually coordinated by state environmental protection and/or waste management agencies. When potentially responsible parties cannot be identified or located, or when responsible parties fail to act, EPA has the authority to remediate abandoned and/or historical sites where hazardous materials contamination is known to exist and to pose a human health hazard.

Pursuant to CERCLA, EPA maintains a National Priority List (NPL) of uncontrolled or abandoned hazardous waste sites identified for priority remediation under the Superfund program. Sites are identified for listing on the basis of the EPA's hazard ranking system (HRS). Sites may also be placed on the NPL if they meet the following requirements.

- The Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Public Health Service has issued a health advisory that recommends removing people from the site.
- EPA has determined that the site poses a significant threat to public health.
- It will be more cost-effective for EPA to use its remedial authority than its emergency removal authority to respond to the hazard posed by the site.

Resource Conservation and Recovery Act (RCRA)

RCRA (42 USC Sec. 6901 *et seq.*) was enacted in 1976 as an amendment to the Solid Waste Disposal Act to address the nationwide generation of municipal and industrial solid waste. RCRA gives EPA authority to control the generation, transportation, treatment, storage, and disposal of hazardous waste, including underground storage tanks storing hazardous substances. RCRA also establishes a framework for the management of non-hazardous wastes. RCRA addresses only active and future facilities; it does address abandoned or historical sites, which are covered by CERCLA (see preceding section).

RCRA was updated in 1984 by the passage of the federal Hazardous and Solid Waste Amendments (HSWA), which required land disposal of wastes to be gradually phased out. HSWA also increased the EPA's enforcement authority and established more stringent hazardous waste management standards, including a comprehensive underground storage tank program.

State Regulations

EPA has granted the state primary oversight responsibility to administer and enforce hazardous waste management programs. In addition, state regulations, which are equal to or more stringent than federal regulations, require planning and management to ensure that hazardous wastes are handled, stored, and disposed of properly to reduce risks to human health and the environment. Several key state laws pertaining to hazardous wastes are discussed below.

Hazardous Materials Release Response Plans and Inventory Act of 1985

The Hazardous Materials Release Response Plans and Inventory Act, also known as the Business Plan Act, requires businesses using hazardous materials to prepare a hazardous materials business plan that describes their facilities, inventories, emergency response plans, and training programs. Under the Business Plan Act, *hazardous materials* are defined as raw or unused materials that are part of a process or manufacturing step. They are not considered hazardous waste, although the health concerns pertaining to the release or inappropriate disposal of these materials are similar to those relating to hazardous waste.

Hazardous Waste Control Act

The Hazardous Waste Control Act created the state hazardous waste management program, which is similar to, but more stringent than, the federal program under RCRA. The Hazardous Waste Control Act is implemented by regulations contained in 26 CCR, which describe the following aspects of hazardous waste management.

- Identification and classification.
- Sources.
- Transport.
- Design and permitting of recycling, treatment, storage, and disposal facilities.
- Treatment standards.
- Operation of facilities, including staff training.
- Closure of facilities.
- Liability issues.

Regulations in 26 CCR list more than 800 materials that may be hazardous and establish criteria for identifying, packaging, and disposing of them. Under the Hazardous Waste Control Act and 26 CCR, hazardous waste generators must complete a manifest that accompanies waste from the generator to the transporter to ultimate disposal location. Copies of the manifest must be filed with DTSC.

Emergency Services Act

The state has developed an emergency response plan to coordinate emergency services provided by federal, state, and local agencies. Rapid response to incidents involving hazardous materials or hazardous waste is an important part of the plan, which is administered by the California Office of Emergency Services. This office coordinates responses of other agencies, including the EPA, California Highway Patrol, the nine RWQCBs, the various air quality management districts, and county disaster response offices.

California Department of Toxic Substances Control

Transport of hazardous materials and wastes from one location to another is regulated exclusively by the federal and state governments, whose regulations are administered by the California Highway Patrol, California Department of Transportation, and DTSC. Regulation of hazardous materials by county and city governments is limited to enforcement of standards, procedures, and policies in the siting, construction, and operation of businesses, farms, and residences within their jurisdiction.

