County of Riverside

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Volume 4 Appendices (Appendices A-1 through K-1)

RIVERSIDE COUNTY
PLANNING DEPARTMENT

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Appendix A-1:
Glossary of Terms/Acronyms

Appendix A-1: Glossary of Terms

The terms in this glossary are adapted from the California General Plan Glossary, 1997, published by the California Planning Roundtable, Naphtali H. Knox, AICP, and Charles E. Knox, Editors.

ADA: Americans with Disabilities Act
ADT: Average daily trips made by vehicles or persons in a 24-hour period
AQMD: Air Quality Management District
BLM: Bureau of Land Management
BMR: Below-market-rate dwelling unit
CC&Rs: Covenants, Conditions, and Restrictions
CDBG: Community Development Block Grant
CEQA: California Environmental Quality Act
CETAP: Community Environmental Transportation Acceptability Process
CHFA: California Housing Finance Agency
CIP: Capital Improvements Program
CMP: Congestion Management Plan
CNEL: Community Noise Equivalent Level
COG: Council of Governments
CRA: Community Redevelopment Agency
dB: Decibel
EIR: Environmental Impact Report (State)---
EIS: Environmental Impact Statement (Federal)
FAR: Floor Area Ratio
FAUS: Federal Aid to Urban Systems
FEMA: Federal Emergency Management Agency
FHWA: Federal Highway Administration
FIR: Fiscal Impact Report
FIRM: Flood Insurance Rate Map
GMI: Gross Monthly Income
GOPR: Governor's Office of Planning and Research, State of California
GPAC: General Plan Advisory Committee
HAP: Housing Assistance Plan
HCD: Housing and Community Development Department of the State of California
HOV: High Occupancy Vehicle
HOT: High Occupancy Toll
ITS: Intelligent Transportation Systems
HUD: U.S. Department of Housing and Urban Development
JPA: Joint Powers Authority
LAFCO: Local Agency Formation Commission
LHA: Local Housing Authority
LOS: Level of Service
MSHCP: Multi Species Habitat Conservation Plan
NEPA: National Environmental Policy Act
NPDES: National Pollutant Discharge Elimination System
PUD: Planned Unit Development
RCIP: Riverside County Integrated Project
RCTC: Riverside County Transportation Commission
RTA: Riverside Transit Agency
RTP: Regional Transportation Plan

SCAG: Southern California Association of Governments
SOI: Sphere of Influence
UBC: Uniform Building Code
UHC: Uniform Housing Code
TDM: Transportation Demand Management
TSM: Transportation Systems Management
TDR: Transfer of Development Rights
TIP: Transportation Improvement Program
TLMA: Transportation and Land Management Agency
TOD: Transit-Oriented Development
TSM: Transportation Systems Management
VMT: Vehicle Miles Traveled

DEFINITIONS

Acceptable Risk: A hazard that is deemed to be a tolerable exposure to danger given the expected benefits to be obtained. Different levels of acceptable risk may be assigned according to the potential danger and the criticalness of the threatened structure. The levels may range from "near zero" for nuclear plants and natural gas transmission lines to "moderate" for open-space, ranches and low-intensity warehouse uses.

Acres, Gross: The entire acreage of a site. Gross acreage is calculated to the centerline of proposed bounding streets and to the edge of the right-of-way of existing or dedicated streets.

Acres, Net: The portion of a site that can actually be built upon. The following are not included in the net acreage of a site: public or private road rights-of-way, public open-space, and flood ways.

Adaptive Reuse: The conversion of obsolescent or historic buildings from their original or most recent use to a new use. For example, the conversion of former hospital or school buildings to residential use, or the conversion of an historic single-family home to office use.

Affordable Housing: Housing capable of being purchased or rented by a household with very low, low, or moderate income, based on a household's ability to make monthly payments necessary to obtain housing. "Affordable to low-and moderate-income households" means that at least 20 percent of the units in a development will be sold or rented to lower income households, and the remaining units to either lower or moderate income households. Housing units for lower income households must sell or rent for a monthly cost not greater than 30 percent of 60 percent of area median income as periodically established by HCD. Housing units for moderate income must sell or rent for a monthly cost not greater than 30 percent of area median income.

Air Rights: The right granted by a property owner to a buyer to use space above an existing right-of-way or other site, usually for development.

Alley: A narrow service way, either public or private, which provides a permanently reserved but secondary means of public access not intended for general traffic circulation. Alleys typically are located along rear property lines.

Ambient: Surrounding on all sides; used to describe measurements of existing conditions with respect to traffic, noise, air and other environments.

Ambient Noise: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Annex, v.: To incorporate a land area into an existing district or municipality, with a resulting change in the boundaries of the annexing jurisdiction.

Aquifer: An underground, water-bearing layer of earth, porous rock, sand, or gravel, through which water can seep or be held in natural storage. Aquifers generally hold sufficient water to be used as a water supply.

Architectural Control; Architectural Review: Regulations and procedures requiring the exterior design of structures to be suitable, harmonious, and in keeping with the general appearance, historic character, and/or style of surrounding areas. A process used to exercise control over the design of buildings and their settings. (See "Design Review")

Area; Area Median Income: As used in State of California housing law with respect to income eligibility limits established by the U.S. Department of Housing and Urban Development (HUD), "area" means metropolitan area or non-metropolitan county. In non-metropolitan areas, the "area median income" is the higher of the county median family income or the statewide non-metropolitan median family income.

