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SAFETY ELEMENT

I. INTRODUCTION

A. PURPOSE OF THE SAFETY ELEMENT

The purpose of the Safety Element is to make the City of Red Bluff aware of any natural or human induced hazard or safety problems so that planning decisions may be influenced by this knowledge, and to encourage adoption of developmental and emergency planning practices designed to reduced loss of life, injuries, property damage, and economic and social dislocation which might otherwise result. The Safety Element is intended to identify risks from major hazards or safety problems in Red bluff, and to provide an assessment of existing protection services and suggest options the community might pursue in order to improve its level of public safety. In this regard, the Safety Element is the primary vehicle for relating local safety planning to city land use decisions and a city should establish land use planning policies and standards based on the analyses provided within it. The Safety Element is mandated by the State of California in Government Code Section 65302(g):

A Safety element for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence, liquefaction and other seismic hazards identified pursuant to Chapter 7.8 (commencing with Section 2690) of Division 2 of the Public Resources Code, and other geologic hazards known to the legislative body; flooding; and wild land and urban fires. The safety element shall include mapping of known seismic and other geologic hazards. It shall also address evacuation routes, military installations, peakload water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards.

(1) Prior to the periodic review of its general plan and prior to preparing or revising its safety element, each city and county shall consult the California Geological Survey of the Department of Conservation and the Office of Emergency Services for the purpose of including information known by and available to the department and the office required by this subdivision.
(2) To the extent that a county's safety element is sufficiently detailed and contains appropriate policies and programs for adoption by a city, a city may adopt that portion of the county's safety element that pertains to the city's planning area in satisfaction of the requirement imposed by this subdivision

The Safety Element has been developed to both correlate and be consistent with the other six mandated elements in the Red Bluff General Plan. The general plan purposes, processes, and a detail description of the planning area and the city sphere-of-influence to be considered are all discussed in the introduction to the Land Use Element.

The concept of public safety expressed in this element is based upon the following assumptions:

1. That natural hazard systems are an unavoidable aspect of life and that not every degree of risk or all hazards can be fully eliminated (e.g., volcanic eruptions)

2. That the impacts of some natural hazards can be increased by human activities (e.g., flooding)

3. That there are human-induced safety problems which can be dealt with in a parallel manner to natural hazards (e.g., hazardous materials)

4. That public policy and action are appropriate in a community to mitigate against hazards which: (a) have a high degree of risk to the general public or (b) have a relatively low risk but which would be considered disasters should the hazardous event occur.

B. GOALS, OBJECTIVES, POLICIES AND IMPLEMENTATION MEASURES FOR PUBLIC SAFETY

1. GOAL: PUBLIC SAFETY

To protect the community of Red Bluff from injury, loss of life, and property damage resulting from natural catastrophes and any hazardous conditions.

2. GOAL: SEISMIC SAFETY

To effectively minimize risks associated with seismic hazards by regulating the design and siting of new development in the City of Red Bluff.

OBJECTIVES AND POLICIES:

a. Require a review of all potential geological hazards, including seismic hazards, for all new developments in identified hazardous areas.

b. Avoid placement of critical structures, public facilities, and high-occupancy structures in areas prone to ground failure during an earthquake.

c. Establish acceptable seismic safety standards so that all new building shall be constructed to resist the stresses and ground shaking produced during earthquakes.

IMPLEMENTATION MEASURES:

a. Record information on potential geologic and seismic hazards with parcel or subdivision maps.

b. Review Building Code requirements to determine the adequacy of standards necessary to protect against all seismic hazards and to assure that the Code is current with the latest technological advances.

c. Develop programs in cooperation with other public agencies to increase public awareness of seismic hazards and to educate the citizens of Red Bluff on public and private actions that can help to minimize injury and property loss before, during, and after an earthquake.

3. GOAL: GEOLOGICAL HAZARDS SAFETY

New development proposed within areas of potential geological hazards shall not be endangered by, nor contribute to, the hazardous conditions on the site or an adjoining properties.

OBJECTIVES AND POLICIES

a. Adequate mitigation shall be required on sites with landslide potential, or erodible soils to protect against injury and property damage and to assure a level of development, which will not accelerate runoff or degrade water quality.

b. Replanting of vegetation following development shall be required on all slopes prone to erosion and / or instability. Drought-resistant plant types shall be used for landscaping on post-development slopes where excess watering might induce land slippage or soil erosion.

c. Discourage clustering of development away from areas considered geologically unstable.

d. Require protection of exposed soil from erosion during the wet season.

e. Require topsoil to be stockpiled and reapplied upon completion of grading to promote vegetative regrowth where feasible.

f. Prohibit earthmoving operations in areas of high soil and slope erosion hazard potential during the wet season unless preauthorized. If such activities are not allowed, measures for sediment containment and erosion control must be in place at the conclusion of each day's work.

g. Require approval of final site development plans, including drainage and erosion control plans, in areas subject to high erosion hazard potential prior to authorization of any initial grading and clearing activities.

IMPLEMENTATION MEASURES:

a. Adopt and enforce a comprehensive Grading and Erosion Control Ordinance, requiring control of existing erosion problems as well as the installation of erosion, sediment, and runoff control measures in new developments.

b. Adopt regulations relative to zoning and subdivision ordinances which regulate land alternatives, road construction or structural development on slopes of 15% or greater.

4. GOAL: FLOOD HAZARD SAFETY

To protect new and existing structures and surfaces from flood damage in order to minimize the economic impacts and threats to public safety. To prevent adverse impacts on drainage basins and stream channels, and to maintain their beneficial function for runoff, water storage and transports, and protection of biotic resources.

OBJECTIVES AND POLICIES

a. Protect the Red Bluff community from risk of flood damage.

b. Approve only those new development proposals that do not compound or impact the potential for damage from flooding in developed areas or adjacent properties.

c. Deny any development proposal, which would disrupt existing drainage channels, in such a manner that total site runoff would be impeded.

d. Require that any increased runoff from a proposed grading or development site be effectively channeled into existing storm drains and not as overland flow onto adjoining properties.

e. Ensure that any development plan does not serve to aggravate the flooding potential of the streams that flow through Red Bluff, especially at times of peak flow.

f. The City shall regulate land uses in flood-prone areas and should allow development only in those areas with appropriate mitigation.

g. The City should promote community awareness regarding the severity and extent of potential local flooding.