Other State Laws, Regulations, and Programs

Additional state regulations that affect hazardous waste management include

- the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), which requires labeling of substances known or suspected by the state to cause cancer; and
- California Government Code Section 65962.5, which requires the Office of Permit Assistance to compile a list of potentially contaminated sites in the state.

Local Policies and Regulations

Yolo County Environmental Health Department

The storage, transport, and disposal of hazardous materials and hazardous wastes in the county are generally subject to Environmental Health Division of the County Health Department oversight. In particular, the Division oversees biosolids application; hazardous materials storage, handling, and emergency response; hazardous waste treatment and waste generators; and above- and below-ground storage tanks which contain hazardous substances.

Certified Uniform Program Agency (CUPA)

The Certified Uniform Program Agency (CUPA) in the county (also known as the Consolidated Hazardous Materials Program and the Unified Program) regulates hazardous materials and wastes to protect the public and the environment from harmful exposure. The CUPA consolidates inspections and fee collection of several hazardous materials and waste programs to reduce regulatory overlap and conflicts.

Yolo Operational Area Hazardous Materials Emergency Response Plan

The Yolo Operational Area Hazardous Materials Emergency Response Plan defines the structure of the emergency response effort made by the county Hazardous Materials Response Team (team). The team can be activated by the Davis or UC Davis Fire Department Duty Officer, who has primary authority to activate the team. The team comprises members of the UC Davis Fire Department, Davis Fire Department, West Sacramento Fire Department, Woodland Fire Department, and Yolo County Division of Environmental Health. The plan also discusses issues regarding whether residents are to evacuate or seek shelter in the event of a hazardous materials incident.

Use of Hazardous Materials in Yolo County

According to the County Emergency Plan (County of Yolo 2000), a range of hazardous materials (e.g., pesticides) are present in the county, most of which are used, stored, or transported for use by the agricultural industry. The materials are stored at permanent storage sites, at road and railway storage sites, in pipelines, and at industrial and agricultural sites.

The Yolo County Environmental Health Division is the CUPA for the cities and unincorporated areas of the County. The Yolo County Environmental Health Division regulates the use, storage, and disposal of hazardous materials by issuing permits, inspecting facilities, and investigating complaints. Businesses that handle or store hazardous materials are required to report these materials through an annual inventory and prepare a business plan describing the procedures to be used during an emergency.

Hazardous Wastes

Hazardous wastes includes products commonly used in residences and businesses, such as pesticides, herbicides, paints and other architectural finishes, motor oil and related fluids, household cleaning products, photographic chemicals, and certain building materials.

The state Hazardous Waste and Substances Sites List (also known as the Cortese List) provides information regarding the location of hazardous materials release sites. Based on the list for the county dated August 18, 2004, only one such site exists in the county, the Frontier Fertilizer Co facility, in Davis at which soil and groundwater contamination by pesticides occurred. The U.S. EPA Superfund Information System identifies the Frontier Fertilizer site as well as the Davis Transmitter site, the Pilau Drain site, CPB Deseret Farms, Van Waters and Rogers, and the Lehr/Old Campus Landfill site at UC Davis as known hazardous waste sites in Yolo County (U.S. Environmental Protection Agency 2004).

Based on data collected by the Central Valley Regional Water Quality Control Board (2004), there were 81 recorded sites of leaking underground storage tanks in the entire county that were under some form of investigation, in the process of being cleaned up, or undergoing post-cleanup monitoring (See Appendix Haz-A). Most of the sites involve gasoline or diesel fuel contamination of soil or a drinking water aquifer; a few involve waste oil contamination. Approximately 193 other sites were recorded as having a “closed” case, indicating that soil or groundwater contamination has been removed.

The county General Plan Open Space & Recreation Element Background Report (County of Yolo 2000) shows, as of late 2000, 20 sites within unincorporated areas of the county at which soil or groundwater contamination has been documented. Nearly all of the sites were located in either Clarksburg or Dunnigan, and in nearly all, gasoline or diesel fuel was the contaminating substance. Roughly half the sites appear to be residences or ranches, with the other half being businesses.

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