Arterial Highway: Medium to higher speeds (30-55 mph), medium to higher capacity (10,000-50,000 average daily trips) roadway that provides intra- and inter-community travel and access to the regional highway and freeway system. Access to community arterials should be provided at collector roads and local streets, discouraging direct access from parcels to existing arterials.

Assessment District: See "Benefit Assessment District."

Assisted Housing: Generally multi-family rental housing, but sometimes single-family ownership units, whose construction, financing, sales prices, or rents have been subsidized by federal, state, or local housing programs including, but not limited to Federal §8 (new construction, substantial rehabilitation, and loan management set-asides), Federal §s 213, 236, and 202, Federal §221(d)(3) (below-market interest rate program), Federal §101 (rent supplement assistance), CDBG, FmHA §515, multi-family mortgage revenue bond programs, local redevelopment and in lieu fee programs, and units developed pursuant to local inclusionary housing and density bonus programs. By January 1, 1992, all California Housing Elements are required to address the preservation or replacement of assisted housing that is eligible to change to market rate housing by 2002.

Attainment: Compliance with State and federal ambient air quality standards within an air basin. (See "Non-attainment")

Base Flood: In any given year, a 100-year flood that has a one percent likelihood of occurring, and is recognized as a standard for acceptable risk.

Bed and Breakfast: Usually a dwelling unit, but sometimes a small hotel, which provides lodging and breakfast for temporary overnight occupants, for compensation.

Below-market-rate (BMR): (1) Any housing unit specifically priced to be sold or rented to low- or moderate-income households for an amount less than the fair-market value of the unit. Both the State of California and the U.S. Department of Housing and Urban Development set standards for determining which households qualify as "low income" or "moderate income." (2) The financing of housing at less than prevailing interest rates.

Benefit Assessment District: An area within a public agency's boundaries that receives a special benefit from the construction of one or more public facilities. A Benefit Assessment District has no independent life; it is strictly a financing mechanism for providing public infrastructure as allowed under various statutes. Bonds may be issued to finance the improvements, subject to repayment by assessments charged against the benefitting properties. Creation of a Benefit Assessment District enables property owners in a specific area to cause the construction of public facilities or to maintain them (for example, a downtown, or the grounds and landscaping of a specific area) by contributing their fair share of the construction and/or installation and operating costs.

Bicycle Lane (Class II facility): A corridor expressly reserved for bicycles, existing on a street or roadway in addition to any lanes for use by motorized vehicles.

Bicycle Path (Class I facility): A paved route not on a street or roadway and expressly reserved for bicycles traversing an otherwise unpaved area. Bicycle paths may parallel roads but typically are separated from them by landscaping.

Bicycle Route (Class III facility): A facility shared with motorists and identified only by signs, a bicycle route has no pavement markings or lane stripes.

Bikeways: A term that encompasses bicycle lanes, bicycle paths, and bicycle routes.

Biotic Community: A group of living organisms characterized by a distinctive combination of both animal and plant species in a particular habitat.

Blight: A condition of a site, structure, or area that may cause nearby buildings and/or areas to decline in attractiveness and/or utility. The Community Redevelopment Law (Health and Safety Code, Sections 33031 and 33032) contains a definition of blight used to determine eligibility of proposed redevelopment project areas.

Blueline Stream: A watercourse shown as a blue line on a U.S. Geological Service topographic quadrangle map.

Bond: An interest-bearing promise to pay a stipulated sum of money, with the principal amount due on a specific date. Funds raised through the sale of bonds can be used for various public purposes.

Brownfield: An area with abandoned, idle, or under-used industrial and commercial facilities where expansion, redevelopment, or reuse is complicated by real or perceived environmental contamination. (See "Greenfield")

Buffer Zone: An area of land separating two distinct land uses that acts to soften or mitigate the effects of one land use on the other.

Buildout; Build-out: Development of land to its full potential or theoretical capacity as permitted under current or proposed planning or zoning designations. (See "Carrying Capacity (3)")

California Air Resources Board: The State of California Agency responsible for air pollution control.

California Clean Air Act: Legislation enacted in 1988 and amended in 1992 and 1996, mandating a planning process to attain state ambient air quality standards

California Environmental Quality Act (CEQA): A State law requiring State and local agencies to regulate activities with consideration for environmental protection. If a proposed activity has the potential for a significant adverse environmental impact, an Environmental Impact Report (EIR) must be prepared and certified as to its adequacy before taking action on the proposed project.

California Housing Finance Agency (CHFA): A State agency, established by the Housing and Home Finance Act of 1975, which is authorized to sell revenue bonds and generate funds for the development, rehabilitation, and conservation of low-and moderate-income housing.

Caltrans: California Department of Transportation.

Capital Improvements Program (CIP): A program established by a city or county government and reviewed by its planning commission, which schedules permanent improvements, usually for a minimum of five years in the future, to fit the projected fiscal capability of the local jurisdiction. The program generally is reviewed annually, for conformance to and consistency with the general plan.

Carbon Monoxide: A colorless, odorless, toxic gas produced through the incomplete combustion of fossil fuels.