IMPLEMENTATION MEASURES:

a. Utilize the 100-year flood profile for all streams as a basis for evaluating future land use in flood plain areas.

b. Enact an ordinance regulating siting of new development within the flood plain, and specific regulations for spacing development near stream channels and channels slopes, with at least a 50-foot setback from stream banks.

c. Develop a flood warning system in order to alert residents in flood prone areas.

d. Strictly enforce existing City (and County) ordinances preventing building fences, dumping trash and fill, altering vegetation, or construction within the mainstream channels.

e. Construct storm drainage improvements in order to correct identified significant flood prone portions of the urban area.

f. Maintain culverts and drainage facilities on public roads, and eliminate obstructions from existing drainage ways.

5. GOAL: FIRE HAZARD SAFETY

To protect the public from wildland and urban fire hazards and reduce the risks of wildfires and structural conflagrations by mitigating or minimizing use and development in high fire hazard areas, and by maximizing fire prevention measures and citizen awareness of fire hazards.

OBJECTIVES AND POLICIES

a. All new development shall be constructed, at a minimum, to the fire safety standards contained in the locally-adopted Uniform Fire and Building Codes.

b. Require all new development, including single-family dwellings on existing parcels of record, to provide adequate access for fire protection.

c. Amend City ordinances to include specific road standards developed in conjunction with the Red Bluff Fire Department.

d. It shall be the City's goal to maintain a maximum response time of 6 minutes to 90% of the city's emergency calls and field an initial assignment of 12 firefighters within 10 minutes total.

e. Maintain an average response time for three-four minutes to all areas of the City.

f. Provide adequate water supplies for fire fighting, especially at times of peak demand.

g. Discourage new development on the periphery of the urban area where wildfire risks are high due to natural factors or provide adequate mitigation measures to address the elevated fire threat.

IMPLEMENTATION MEASURES:

a. Enforce the existing City ordinance regarding weed abatement on all lots and larger properties within city limits.

b. Adopt an ordinance for the provision of fire-resistant materials and landscaping, and the use of early warning systems such as sprinklers with alarms for all new developments.

c. To the maximum extent feasible conduct periodic inspections of vacant properties to ensure that dry weeds and other combustible fuels are not permitted to accumulate.

d. Adopt a policy for providing adequate water supply for fire fighting purposes to all parts of the airport.

e. Adopt a policy for ensuring a rational system of signing and mapping for City structure, and for detailed mapping of each dwelling in multi-residence structures for aid in location by fire fighting units.

f. Continue to provide staffing for fire fighting personnel within acceptable guidelines.

6. GOAL: PUBLIC PROTECTION SERVICES

Maintain public safety services (police and fire) at an approved and effective level.

OBJECTIVES AND POLICIES

a. Level of service for personnel, equipment, and facilities for policy and fire protection services to the greatest possible extent shall be maintained.

b. A goal of a ratio of two sworn police officers per 1,000 city population shall be regarded as optimum.

c. Involve fire department input in the planning for fire protection services in areas to the south or north of the City of Red Bluff that may extend the response time of the department beyond acceptable limits.

d. Incorporate fire and crime prevention measures into development planning to the extent feasible.

e. Encourage policies that maintain access routes free of traffic obstacles.

f. The City of Red Bluff shall continue to use the Tehama County Integrated Waste Management Plan and the Hazardous Waste Management Plan when addressing how to handle wastes or materials that pose a threat to human health or the environment by being toxic, reactive, corrosive, or flammable.

g. Promote continuing training of fire and police department personnel in hazardous materials handling, response, and emergency medical techniques and procedures.

IMPLEMENTATION MEASURES:

a. In order to minimize the dangers of hazardous materials, the City shall require the handling, transport, treatment, disposal, or storage of such materials or waste in a manner that is consistent with Tehama County's Integrated Waste Management Plan and the Hazardous Waste Management Plan.

b. In concert with all affected public and private agencies, the City shall work to update the existing Emergency Plan and integrate it with the existing Multihazard Functional Plan.

c. Continue to update the City's integrated Multihazard Functional Plan. Identify specific facilities and lifelines critical to effective disaster response and evaluate their abilities to survive and operate efficiently immediately after a major disaster.

d. Continue to integrate local emergency disaster planning with all applicable state and local public protection agencies.

C. ENVIRONMENTAL SETTING

1. GEOLOGY

The City of Red Bluff is located in the northern end of the Sacramento River Valley of California. The city has developed on a relatively level series of terraces on both sides of the Sacramento River at a general elevation of 300-360 feet above sea level. Red Bluff is surrounded by mountains on three sides, with the Coast Ranges roughly 30 miles to the west, the Sierra Nevada about 40 miles to the east, and the Cascade system about 45 miles to the northeast and north. The general topography of the Red Bluff area is one of rolling hills, which have been dissected locally by steam flowing, from the adjacent highlands as tributaries to the Sacramento River.

Geologically the region is considered to be part of the Great Valley province, which is a 400 mile-long by 60 mile-wide sedimentary basin located between the Sierra Nevada and the Coast Rangers. The valley floor and the adjacent hills and riverine terraces are thus composed of sedimentary and volcanic deposits which differ lithologically from the mainly granitic and metamorphic rocks of the Sierra Nevada and the metamorphic rocks of the Coast Ranges.

To the west of the Sacramento River, about 55% of the City of Red Bluff lies atop the Tehama Formation. The Tehama Formation is also the major geologic unit that underlies the drainage systems west of the city. This formation is Upper Pliocene in age and is comprised of non-marine sedimentary rocks. It is semi-consolidated and typically fine-grained, both of which are characteristics, which influence the general topography and can act to determine natural rates of erosion. The rocks of the Tehama Formation are characterized as "poorly sorted pale yellow to greenish gray silt, silty clay, locally tuffaceous sand and gravel which weather to pale bluff and yellow-brown color" (U.S. Geological Survey, 1960). The formation also contain scattered lenses of gravel often intermixed with a clay or silt matrix. The soil erodibility and landsliding potential of this

formation depends on its composition with silt outcrops being more erodible than sand or clay (DR, 1991). The Tehama Formation generally weathers into rounded hills with moderate relief and a thin soil cover. Along stream courses it is exposed in bluffs from 20 to 60 feet in height.

Roughly 20% of the City of Red Bluff sits on rocks of the Red Bluff Formation. This is a coarse gravelly deposit of non-marine sedimentary rocks, which is Pleistocene in age. The Red Bluff Formation originally formed on a regional gently inclined erosional surface (the Red Bluff pediment) atop the Tehama Formation. It is characterized as "well-rounded boulders and gravel within a tan to brick-red iron-stained matrix of sand and some clay" (USGS, 1960). The Red Bluff Formation underlies the city to the south and southwest and also outcrops in the northeast, just south of Dibble Creek. In the City of Red Bluff and in the lower course of Brickyard Creek, the formation is as thick as 30 feet and is very coarse in texture.