Carrying Capacity: Used in determining the potential of an area to absorb development: (1) The level of land use, human activity, or development for a specific area that can be accommodated permanently without an irreversible change in the quality of air, water, land, or plant and animal habitats. (2) The upper limits of development beyond which the quality of human life, health, welfare, safety, or community character within an area will be impaired. (3) The maximum level of development allowable under current zoning. (See "Buildout")

Channelization: (1) The straightening and/or deepening of a watercourse for purposes of storm-runoff control or ease of navigation. Channelization often includes lining of stream banks with a retaining material such as concrete. (2) At the intersection of roadways, the directional separation of traffic lanes through the use of curbs or raised islands that limit the paths that vehicles may take through the intersection.

Clustered Development: Development in which a number of dwelling units are placed in closer proximity than usual, or are attached, with the purpose of retaining an open-space area.

Collector: Relatively-low-speed (25-30 mph), relatively-low-volume (5,000-20,000 average daily trips) street that provides circulation within and between neighborhoods. Collectors usually serve short trips and are intended for collecting trips from local streets and distributing them to the arterial network.

Community Care Facility: Elderly housing licensed by the State Health and Welfare Agency, Department of Social Services, typically for residents who are frail and need supervision. Services normally include three meals daily, housekeeping, security and emergency response, a full activities program, supervision in the dispensing of medicine, personal services such as assistance in grooming and bathing, but no nursing care. Sometimes referred to as residential care or personal care. (See "Congregate Care")

Community Development Block Grant (CDBG): A grant program administered by the U.S. Department of Housing and Urban Development (HUD) on a formula basis for entitlement communities, and by the State Department of Housing and Community Development (HCD) for non-entitled jurisdictions. This grant allots money to cities and counties for housing rehabilitation and community development, including public facilities and economic development.

Community Facilities District: Under the Mello-Roos Community Facilities Act of 1982 (Government Code Section 53311 et seq), a legislative body may create within its jurisdiction a special district that can issue tax-exempt bonds for the planning, design, acquisition, construction, and/or operation of public facilities, as well as provide public services to district residents. Special tax assessments levied by the district are used to repay the bonds.

Community Noise Equivalent Level (CNEL): A 24-hour energy equivalent level derived from a variety of single-noise events, with weighting factors of 5 and 10 dBA applied to the evening (7 PM to 10 PM) and nighttime (10 PM to 7 AM) periods, respectively, to allow for the greater sensitivity to noise during these hours.

Community Park: Land with full public access intended to provide recreation opportunities beyond those supplied by neighborhood parks. Community parks are larger in scale than neighborhood parks but smaller than regional parks.

Community Redevelopment Agency (CRA): A local agency created under California Redevelopment Law (Health & Safety Code §33000, et. seq.), or a local legislative body that has been elected to exercise the powers granted to such an agency, for the purpose of planning, developing, re-planning, redesigning, clearing, reconstructing, and/or rehabilitating all or part of a specified area with residential, commercial, industrial, and/or public (including recreational) structures and facilities. The redevelopment agency's plans must be compatible with adopted community general plans.

Concurrency: Installation and operation of facilities and services needed to meet the demands of new development simultaneous with the development.

Condominium: A structure of two or more units, the interior spaces of which are individually owned; the balance of the property (both land and building) is owned in common by the owners of the individual units.

Congestion Management Plan (CMP): A mechanism employing growth management techniques, including traffic level of service requirements, standards for public transit, trip reduction programs involving transportation systems management and jobs/ housing balance strategies, and capital improvement programming, for the purpose of controlling and/or reducing the cumulative regional traffic impacts of development.

Congregate Care: Apartment housing, usually for seniors, in a group setting that includes independent living and sleeping accommodations in conjunction with shared dining and recreational facilities. (See "Community Care Facility.")

Consistency; Consistent With: Free from significant variation or contradiction. The various diagrams, text, goals, policies, and programs in the general plan must be consistent with each other, not contradictory or preferential. The term "consistent with" is used interchangeably with "conformity with." The courts have held that the phrase "consistent with" means "agreement with; harmonious with." Webster defines "conformity with" as meaning harmony, agreement when used with "with." The term "conformity" means in harmony therewith or agreeable to (Sec 58 Ops.Cal.Atty.Gen. 21, 25 [1975]). California State law also requires that a general plan be internally consistent and also requires consistency between a general plan and implementation measures such as the zoning ordinance. As a general rule, an action program or project is consistent with the general plan if, considering all its aspects, it will further the objectives and policies of the general plan and not obstruct their attainment.

Conveyance Tax: A tax imposed on the sale, lease, or transfer of real property.

Covenants, Conditions, and Restrictions (CC&Rs): A term used to describe restrictive limitations that may be placed on property and its use, and which usually are made a condition of holding title or lease.

Critical Facility: Facilities housing or serving many people, that are necessary in the event of an earthquake or flood, such as hospitals, fire, police, and emergency service facilities, utility "lifeline" facilities, such as water, electricity, and gas supply, sewage disposal, and communications and transportation facilities.

Cul-de-sac: A short street or alley with only a single means of ingress and egress at one end and with a large turnaround at its other end.

Cultural Resources: *Cultural resources are evidence of past human activity that becomes important for scientific, historic, and/or religious reasons to communities, descendent groups, and individuals. Cultural resources may include areas, places, sites (particularly archeological sites), buildings, structures, objects, records, or manuscripts associated with history or prehistory. Some specific examples of cultural resources are historic properties, traditional use areas, and sacred resource areas.*

Cumulative Impact: As used in CEQA, the total impact resulting from the accumulated impacts of individual projects or programs over time.

dB: Decibel; a unit used to express the relative intensity of a sound as it is heard by the human ear. See the noise element guidelines in Appendix A for a technical definition.

dBA: The "A-weighted" scale for measuring sound in decibels; weighs or reduces the effects of low and high frequencies in order to simulate human hearing. Every increase of 10 dBA doubles the perceived loudness though the noise is actually ten times more intense.

Dedication: The turning over by an owner or developer of private land for public use, and the acceptance of land for such use by the governmental agency having jurisdiction over the public function for which it will be used. Dedications for roads, parks, school sites, or other public uses often are made conditions for approval of a development by a city or county.

Dedication, In lieu of: Cash payments that may be required of an owner or developer as a substitute for a dedication of land, usually calculated in dollars per lot, and referred to as in lieu fees or in lieu contributions.

Defensible space:

a) Open-spaces, entry points, and pathways configured to provide maximum opportunities to rightful users and/or residents to defend themselves against intruders and criminal activity.

b) A separation zone between wildlands and structures where fuel, including natural and ornamental vegetation, man-made combustible materials, and ancillary structures, is managed or modified to minimize the spread of

fire to the structure and allow space for defending structures from burning vegetation.

Deficiency Plan: An action program for improving or preventing the deterioration of level of service on the Congestion Management Agency street and highway network.

Density, Residential: The number of permanent residential dwelling units per gross acre of land.

Density Bonus: The allocation of development rights that allows a parcel to accommodate additional square footage or additional residential units beyond the maximum for which the parcel is zoned. Under Government Code Section 65915, a housing development that provides 20 percent of its units for lower income households, or ten percent of its units for very low-income households, or 50 percent of its units for seniors, is entitled to a density bonus and other concessions.

Density, Employment: A measure of the number of employed persons per specific area (for example, employees/acre).

Density Transfer: A way of retaining open space by concentrating densities usually in compact areas adjacent to existing urbanization and utilities while leaving unchanged historic, sensitive, or hazardous areas. In some jurisdictions, for example, developers can buy development rights of properties targeted for public open space and transfer the additional density to the base number of units permitted in the zone in which they propose to develop.

Design Review; Design Control: The comprehensive evaluation of a development and its impact on neighboring properties and the community as a whole, from the standpoint of site and landscape design, architecture, materials, colors, lighting, and signs, in accordance with a set of adopted criteria and standards. "Design Control" requires that certain specific things be done and that other things not be done. Design Control language is most often found within a zoning ordinance. "Design Review" usually refers to a system set up outside of the zoning ordinance, whereby projects are reviewed against certain standards and criteria by a specially established design review board or committee. (See "Architectural Control")

Detachment: Withdrawal of territory from a special district or city; the reverse of annexation.

Detention Dam/Basin/Pond: Dams may be classified according to the broad function they serve, such as storage, diversion, or detention. Detention dams are constructed to retard flood runoff and minimize the effect of sudden floods. Detention dams fall into two main types. In one type, the water is temporarily stored, and released through an outlet structure at a rate that will not exceed the carrying capacity of the channel downstream. Often, the basins are planted with grass and used for open-space or recreation in periods of dry weather. The other type, most often called a Retention Pond, allows for water to be held as long as possible and may or may not allow for the controlled release of water. In some cases, the water is allowed to seep into the permeable banks or gravel strata in the foundation. This latter type is sometimes called a Water-Spreading Dam or Dike because its main purpose is to recharge the underground water supply. Detention dams are also constructed to trap sediment. These are often called Debris Dams.

Developable Land: Land that is suitable as a location for structures and that can be developed free of hazards to, and without disruption of, or significant impact on, natural resource areas.

Development Agreement: A legislatively approved contract between a jurisdiction and a person having legal or equitable interest in real property within the jurisdiction (California Government Code §65865 et. seq.) that "freezes" certain rules, regulations, and policies applicable to development of a property for a specified period of time, usually in exchange for certain concessions by the owner.

Development Fee: See "Impact Fee"

Duet: A detached building designed for occupation as the residence of two families living independently of each other, with each family living area defined by separate fee title ownership.

Duplex: A detached building under single ownership that is designed for occupation as the residence of two families living independently of each other.

Dwelling Unit: A room or group of rooms (including sleeping, eating, cooking, and sanitation facilities, but not more than one kitchen), that constitutes an independent housekeeping unit, occupied or intended for occupancy by one household on a long-term basis.

Easement: Usually the right to use property owned by another for specific purposes or to gain access to another property. For example, utility companies often have easements on the private property of individuals to be able to install and maintain utility facilities.

Easement, Conservation: A tool for acquiring open-space with less than full-fee purchase, whereby a public agency buys only certain specific rights from the land owner. These may be positive rights (providing the public with the opportunity to hunt, fish, hike, or ride over the land) or they may be restrictive rights (limiting the uses to which the land owner may devote the land in the future.)

Elderly: Persons age 62 and older. (See "Seniors")

Elderly Housing: Typically one- and two-bedroom apartments or condominiums designed to meet the needs of persons 62 years of age and older or, if more than 150 units, persons 55 years of age and older, and restricted to occupancy by them.