The remaining 25% of the City of Red Bluff has been developed on post-Pleistocene (recent) river and stream channel deposits in the adjacent to the valley of the Sacramento River. This includes all of the Red Bluff east of the Sacramento River and the main course of Reeds Creek. These deposits are comprised of sand, gravel, silt, and minor amounts of clay, which have been deposited along channels and atop flood plains, and natural levees of the major stream. Since these alluvial deposits have been formed by stream erosion primarily of the older Tehama and Red Bluff formations, their texture is high in gravel and soils formed on them are generally well drained, have moderate permeability, and have a high runoff due to reddish clay substrata. Along the immediate stream courses, alluvial deposits occur as loose unconsolidated sand and gravel in the active stream channel and as sand, silt and clay intermixed with lenses of gravel on the flood plain and levees adjacent to the active channel (DR, 1991).

2. TOPOGRAPHY AND DRAINAGE

The topography of the City of Red Bluff is gently rolling with little general relief except along stream courses. Slopes within the city are generally below ten percent; however, slopes of thirty to seventy percent can occur along stream banks. Slopes atop riverine terraces and in valley floors are generally less than five percent.

The city is crossed from west to east by a sequence of active streams flowing as tributaries to the Sacramento River. From north to south these are Blue Tent Creek, Dibble Creek, Brewery Creek, Brickyard Creek, Reeds Creek, Grasshopper Creek and Red Bank Creek. All of these streams show active alluvial processes, which include high discharges in the winter-early spring period, and annual deposition of sand, gravel and silt as they join the Sacramento River.

The flooding history of the largest of these streams, Reeds creek, has generated concern on the part of the Department of Water Resources of the State of California, which has resulted in two recent studies focusing on this problem (DR, 1987 and 1991). These studies, corroborated by others in similar

locales, clearly demonstrate that human activities in the water-shed upstream from Red Bluff play a significant role in sedimentation, peaks of water flow, and erosional capacity streams as they flow downstream across the City of Red Bluff. Since the city lies at the eastern ends of these drainages and has areas of high residential densities and paved streets, runoff from these urban surfaces represent an additional source of water for the channels. At times of peak discharge, this can lead to localized flooding and the back up of urban drainage systems. There is a partial levee system along the lower portion of Reeds Creek, which helps to protect the adjacent urban area from overbank flooding during periods of high stream flow.

3. SOILS

The description of the soils of Red Bluff are provided in the Open Space and Conservation Elements of this plan. Of special concern in this Safety Element is the degree to which specific soils can be considered to be hazardous in term of erodibility or accommodation to a hazardous event such as earthquake or flooding. Soil erosion is generally of greatest concern on hillsides and along stream banks where runoff waters reach their highest velocities and can undercut or carry away ground deposits that support structures. Erosion can also pose a hazard where runoff materials deposit their sediments, as along stream confluences with the Sacramento River.

Soils can serve to increase the seismic hazard in an area by undergoing liquefaction during the shaking accompanying an earthquake. Additionally, the high shrink-swell potential of a soil can lead to is classification as an expansive soil which can lead to problems for the siting of structures upon it. The Tehama County General Plan (1974) maps nearly all the City of Red Bluff as being located on “high expansive soils.” This designation is also applied to all surfaces west of the city regardless of geologic formation, altitude, topography, or changes of substrata. While there are locally high deposits of weathered secondary minerals such as clay and also local areas of clay headpans and substrates, this characterization can only be considered to be too generally for use as a planning guide.

4. CLIMATE

The climate of Red Bluff may be characterized as a subtropical summer-dry (inland Mediterranean) type. This climate has warm to hot summers and mild to cool winters, with a distinctive winter precipitation regime. The long, dry summer period is unique to this climatic type and is a feature shared commonly with most of the California. The winter season is characterized by the passage of mid-latitude cyclonic storms (wave cyclones) passing eastward from the Pacific Ocean and bringing moist, unstable air masses into interior Northern California. The actual number of storm centers of low pressure, as well as the strengths of associated cold and warm fronts, is quite different from year to year. This variability is the primary determinant of precipitation quantities from one year to another (Table 1).

TABLE 1

ANNUAL PRECIPITATION TOTALS FOR RED BLUFF, 1969-1991

YEAR	PRECIP.	YEAR	PRECIP.
1960	25.6	1976	7.20
1961	18.95	1977	19.29
1962	21.11	1978	31.72
1963	22.46	1979	29.23
1964	17.08	1980	20.43
1965	19.67	1981	30.99
1966	20.04	1982	25.72
1967	19.11	1983	48.98
1968	24.10	1984	15.61
1969	26.93	1985	14.00
1970	29.29	1986	NA
1971	13.10	1987	NA
1972	17.23	1988	19.30
1973	31.67	1989	21.20
1974	20.62	1990	24.76
1975	19.65	1991	25.57

The Wettest two seasons (consecutive), normal 42.98

74.39 in 1877 – 1879
77.22 in 1940 – 1942
74.70 in 1981 – 1983

The wettest three season (consecutive), normal 64.48

104.65 in 1877 – 1880
106.77 in 1939 – 1942
105.69 in 1980 -- 1983

Red Bluff receives roughly 21.5 inches of precipitation annually, based on data, which has been collected since 1871. The city is located somewhat in the rain shadow of the Coast Ranges and precipitation quantities generally increase to double this amount along the western sides of the Sierra Nevada and three times as much near Sierran summits to the east. There is a wide fluctuation in the annual precipitation at Red Bluff, from an absolute minimum of 7.20 inches in 1976 to an absolute maximum of 48.98 inches in 1983. Lengthy periods of wet years are rate, with the wettest two consecutive seasons providing about 70-80% greater than normal, and the wettest three consecutive seasons providing about 64% greater than normal (Table 1). Snowfall is infrequent and usually very light in amount when it does occur. Precipitation during the late spring and summer months is confined to occasional convectional thundershower activity and is likewise quite light in amount.

Winter months are dominated by the passage of storms and by general cooling. Cooler air tends to settle into the northern Sacramento Valley from adjacent mountainous area, where radiational cooling during relatively calm, clear winter night can lead to low temperatures. Winter temperatures range from a monthly normal of 45.5 F for January to about 54 F March and November. Absolute minimum of 20 F have been recorded for both December and January. The rainiest months are between November and March, with 79% of the annual total being received during those five months. This concentration is significant in terms of stream regimes and peak periods of runoff leading to a potential flooding hazard in wet years.

The summer months are usually quite dry with only about 1.52 inches, 7% of the annual total, arriving in the five-month period of May-September. By mid-summer the Sacramento Valley is usually occupied by an elongated thermal low pressure due to intense heating accompanied by an elongated thermal low pressure due to intense heating of the land surface. The retreat northward of the winter storm tracks is accompanied by the domination of Northern California by massive atmospheric subsidence from the eastern margins of the north pacific subtropical high-pressure system. Warm, dry sinking air masses now dominate the Sacramento Valley and its foothills bringing clear skies and maximum sunshine exposure. Winter percentages of possible sunshine ranged from 52% in December to 69% in March. Summer percentages of possible sunshine range from 85% in May to 94-96% in July and August – leading to an annual figure of 79% (Table 2). Average summer temperatures range from 71.6 F to April to 98 F and 95.7 F in July and August. Record high temperatures of 119 F for July and 121 F for August have been recorded, and long periods of daily temperatures above 90 F are noted (27 for July and 25 for August). Relative humidities during the mid to late summer are also quite low, ranging between 10-23 % (late afternoon) for the June-September period.

The summer patterns of rainfall, sunshine, temperature, and relative humidity are crucial in explaining the seasonality of the wildland fire hazard in the Red Bluff region.

Prevailing winds are up the valley from the southeast and down the valley from the northwest. Highest wind speeds are usually southerly in association

with frontal activity, frequently reaching 50-60 miles per hour (and occasionally greater) with the strongest fronts (Lingenfelter, 1970). Northerly winds reach speeds of 30-40 mph and only rarely exceed 50 mph. These winds occur mainly in the fall-winter-spring month. Persistent radiation and evaporation fogs occur during winter months under the influence of a stagnant high-pressure system, and particularly if there are calm conditions and if the ground is saturated from recent rains. Wind scour acts to relieve foggy conditions; however, it is noted that the number of foggy days per year is increasing due to human air pollution. Like snowfall, fog and high wind are not important climatic hazardous variables on a long-term basis at Red Bluff.

TABLE 2

Month	Average Monthly Temperature (F)	Normal Daily Maximum Temperature (F)	Average Monthly Precipitation	Percentage of Possible Sunshine
January	45.5	53.6	4.50 (10.17)	54
February	49.7	59.5	3.31 (11.38)	63
March	54.1	63.8	2.39 (9.21)	69
April	60.4	71.6	1.51 (5.79)	80
May	68.3	80.6	0.77 (4.04)	85
June	76.2	89.3	0.43 (1.63)	89
July	83.8	98.0	0.06 (0.69)	96
August	81.0	95.7	021 (1.56)	94
September	76.0	90.6	0.46 (2.47)	92
October	65.6	78.3	1.16 (4.30)	81
November	54.5	64.0	3.10 (10.29)	61
December	47.1	54.7	3.59 (10.29)	52
Annual	62.6		21.49	79

Source: U.S. Weather Service (1983) – update?

II. POTENTIAL NATURAL HAZARDS

A. SEISMIC HAZARDS

1. FAULTING AND EARTHQUAKES

All aspects of seismic safety are regarded as critically important aspects of any general plan Safety Element in California. The primary seismic hazard is earthquake activity, which originates as shock waves, generated by faulting – movements as rocks are displaced along an active fault. The primary associated seismic hazard are ground shaking and the potential for ground rupture along the surface traces of the fault line. Secondary seismic hazards result from the interaction of ground shaking with existing bedrock and soil conditions and include liquefaction, ground subsidence and landslides. Water bodies affected by earthquake shock waves may demonstrate tsunamis along seacoasts and seiches in enclosed water bodies.

The devastating San Fernando earthquake of February 1971 heavily influenced the California legislature to codify the codify the approach to planning for the earthquake hazard. The Alquist-Priolo Special Studies Zones Act was signed into law in December 1972 and went into effect on March 7, 1973. The purpose of this Act is to prohibit the location of most structures for human occupancy across the traces of active faults and mitigate thereby the hazard of fault-rupture (earthquake shaking) (Section 2621.5). Under the Act, the State Geologist (Chief of the Division of Mines and Geology) is required to delineate "Special Studies Zones" along known active faults in California. Cities and counties affected will be provided with Official Maps of these faults in order to regulate certain development projects within these zones. They must withhold development permits for sites within the special studies zones until detailed geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting (CDC, 1990 revision). The mapping of Special Studies Zones began in 1973 with attention to the most important known surface faults in California (e.g., the San Andreas, Calaveras, Hayward, and San Jacinto faults). As of January 1990, 448 Official Maps of Special Studies Zones have been issued, and nearly 25% of these have been re-studied and revised.

The most recent listing of cities and counties affected by the Alquist-Priolo Act does not include either the City of Red Bluff or Tehama County. The closest surface fault to Red Bluff is the Elder Creek Fault, which lies 21 miles to the southwest. The nearest recently active surface is the Cleveland Hill Fault, a relatively short fault in southeastern Butte County about 66 miles from Red Bluff. An earthquake on this fault occurred on August 1, 1975 and had a magnitude of 5.7 on the Richter Scale. Studies relating to the earthquake hazard in the northern Sacramento River Valley and adjacent northeastern California generally support the following conclusions:

(a) Of known earthquakes in this region, 90% were of intensity V or less on the Mercalli Scale.

(b) There have been no human injuries or deaths and only very limited property damage from earthquakes within this region.

(c) There is no evidence of an earthquake greater than magnitude 6.5 having occurred in the region in historic times.

(d) Since a hypothetical intensity VIII earthquake might occur anywhere in interior Northeastern California (a large earthquake), planning within this region should be based upon this event as a maximum intensity. And,

(e) The earthquake hazard in this region is not great when compared with the rest of the State, nor is it great when compared with other natural systems in the same regions (Guyton and Scheel, 1974).

Based on present geologic knowledge of the City of Red Bluff and adjacent portions of Tehama County, there is little likelihood of a Special Studies Zone being mapped based on an "active fault", which is one which has had surface displacement during the last 11,000 years (the Holocene). There is also no evidence of a "potentially active fault", which is defined as one, which has shown evidence of surface displacement during the last 1.6 million years (the Pleistocene Epoch). The only mapped fault system in Red Bluff has been named the Red Bluff Fault. The Red Bluff Fault is a "subsurface feature that extends northeast and southwest form Red Bluff" as mapped by Harwood and Helley (USGS, 1987). The evidence for this fault is based upon proprietary subsurface data: however, they report that "there are no surface feature that can be associated unequivocally with the fault even though there may be as much as 450 feet of subsurface vertical offset, south side down (DWR, 1991, p.17).