Emergency Shelter: A facility that provides immediate and short-term housing and supplemental services for the homeless. Shelters come in many sizes, but an optimum size is considered to be 20 to 40 beds. Supplemental services may include food, counseling, and access to other social programs. (See "Transitional Housing")

Eminent Domain: The right of a public entity to acquire private property for public use by condemnation and the payment of just compensation.

Emission Standard: The maximum amount of pollutant legally permitted to be discharged from a single source, either mobile or stationary.

Endangered Species: A species of animal or plant is considered to be endangered when its prospects for survival and reproduction are in immediate jeopardy from one or more causes.

Environment: CEQA defines environment as "the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, mineral, flora, fauna, noise, and objects of historic or aesthetic significance."

Environmental Impact Report (EIR): A report required pursuant to the California Environmental Quality Act which assesses all the environmental characteristics of an area, determines what effects or impacts will result if the area is altered or disturbed by a proposed action, and identifies alternatives or other measures to avoid or reduce those impacts. (See "California Environmental Quality Act")

Environmental Impact Statement (EIS): Under the National Environmental Policy Act, a statement on the effect of development proposals and other major actions that significantly affect the environment.

Erosion: (1) The loosening and transportation of rock and soil debris by wind, rain, or running water. (2) The gradual wearing away of the upper layers of earth.

Exaction: A contribution or payment required as an authorized precondition for receiving a development permit; usually refers to mandatory dedication (or fee in lieu of dedication) requirements found in many subdivision regulations.

Expansive Soils: Soils that swell when they absorb water and shrink as they dry.

Fair Market Rent: The rent, including utility allowances, determined by the United States Department of Housing and Urban Development for purposes of administering the Section 8 Existing Housing Program.

Family: (1) Two or more persons related by birth, marriage, or adoption [U.S. Bureau of the Census]. (2) An individual or a group of persons living together who constitute a bona fide single-family housekeeping unit in a dwelling unit, not including a fraternity, sorority, club, or other group of persons occupying a hotel, lodging house or institution of any kind [California].

Farmers Home Administration (FmHA): A federal agency providing loans and grants for improvement projects and low-income housing in rural areas.

Farmland: Refers to eight classifications of land mapped by the U.S. Department of Agriculture Soil Conservation Service. The five agricultural classifications defined below- except Grazing Land- do not include publicly owned lands for which there is an adopted policy preventing agricultural use.

Fault: A fracture in the earth's crust forming a boundary between rock masses that have shifted.

Feasible: Capable of being accomplished in a successful manner within a reasonable time taking into account economic, environmental, social, and technological factors.

Field Act: Legislation, passed after a 1933 Long Beach earthquake that collapsed a school, which established more stringent structural requirements and standards for construction of schools than for other buildings.

Fiscal Impact Analysis: A projection of the direct public costs and revenues resulting from population or employment change to the local jurisdiction(s) in which the change is taking place. Enables local governments to evaluate relative fiscal merits of general plans, specific plans, or projects.

Flood, 100-Year: The magnitude of a flood expected to occur on the average every 100 years, based on historical data. The 100-year flood has a 1/100, or one percent, chance of occurring in any given year.

Flood Insurance Rate Map (FIRM): For each community, the official map on which the Federal Insurance Administration has delineated areas of special flood hazard and the risk premium zones applicable to that community.

Floodplain: The relatively level land area on either side of the banks of a stream regularly subject to flooding. That part of the floodplain subject to a one percent chance of flooding in any given year is designated as an "area of special flood hazard" by the Federal Insurance Administration.

Floodplain Fringe: All land between the floodway and the upper elevation of the 100-year flood.

Floodway: The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the "base flood" without cumulatively increasing the water surface elevation more than one foot. No development is allowed in floodways.

Floor Area, Gross: The gross floor area of a single-story building consists of its square footage as measured from the interior face of external walls, but not including any space where the floor-to-ceiling height is less than six feet and not including courtyard spaces without ceilings that are open and unobstructed to the sky. The gross floor area of a multi-story building consists of the sum of the horizontal areas of the several floors of a building measured from the interior face of exterior walls, but not including any space where the floor-to-ceiling height is less than six feet, and not including any stairwells, shafts, or courtyard spaces. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above. For the purposes of floor area calculation, a shaft is defined as "an interior space, enclosed by walls or construction, extending through one or more stories or basements that connects openings in successive floors, or floors and roof, to accommodate elevators, dumbwaiters, mechanical equipment, or similar devices, or to transmit light or ventilation air." (California Building Code)

Floor Area Ratio (FAR): A term utilized to measure the allowable building intensity of nonresidential structures on a

site, calculated by dividing the gross floor area by the total net acres of the site. For example, on a site with 40,000 square feet of net land area, a Floor Area Ratio (FAR) of 1.0 will allow a maximum of 40,000 square feet of gross floor area to be built, whereas a FAR of 1.5 would allow 60,000 square feet of gross floor area, and a FAR of 0.5 would allow 20,000 square feet of gross floor area. Compliance of nonresidential projects covering multiple parcels with FAR building intensity restrictions may be calculated on an overall project basis rather than on individual parcels within the project; in such situations, the County of Riverside may require reciprocal use agreements, parcel mergers, or specification of property owner rights and responsibilities through Covenants, Conditions, and Restrictions or other recorded documents.

Fossil Fuel: Coal, oil and natural gas; so called because they are the remains of ancient plant and animal life.