The objectives and policies listed previously reflect the somewhat anomalous position of planning the earthquake hazard for the City of Red Bluff. It is clear that the broader statewide dimensions of planning for the seismic hazard include toward carefulness, however, a tendency to heavily discount this hazard based upon the historically low profile of damaging activity might occur. The policies as listed reflect a middle course of action which would recommend a consideration of potential geological hazards for all proposed developments, yet require detailed geological investigations only for those areas with known geological problems. Major projects where considerable public risk is apparent, as in the case of the siting of municipal facilities or critical structure such as hospitals, should be required to submit carefully documented geological and engineering reports which should consider the local seismic risk along with all other related non-seismic geological hazards.

2. OTHER SEISMIC HAZARDS

a. Ground Shaking

Several factors influence the amount of ground shaking at any locality. The principal ones are the distance from the epicenter of the fault movement, and the local bedrock-soil conditions. Bedrock areas will have a different shaking impact compared with area underlain with softer, less consolidated materials. The stream valleys, which are veneered with alluvium, would thus be more likely to be affected by ground shaking, as would any areas with sand and mud.

b. Liquefaction

Wherever there is poorly consolidated material (such as sand and salt) and a shallow depth to groundwater, there is a potential for the soil to liquefy during ground shaking. Only strong earthquakes provide sufficient intensity of shaking to cause liquefaction, but if one does, the soil can act as a fluid. Structure can tilt or sink, highway overcrossings, levees, and bridge abutments can fail, and lateral ground movement can occur on slopes as low as 3%. Areas of Red Bluff most susceptible to such potential activity would be the beds of stream courses and riverbank exposures such as bluffs. Site investigations and testing would have to be conducted in order to determine the potential for soil liquefaction as well as the potential for other seismic impacts.

c. Landslides

Slope failure due to mass movement processes under the influence of gravity can occur with or without an earthquake. These include debris slides, earth flows, slump blocks, mudflows, and rock avalanches. The major factors creating this hazard are: slope steepness, parent materials, water content in the materials involved, and human-caused alternations. These alternations may take the form of: over-steepening of slopes by excavation, cutting and filling along the bedding plane, removal of materials at the base of a slope, placing fills or structure on potentially unstable slopes, adding irrigation water to slop or terrace surfaces, and vegetation removal leading to accelerated erosion. Some potentially unstable slopes can be stabilized or developed in such a manner as to minimize landsliding. Site investigations, careful planning in areas of steeper slopes, and mitigation designs are needed. If investigation indicates a limit to the mitigating measures, the landslide potential may constrain the ultimate human use of the site. This may be the situation along the banks of major streams such as the Sacramento River, Reeds Creek and Brickyard Creek. Aerial photographic surveys reveal that large-scale landslides are rare in the 75 square miles of the Reeds Creek drainage basin; however, several large earthflows occur outside the city limits along the north side of Brickyard Creek (DWR, 1992).

d. Tsunami

A tsunami is a seismic sea wave generated by earthquakes on ocean floors, which serve to generate long ocean waves. These waves cause high water damage when they ultimately strike a seacoast. Because of its inland location, the City of Red Bluff is not susceptible to such a hazard.

e. Seiche

Seiche is the periodic oscillation of a landlocked body of water such as a lake or reservoir, usually caused by seismic activity. The lack of such aquatic features in the Red Bluff area renders the city not subject to this hazard.

B. NON-SEISMIC GEOLOGIC HAZARDS

1. EROSION

Erosion of topsoil is generally of greatest concern on hillsides and along terrace sides and stream banks where runoff reaches its highest velocity. This can serve to undermine structures by carrying away supporting ground materials. Deposition of eroded materials can also create a hazard when debris is deposited at the base of a slope or where streams reach a confluence, thus impeding drainage. Erosion can be prevented or minimized by proper siting of development projects away from steep slopes and back from stream banks. Other mitigations include: minimizing landform alteration, limiting vegetation removal, recontouring to allow for proper runoff and soil drainage, and revegetating or covering graded areas to slow runoff velocity and encourage slope stability.

2. VOLCANIC HAZARD

The City of Red Bluff is located 45 miles from Mount Lassen, the 10,452 foot high mountain, which was the most recent large-scale volcanic eruption in California. The volcano erupted sporadically between 1914 and 1921 and in its eruptions of June 14, 1914 and May 19, 1915 produced vertical clouds of vapor and ashes to a height of over five mile in the atmosphere. These clouds were witnessed from Red Bluff, which was not affected by debris fallout due to the lack of high winds and the distance involved. Additional recent volcanic activity occurs near Paynes Creek, 21 miles to the northeast of Red Bluff. Tectonically, Red Bluff is situated on as much as 2,000 feet of sedimentary materials in the Great Valley structural trough, which is more a product of ancient plate tectonic movement than volcanic eruptions, which characterize the Cascades geologic province. The treat of a volcanic eruption within the Red Bluff area is thus minimal.

C. FLOOD HAZARDS

1. TYPES OF FLOOD HAZARDS

Flood hazards fall within three basic categories: natural seasonal flooding, dam inundation, and mud and debris flows. Natural flooding results from seasonal rainstorms that cause streams to overflow their banks, and the degree of local flooding can be aggravated by inadequacies in local storm drain facilities. Dam inundation occurs in association with structural failure of a nearby water impoundment. Mud and debris flows originate in hilly areas having sediment deposits that are poorly drained. These would mainly occur in upland areas some distance to the west of the City of Red Bluff.

Red Bluff would be affected by a structural failure of Shasta Dam, 42 miles to the north. Both this dam, and the smaller Keswick Dam to the south, are major impoundments of drainage waters of the Sacramento River and its northern tributaries. Lake Shasta has a holding capacity of 4.5 million-acre feet of water and Keswick Reservoir has a capacity of 0.02 million-acre feet. A failure of Shasta Dam would release considerable floodwaters into the main channel of the Sacramento River, and, depending on the quantity released, the timing of the flooding, the amount under storage, the season of the year, and pre-existing hydrological conditions along the Sacramento River and its tributaries between Redding and Red Bluff, the consequences could be catastrophic.

The major natural hazard system affecting the City of Red Bluff is natural seasonal flooding. The construction of Shasta Dam was part of the Central Valley Project, a scheme, which involves a system of twenty dams and reservoirs, as well as canals, power plants, and other facilities. The Red Bluff Diversion Dam, which diverts water from the Sacramento River into the Tehama-Colusa Canal, and affects the impoundment of water into "Lake Red Bluff," is a part of this project. Shasta Dam was intended by the U.S. Bureau of Reclamation to be a major flood control storage facility, thus lessening the threat of natural winter-spring flooding to communities downstream, such as Red Bluff.

The flooding hazard of the City of Red Bluff, while not severe overall, is today most notable along the lower courses of the main streams that flow from the eastern foothills of the Coast Range through Red Bluff to their confluences with the Sacramento River. These streams are: Red Bank, Grasshopper, Reeds, Brickyard, Brewery, Dibble, and Blue Tent Creeks. Overbank runoff from these streams pose the greatest threat of urban flooding. Thus, the hydrological profiles of these drainage systems are of concern in floodplain planning in the City of Red Bluff. The drainage carried by these tributary streams are largely a function of the amount and season of rainfall, the basin drainage area, and channel characteristics.

The most recent flooding events in the City occurred during January, March, and December 1983 when Reeds Creek overflowed its banks along the lower mile of its course through Red Bluff. These flood events flooded 65 homes and involved considerable emergency efforts by local agencies. Floodwaters were estimated to be between 3 – 4 feet deep inside homes in the affected areas. As part of the public outcry for remediation, a number of studies have been made of the Reeds Creek drainage basin, and the flooding potential of the stream by the Department of Water Resources. These studies have examined both the natural factors and the human factors of the flood hazard along this stream, and these conclusions may be extrapolated to the other streams flowing through Red Bluff.

2. FACTORS AFFECTING THE FLOOD HAZARD

The natural climatic pattern of the region plays a role in stream flooding. It is significant to note that 1983 was the wettest year on record (48.98 inches). It is also notable that heavy rainfall during November-December, 1982 and November-December, 1983 acted to swell the runoff into Reeds Creek. The monthly total in the early to mid-winter period may be more important indicators of flooding potential than annual totals, since the flooding of 1964 occurred with only 17.08 inches of total precipitation, but 9.31 inches occurred in November-December alone.

The human factors that have affected the watersheds of steams like Reeds Creek are: the operation of the Red Bluff Diversion Dam, which has caused short-term changes in the stream erosion-deposition cycle (especially situation in the stream channel downstream); clearing of oak trees and soil compaction by grazing animals, which have caused increased runoff and peak flows; placing of obstructions (bridges and pipelines) in stream channels; human

occupation of floodplains, and the spread of impermeable urban surfaces such as streets which can increase the velocity of surface runoff into stream channels.

The streams, which flow through Red Bluff, drain significant watershed to the west of the City. Reeds Creek has a drainage basin of 74.4 square miles, Red Bank Creek occupies 89.6 square miles, and the aggregate of these and the other five stream drainage basins is 246.5 square miles. It is clear that long-term land management decisions in these basins, especially with regard to forest clearance and streamside alterations is of concern of the residents of Red Bluff.

3. PLANNING FOR FLOOD HAZARDS

In floodplain planning, the 100-year floodplain can be mapped. This is the area, which is estimated to have a 1% chance per year of inundation. It must be considered that this is only statistical probability. Also mappable, given detailed data, are 50-year, 20-year, 10-year, and 5-year floodplains. The 100-year (recurrence interval) of floodwaters from Red Bank Creek has a magnitude of 21,000 cfs., while the 10-year magnitude is 12,000 cfs. These data would allow proper planning of drainage-ways during times of peak flow. The 100-year floodplain has been set by FEMA as the “base flood” standard for acceptable risk. The National Flood Insurance Program (FEMA) has studies the floodways of Red Bluff and has prepared maps of the 100-year (and 500-year) floodplains for all streams flowing through Red Bluff.

At the present time, Red Bluff relies on the natural drainage channels for its surface runoffs. A study conducted in 1962 resulted in the identification of potential flood hazard areas, and drainage facilities were constructed by the City to relieve these. However, some “missing flood control improvements” are yet to be constructed primarily because the financial sponsorship is lacking and the infill nature of urbanization in Red Bluff has allowed some development to avoid mitigation of drainage impacts from their isolated projects (Bryon and Associate, 1991). The City Master Plan study for infrastructure systems (Bryon and Associates, 1991) identifies local flood hazard areas and suggests remedies. Similar recommendations were made by the Department of Water Resources in the 1987 study of the Reeds Creek flood of 1983. the main areas affected are:

(1) Most homes on Musick Avenue and along Aloha Street from South Jackson Street to Aloha Court are located on the 100-year floodplain.
(2) Vista School at Vista Way and South Jackson would suffer from drainage problems.
(3) An area east of Airport Blvd. and north of Kimball Road would suffer from runoff backup.
(4) A potential exists for some inundation of Forward Park.
(5) The vicinity of the Union Pacific right-of-way between Walnut Street and Reeds Creek has a high potential for future flooding with continued development.

The 1991 infrastructure plan concludes:

> "Red Bluff relies for runoff primarily on the natural drainage courses, which bisect its sphere of influence. Current design philosophy permits overland flow in street gutters as a means of balancing flood protection needs with local financial resources. However, as development approaches buildout in the core area, it may be desirable to convey the peak runoff quantity from a 100-year storm event (design capacity) to the receiving stream in some type of physical facility, e.g., storm drain pipes, concrete-lined channels, detention basins, ect."

Limiting land uses in the floodplain to those that can sustain periodic flooding will have the greatest long-term benefits. Appropriate uses would be open space and recreation. Developments already occurring in the floodplain should be encouraged to undertake appropriate development must mitigate potential impacts, upstream and especially downstream. No development should be allowed, which would raise the level of the 100-year flood. Surface runoff from areas that drain into streams should be controlled by measures, which prevent erosion, and soil erosion during construction should likewise be carefully monitored and controlled. Since localized flooding may occur where immediate access to stream channels is not feasible for runoff, or, if runoff is blocked by existing development project, storm drainage improvements will be required.

An FW (Floodway) overlay is hereby created with the adoption of this Safety Element. The boundaries of the FW Zoning District shall correspond to the Floodway Boundaries on the approved Floodway Boundary and Floodway Maps produced by the Federal Emergency Management Administration (FEMA).

No use, development or alteration of the FW overlay is allowed with prior City approval. Prior to granting approval to use, develop or alter land within an FW overlay area, the City shall make findings that the proposed use, development or alteration of the floodway conforms to the City's Flood Damage Prevention Regulations (City Code Chapter 26) and applicable Federal (FEMA) regulations.

D. FIRE HAZARDS

Wildfires continue to pose significant threat to most Northern California communities, including Red Bluff. The wildfire hazard is the consequence of three main factors:

(1) A climatic pattern with long dry summers, clear skies with maximum solar radiation, high daytime summer temperatures, and extremely low relative humidities.
(2) Vegetation communities, which often have adapted to this seasonal drought by becoming fire tolerant (e.g., chaparral), and have high fuel loading.
(3) Human settlement patterns which often are interspersed with areas of heavy vegetation/fuel accumulations along canyons, slopes, and foothill areas.