Freeway: A high-speed, high-capacity, limited-access road serving regional and county-wide travel. Such roads are free of tolls, as contrasted with "turnpikes" or other "toll roads" now being introduced into Southern California. Freeways generally are used for long trips between major land use generators. At Level of Service ÒE,Ó they carry approximately 1,875 vehicles per lane per hour, in both directions. Major streets cross at a different grade level.

Fugitive Dust: Dust particles which are introduced into the air through certain activities such as soil cultivation, off-road vehicles, or any vehicles operating on open fields or dirt roadways.

Granny Flat: See "Second Unit"

Ground Failure: Ground movement or rupture caused by strong shaking during an earthquake. Includes landslide, lateral spreading, liquefaction, and subsidence.

Ground Shaking: Ground movement resulting from the transmission of seismic waves during an earthquake.

Groundwater: Water under the earth's surface, often confined to aquifers capable of supplying wells and springs.

Groundwater Recharge: The natural process of infiltration and percolation of rainwater from land areas or streams through permeable soils into water-holding rocks that provide underground storage ("aquifers").

Group Quarters: A residential living arrangement, other than the usual house, apartment, or mobile home, in which two or more unrelated persons share living quarters and cooking facilities. Institutional group quarters include nursing homes, orphanages, and prisons. Non-institutional group quarters include dormitories, shelters, and large boardinghouses.

Growth Management: The use by a community of a wide range of techniques in combination to determine the amount, type, and rate of development desired by the community and to channel that growth into designated areas. Growth management policies can be implemented through growth rates, zoning, capital improvement programs, public facilities ordinances, urban limit lines, standards for levels of service, and other programs. (See "Congestion Management Plan")

Habitat: The physical location or type of environment in which an organism or biological population lives or occurs.

Handicapped: A person determined to have a physical impairment or mental disorder expected to be of long or indefinite duration. Many such impairments or disorders are of such a nature that a person's ability to live independently can be improved by appropriate housing conditions.

Hazardous Material: Any substance that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. The term includes, but is not limited to, hazardous substances and hazardous wastes.

High-Occupancy Structure: All pre-1935 buildings with over 25 occupants, and all pre-1976 buildings with over 100 occupants.

High Occupancy Vehicle (HOV): Any vehicle other than a driver-only automobile (e.g., a vanpool, a bus, or two or more persons to a car).

Historic Preservation: The preservation of historically significant structures and neighborhoods until such time as, and in order to facilitate, restoration and rehabilitation of the building(s) to a former condition.

Homeless: Persons and families who lack a fixed, regular, and adequate nighttime residence. Includes those staying in temporary or emergency shelters or who are accommodated with friends or others with the understanding that shelter is being provided as a last resort. California Housing Element law, Section 65583(c)(1) requires all cities and counties to address the housing needs of the homeless. (See "Emergency Shelter" and "Transitional Housing.")

Hotel: A facility in which guest rooms or suites are offered to the general public for lodging with or without meals and for compensation, and where no provision is made for cooking in any individual guest room or suite. (See "Motel.")

Household: All those persons (related or unrelated), who occupy a single housing unit. (See "Family")

Householder: The head of a household.

Households, Number of: The count of all year-round housing units occupied by one or more persons. The concept of household is important because the formation of new households generates the demand for housing. Each new household formed creates the need for one additional housing unit or requires that one existing housing unit be shared by two households. Thus, household formation can continue to take place even without an increase in population, thereby increasing the demand for housing.

Housing and Community Development Department (HCD): The State agency that has principal responsibility for assessing, planning for, and assisting communities to meet the needs of low- and moderate-income households.

Housing and Urban Development, U.S. Department of (HUD): A cabinet-level department of the federal government that administers housing and community development programs.

Housing Authority, Local (LHA): Local housing agency established in State law, subject to local activation and operation. Originally intended to manage certain federal subsidies, but vested with broad powers to develop and manage other forms of affordable housing.

Housing Unit: The place of permanent or customary abode of a person or family. A housing unit may be a single-family dwelling, a multi-family dwelling, a condominium, a modular home, a mobile home, a cooperative, or any other residential unit considered real property under State law. A housing unit has, at least, cooking facilities, a bathroom, and a place to sleep. It also is a dwelling that cannot be moved without substantial damage or unreasonable cost. (See "Dwelling Unit" "Family" and "Household")

Impact Fee: A fee, also called a development fee, levied on the developer of a project by a city, county, or other public agency as compensation for otherwise-unmitigated impacts the project will produce. Section 66000, et seq., specifies that development fees shall not exceed the estimated reasonable cost of providing the service for which the fee is charged. To lawfully impose a development fee, the public agency must verify its method of calculation and document proper restrictions on use of the fund.

Impervious Surface: Surface through which water cannot penetrate, such as roof, road, sidewalk, and paved parking lot. The amount of impervious surface increases with development and establishes the need for drainage facilities to carry the increased runoff.

Inclusionary Zoning: Provisions established by a public agency to require that a specific percentage of housing units in a project or development remain affordable to very low- and low- income households for a specified period.

Incubator Space: Retail or industrial space that is affordable to new, low-margin businesses.
Industrial: The manufacture, production, and processing of consumer goods. Industrial is often divided into "heavy industrial" uses, such as construction yards, quarrying, and factories; and "light industrial" uses, such as research and

development and less intensive warehousing and manufacturing.

Infill Development: Development of vacant land (usually individual lots or left-over properties) within areas that are already largely developed.