The City of Red Bluff is affected by the first of these factors but is only minimally affected by the last two. The main vegetation communities of the city are oak woodland, valley grasslands, and riparian forest (see Conservation Element for a complete description of these types). Heavy concentrations of chaparral shrubs are rare, and the main vegetative cover is scattered oak trees with an understory of native and introduced herbaceous species of grasses and other non-woody plants. Riparian strips of denser tree growth with an understory of shrubs and scrub oak are sporadic along some of the major stream courses such as Reed's Creek.

A catastrophic wildfire has not affected Red Bluff in recent decades and the threat from one is small. The rapid response time of units from Red Bluff Fire Department has allowed containment of vegetation fires, while they are still small. The number of vegetation (grass and brush) in 2007 was 44 out of a total of 152 incidents, a figure, which is about the average for the 2000-2007 period.

When considering the wildland fire hazard, the primary environmental concern is the buildup of combustible material. Combustible fuels management is the most direct method of reducing the intensity, and thus the potential damage, of wildfires. The California Department of Forestry (CDF) estimates the following fuel volumes from the vegetation communities of the Red Bluff area:

VEGETATION COMMUNITY	TONS OF FLAMMABLE FUEL PER ACRE
1. Blue Oak Woodland	1.05 - 3.40
2. Open Chaparral Shrub	7.31 - 32.54
3. Closed Riparian Forest	27.19 - 35.00

(CDF, 1976)

The high fuel loading coupled with long, dry summer season creates a peak fire hazard during June to October. Other conditions, which might serve to increase the fire hazard, include slope and exposure, the nature of access roads, the distance from the main fire station, water availability, and competition for response by multiple calls for assistance. Additionally, the arrival of heavy fall to spring rainfall, while lowering the fire hazard during this period, can lead to heavier late spring vegetative growth, which leads to an increased fire hazard by late summer – early fall.

An awareness of these conditions led to the enactment of a strong weed abatement ordinance in April 1990 (City ordinance 821 – See Appendix A). This ordinance establishes effective measure for the control of flammable vegetation on open spaces within the city prior to June 1. Additional Weed Abatement Standards are followed for parcels of three acres and larger (Appendix). The Red Bluff Fire Department is in conformance with the California Fire Safe Regulation enumerated in Public Resources Code 4290.

Specific implementation recommendations by Fire Department officials relate to hydrant spacing, traffic flow in new subdivision, and the need for appropriate sprinkler regulations for new developments. These have been

integrated into section I.B of this element, and should be viewed alongside parallel recommendations included in the Land Use Element and the Open Space Element.

III. PUBLIC PROTECTION SERVICES

A. FIRE

The City of Red Bluff has one centrally located Fire Department and station, which shares a facility with the Policy Department. The central location of the fire station is important in the provision of services to all parts of the city. It is the City's goal to maintain an average response time of 4 minutes or less to 90% of the annual emergency calls. The City currently employs 13 full-time firefighters and an additional 25 part-time personnel. The department is an all-risk agency with strong automatic and mutual aid agreements with the Tehama County Fire Department. The department has four fire engines, one aerial truck, one quick attack unit, one air/light unit and a number of 4X4 staff and utility vehicles.

In 2006, the Insurance Services Office (ISO) recommended that the Red Bluff Fire Department (RBFD) maintain its ISO PPC rating of "3" – a rating that it has held since 1990. Since the deparment maintains four engines companies and one truck company, the number of required firefighters would need to be in the range of 22-24, given a recommended fire protection standard of 1.67 firefighters per per 1,000 people. Should the department be increased in personnel to a level commensurate to increasing the rating to class 2, there would be a reduction of fire insurance rates by about 10% for commercial occupancies within the City of Red Bluff. A clear objective of the Fire Department is therefore to increase available fire-fighters per shift to seven.

Additional qualified fire-fighter protection as well as consequent equipment needs will also be needed as Red Bluff continues to increase in populationSince population increase is most evident in new subdivision to the south and north of the city center of Red Bluff, the response time from the central fire station may be diminished due to distance, increased traffic loads on main arterials, and the need to traverse networks of secondary roads. Attention should be paid to the potential future need for a second fire station in the southern part of Red Bluff in order to plan for such a geographical pattern of city expansion. The present facility has served the city for nearly thirty years; however, there is an obvious shortage of space in the 7,000 square foot station complex, and this will become even more acute as new functions and personnel are added (Bryon and Murphy, 1991).

Current Fire Department concerns relative to land use planning and future development projects within the urban area are addressed in the objectives and policies in section I.B, and relate to the following:

(1) The provision of adequate water supplies, especially during times of peak demand, with water flows of 1,500gal/min. in residential areas and 3,000 gal/min. for commercial areas. Hydrant spacing should be 500 feet and 300 feet in residential and commercial areas respectively.
(2) Providing adequate access and egress of large and heavy fire apparatus to every proposed project and development must always be considered.
(3) The adequate planning for fire-fighting capabilities in areal of critical facilities, e.g. at the airport, water for fire-fighting should be available to the end of each runway.
(4) A regular and consistent system of signing and addressing needs to be applied in all new subdivisions in order to ensure proper guidance of fire-fighting units.

B. POLICE

The City of Red Bluff is staffed with 23 sworn officers and 11 ancillary staff members, for a total of 34 personnel. The Police Department operates out of the central Public Safety Complex in the city center. The city owns and operates five marked patrol cars, one traffic enforcement car, three detective cars, two motorcycles, and one Community Service Officer (CSO) pick-up truck. The department shares vehicular maintenance functions with the Fire Department, which results in a savings to the city of expenses in this area.

Professional staff is assisted by six trained police officers who assist sworn officers in such activities as: riding in patrol units, park supervision, and a t special activities where large crowds are involved. This function is seen as critically important by the department, which is continuing its recruitment, training, and award programs for this volunteer effort. The department has implemented or jointly participates in a total of 21 specialized law enforcement programs, including Neighborhood Watch, Secret Witness, Juvenile Services, Interagency Drug Enforcement, D.U.I., Weapons Training, among others. The department participates in mutual aid agreements with the Tehama County Sheriff's Office and the California Highway Patrol. The department also benefits from the close proximity of police facilities of these two agencies to the Red Bluff urban area.

The Police Department, like the Fire Department, has an important role in emergencies. The primary role of the Policy Department in a fire emergency is public safety and traffic control. Personnel in both departments have had training in advanced first aid and CPR. Additionally, two sworn officers are fully trained in hazardous material response. Police personnel are fully integrated in the "emergency operations plan" and are prepared to respond to all types of incidents.