Infrastructure: Public services and facilities, such as sewage-disposal systems, water-supply systems, other utility systems, and roads.

In Lieu Fee: (See "Dedication, In lieu of")

Institutional Uses: (1) Publicly or privately owned and operated activities such as hospitals, convalescent hospitals, intermediate care facilities, nursing homes, museums, and schools and colleges; (2) churches and other religious organizations; and (3) other non-profit activities of a welfare, educational, or philanthropic nature that cannot be considered residential, commercial, or industrial. (See "Public and Quasi-public Facilities")

Intensity, Building: For residential uses, the actual number or the allowable range of dwelling units per acre (per gross acre, as used in this General Plan). For non-residential uses, the actual or the maximum permitted floor area ratios (FARs).

Inter-agency: Indicates cooperation between or among two or more discrete agencies in regard to a specific program.

Interest, Fee: Entitles a land owner to exercise complete control over use of land, subject only to government land use regulations.

Interest, Less-than-fee: The purchase of interest in land rather than outright ownership; includes the purchase of development rights via conservation, open-space, or scenic easements. (See "Easement, Scenic," "Lease," and "Leasehold Interest")

Intrusive Noise: That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence, and tonal or informational content as well as the prevailing noise level.

Inversion Layer: A layer of warm air that traps the cooler air and any pollutants it carries, below.

Issues: Important unsettled community matters or problems that are identified in a community's general plan and dealt with by the plan's objectives, policies, plan proposals, and implementation programs.

Jobs/Housing Balance; Jobs/Housing Ratio: The availability of affordable housing for employees. The jobs/housing ratio divides the number of jobs in an area by the number of employed residents. A ratio of 1.0 indicates a balance. A ratio greater than 1.0 indicates a net in-commute; less than 1.0 indicates a net out-commute.

Joint Powers Authority (JPA): A legal arrangement that enables two or more units of government to share authority in order to plan and carry out a specific program or set of programs that serves both units.

L_{10}: The A-weighted sound level exceeded ten percent of the sample time. Similarly, L_{50}, L_{90} etc.

Land Banking: The purchase of land by a local government for use or resale at a later date. "Banked lands" have been used for development of low- and moderate-income housing, expansion of parks, and development of industrial and commercial centers. Federal rail-banking law allows railroads to bank unused rail corridors for future rail use while allowing interim use as trails.

Landmark: (1) A building, site, object, structure, or significant tree, having historical, architectural, social, or cultural significance and marked for preservation by the local, state, or federal government. (2) A visually prominent or

outstanding structure or natural feature that functions as a point of orientation or identification.

Land Use Classification: A system for classifying and designating the appropriate use of properties.

Lateral Spreading: Lateral movement of soil, often as a result of liquefaction during an earthquake.

Ldn: Day-Night Average Sound Level. The A-weighted average sound level for a given area (measured in decibels) during a 24-hour period with a 10 dB weighting applied to night-time sound levels. The Ldn is approximately numerically equal to the CNEL for most environmental settings.

Lead: A gray-white metal that is soft, malleable, and resistant to corrosion. Sources of lead resulting in concentrations in the air include industrial sources and weathering of soils followed by fugitive dust emissions

Lease: A contractual agreement by which an owner of real property (the lessor) gives the right of possession to another (a lessee) for a specified period of time (term) and for a specified consideration (rent).

Leasehold Interest: (1) The interest that the lessee has in the value of the lease itself in condemnation award determination. (2) The difference between the total remaining rent under the lease and the rent the lessee would currently pay for similar space for the same time period.

Leq: The energy equivalent level, defined as the average sound level on the basis of sound energy (or sound pressure squared). The Leq is a "dosage" type measure and is the basis for the descriptors used in current standards, such as the 24-hour CNEL used by the State of California.

Level of Service (LOS) Standard: A standard used by government agencies to measure the quality or effectiveness of a municipal service, such as police, fire, or library, or the performance of a facility, such as a street or highway.

Level of Service (Traffic): A scale that measures the amount of traffic that a roadway or intersection can accommodate, based on such factors as maneuverability, driver dissatisfaction, and delay.

Level of Service A: Indicates a relatively free flow of traffic, with little or no limitation on vehicle movement or speed.

Level of Service B: Describes a steady flow of traffic, with only slight delays in vehicle movement and speed. All queues clear in a single signal cycle.

Level of Service C: Denotes a reasonably steady, high-volume flow of traffic, with some limitations on movement and speed, and occasional backups on critical approaches.

Level of Service D: Designates the level where traffic nears an unstable flow. Intersections still function, but short queues develop and cars may have to wait through one cycle during short peaks.

Level of Service E: Represents traffic characterized by slow movement and frequent (although momentary) stoppages. This type of congestion is considered severe, but is not uncommon at peak traffic hours, with frequent stopping, long-standing queues, and blocked intersections.

Level of Service F: Describes unsatisfactory stop-and-go traffic characterized by "traffic jams" and stoppages of long duration. Vehicles at signalized intersections usually have to wait through one or more signal changes, and "upstream" intersections may be blocked by the long queues.

Life-cycle Costing: A method of evaluating a capital investment that takes into account the sum total of all costs associated with the investment over the lifetime of the project.