The location and function of Red Bluff have a special impact on policy protection services. Red Bluff serves as the County Seat of Tehama County, and also is located at the junction of a major intercity highway (Highway 99) and Interstate 5. These factors ensure a large daytime service function and traffic corridor problems that peak during the day but extend to a 24-hour basis. Departmental estimates indicate that the residential population of 12,900 is expanded to a daily service population of nearly 30,000 during peak times. The

present sworn officer to population ratio of the Red Bluff Policy Department is about 1.8 per 1,000 people. The ideal ratio, by department standards, would be maintain a ratio of 2:1,000 people, which, given the present population of the city alone would mean the addition of three sworn officers to the police force.

C. HAZARDOUS MATERIALS

The City of Red Bluff has no high hazardous materials use facility such as oil refineries or chemical manufacturing plants. There are also no large storage facilities for hazardous materials such as chemicals, solvents, or fuels. "Hazardous Materials" covers a large number of substances that are an actual or potential danger to the public. These include heavy metals, toxic chemicals; flammable and/or explosive gases, liquids, and solids; corrosive materials, infectious substances, and radioactive materials. After domestic or commercial use many of these substances become "hazardous waste materials." The need to develop a rational planned approach to long-term hazardous waste management became increasingly important after 1980. Partly in response to this concern, Assembly Bill 2948 was passed in 1986. This bill provided funding to California counties to prepare hazardous waste management plans.

Tehama County elected to prepare a County Hazardous Waste Management Plan (CHWMP) under the auspices of AB 2948. The Tehama County CHWMP complies with the California Department of Health Services' "Guidelines for the Preparation of Hazardous Waste Management Plan" (DHS, June 30, 1987). The plan was presented in September 1988 and revised in January 1989. The plan is currently used by Tehama County and its guidelines are relied upon by the City of Red Bluff for all aspects of tis management of hazardous wastes. The Tehama CHWMP was the basis for the recommendations for "existing and proposed hazardous waste disposal" (Section IV B) of the Land Use Element. The specific guidelines of the CHWMP were enumerated therein.

The transportation of hazardous materials (and waste) within the City is a matter of public protection concern. The transportation of hazardous materials is largely regulated by federal and state agencies; however, an accident involving the spillage of hazardous materials becomes a county or city response need depending on the locality. The danger of such an occurrence relates directly to the presence of a major interstate highway and railroad line transecting the city. While these two transport lines are relatively straight and level, they represent areas involving high traffic congestion within the city limits. The Tehama CHWMP suggests specific policies to review for adequacy of the inspection and licensing activities for vehicles used in the county, to periodically check manifest records to ensure that licensed haulers are being used, review county transportation routes to determine if there are roads on which hazardous substances or waste transport should be prohibited, ensure that vehicles hat transport hazardous materials for county agencies are in full compliance with state and federal law, and review adequacy of the County's monitoring (and agency procedure) for transporting hazardous materials and wastes. These policies can be adapted to city needs and the appropriate city ordinances can be adopted to conform with County policies and actions and to fit the needs of the people of Red Bluff.

D. EMERGENCY PREPAREDNESS

The public agencies of the City of Red Bluff were integrated into the Fire Department's "emergency operations plan" in August 1991. This plan has integrated agency response to a variety of potential emergencies: Flood, Fire, Earthquake, Explosion, Snow Storm, Civil Disturbance, and Hazardous material Spill. A stepwise procedure involving notification, Mutual Aid involvement, and appropriate agency and personnel response, is detailed for each potential emergency circumstance. A copy of this disaster plan is included in the Appendix to this element.

In addition, all fire-fighting personnel attend training sessions dealing with vehicle extrication procedures, hazardous materials handling, cardiopulmonary resuscitation, and advance first aid procedures. Police personnel are similarly trained, with two sworn officers fully trained in hazard management response. Both the Fire and Police Departments feel comfortable with the level of emergency preparedness of their staffs, and with the recommendations for handling hazardous materials in the County's management plan. Both Public Safety agencies maintain Mutual Aid agreements with appropriate outside fire and policy agencies, and emergency medical response personnel are on duty or on call at St. Elizabeth's Hospital, the City's major health provider.

The official Emergency Plan for the City of Red Bluff was written in May 1975, updated in 1977, and extended as current by the State of California Office of Emergency Services in 1981, with a need to update in 1984. The City Emergency Plan will need to be correlated with the "emergency operations plan" and fully updated to existing emergency, safety, and public health guidelines.

REFERENCES

Bryan, Murphy Associates, City of Red Bluff 1991 Master Plan. San Ramon, California, May 1991.

California State University, Chico, Department of Geography and Planning, General Plan Elements: Land Use and Conservation. 1993.

City of Red Bluff, Police Department. "1991 Annual Report and Statistical Review," March 1992.

City of Red Bluff, "City Disaster Plan," August 12, 1991.

City of Red Bluff, Fire Department. 1990 Annual Report, March 1991.

City of Red Bluff, Office of Emergency Services "Emergency Plan," 1975 and 1981.

Federal Emergency Management Agency, Flood Boundary and Floodway Maps, City of Red Bluff, February 1987.

Federal Emergency Management Agency, "Flood Insurance Study – City of Red Bluff, California, " March, 1986.

Guyton and Scheel, Earthquake and Volcanic Hazards in Northeastern California, Chico, 1974.

Lingenfelter, Keith. Usual and Unusual Weather at Red Bluff and Vicinity, Red Bluff, 1970.

State of California, Department of Water Resources, Reeds Creek Flood Study, Sacramento, December 1987.

State of California, Department of Water Resources, Sacramento Valley Westside Tributary Watershed Erosion Study: Reeds Creek Watershed, Sacramento, October 1991.

State of California, Division of Forestry, "Fire Control Notes," No. 37, September 1976.

State of California, Air Resourced Board, "Climate of the Sacramento Valley Ar Basin, " November, 1974.

State of California, Department of Conservation, Division of Mines and Geology, "Fault-Rapture Hazard Zones in California," Special Publication 42, Revised 1990.

State of California, Office of Planning and Research, "Hazardous Waste and Substances Sites List, Red Bluff, California," September 1988.

Tehama County, Hazardous Waste Management Plan, Volumes I and II, January 1989.

Tehama County, Hazardous Waste Management Plan, Volumes I and II, September 1988.

Tehama County, "Tri-County Area Planning Area, General Plan Elements: Safety, Seismic Safety, Noise, Scenic Highways," 1974.

United States Geological Survey, Geologic Map: Redding Sheet, 1969.

United States Geological Survey, "Preliminary Geological Map of the Red Bluff 100,000 Quadrangle, California," Open-File Map of 84-105, 1984.

United States Weather Bureau, Climatic Summary of the United States, Washington, D.C., 1964 and 1984.

Warner, Richard (Ed.), California Riparian Systems, University of California Press, Berkeley, California, 1982.

1993 SAFETY ELEMENT

Appendix Contents

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