Linkage: With respect to jobs/housing balance, a program designed to offset the impact of employment on housing need within a community, whereby project approval is conditioned on the provision of housing units or the payment of an

equivalent in-lieu fee. The linkage program must establish the cause-and-effect relationship between a new commercial or industrial development and the increased demand for housing.

Liquefaction: The transformation of loose, wet soil from a solid to a liquid state, often as a result of ground shaking during an earthquake.

Live-work Quarters: Buildings or spaces within buildings that are used jointly for commercial and residential purposes where the residential use of the space is secondary or accessory to the primary use as a place of work.

Local Agency Formation Commission (LAFCO): A five- or seven-member commission within each county that reviews and evaluates all proposals for formation of special districts, incorporation of cities, annexation to special districts or cities, consolidation of districts, and merger of districts with cities. Each county's LAFCO is empowered to approve, disapprove, or conditionally approve such proposals. The LAFCO members generally include two county supervisors, two city council members, and one member representing the general public. Some LAFCOs include two representatives of special districts.

Local Coastal Program Land Use Plan: The relevant portion of a local government general plan or coastal element that details type, location, and intensity of land use, applicable resource protection and development policies, and, where necessary, implementation actions.

Low-income Household: A household with an annual income usually no greater than 80 percent of the area median family income adjusted by household size, as determined by a survey of incomes conducted by a city or a county, or in the absence of such a survey, based on the latest available eligibility limits established by the U.S. Department of Housing and Urban Development (HUD) for the Section 8 housing program.

Low-income Housing Tax Credits: Tax reductions provided by the federal and State governments for investors in housing for low-income households.

Life-cycle Housing: *Housing with fixed accessible features (wider doors and halls, open floor spaces, clear traffic patterns, etc.). It also provides for adaptable features, such as wall reinforcement for grab bars and removable base cabinets for future knee space. Adaptive features make a housing unit more appealing to all ages, and they increase occupant comfort and independence while adding to property value.*

Manufactured Housing: Residential structures that are constructed entirely in the factory, and which since June 15, 1976, have been regulated by the federal Manufactured Home Construction and Safety Standards Act of 1974 under the administration of the U.S. Department of Housing and Urban Development (HUD). (See "Mobile Home" and "Modular Unit")

Mean Sea Level: The average altitude of the sea surface for all tidal stages.

Median Strip: The dividing area, either paved or landscaped, between opposing lanes of traffic on a roadway.

Mercalli Intensity Scale: A subjective measure of the observed effects (human reactions, structural damage, geologic effects) of an earthquake. Expressed in Roman numerals from I to XII.

Microclimate: The climate of a small, distinct area, such as a city street or a building's courtyard; can be favorably altered through functional landscaping, architecture, or other design features.

Minipark: Small neighborhood park of approximately one acre or less.

Mixed-use: Properties on which various uses, such as office, commercial, institutional, and residential, are combined in a single building or on a single site in an integrated development project with significant functional interrelationships and a coherent physical design. A "single site" may include contiguous properties.

Mobile Home: A structure, transportable in one or more sections, built on a permanent chassis and designed for use as a single-family dwelling unit and which (1) has a minimum of 400 square feet of living space; (2) has a minimum width in excess of 102 inches; (3) is connected to all available permanent utilities; and (4) is tied down (a) to a permanent foundation on a lot either owned or leased by the homeowner or (b) is set on piers, with wheels removed and skirted, in a mobile home park. (See "Manufactured Housing" and "Modular Unit")

Moderate-income Household: A household with an annual income between the lower income eligibility limits and 120 percent of the area median family income adjusted by household size, usually as established by the U.S. Department of Housing and Urban Development (HUD) for the Section 8 housing program. (See "Area" and "Low-income Household")

Modular Unit: A factory-fabricated, transportable building or major component designed for use by itself or for incorporation with similar units on-site into a structure for residential, commercial, educational, or industrial use. Differs from mobile homes and manufactured housing by (in addition to lacking an integral chassis or permanent hitch to allow future movement) being subject to California housing law design standards. California standards are more restrictive than federal standards in some respects (e.g., plumbing and energy conservation). Also called Factory-built Housing and regulated by State law of that title. (See "Mobile Home" and "Manufactured Housing")

Motel: (1) A hotel for motorists. (2) A facility in which guest rooms or suites are offered to the general public for lodging with or without meals and for compensation, and where guest parking is provided in proximity to guest rooms. Quite often, provision is made for cooking in individual guest rooms or suites. (See "Hotel.")

Multiple Family Building: A detached building designed and used exclusively as a dwelling by three or more families occupying separate suites.

Multiplier Effect: The recirculation of money through the economy multiplies its impact on jobs and income. For example, money paid as salaries to industrial and office workers is spent on housing, food, clothes and other locally-available goods and services. This spending creates jobs in housing construction, retail stores (e.g., grocery and drug stores) and professional offices. The wage paid to workers in those industries is again re-spent, creating still more jobs. Overall, one job in basic industry is estimated to create approximately one more job in non-basic industry.

Municipal Services: Services traditionally provided by local government, including water and sewer, roads, parks, schools, and police and fire protection.

National Ambient Air Quality Standards: The prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area.

National Environmental Policy Act (NEPA): An act passed in 1974 establishing federal legislation for national environmental policy, a council on environmental quality, and the requirements for environmental impact statements. National Flood Insurance Program: A federal program that authorizes the sale of federally subsidized flood insurance in communities where such flood insurance is not available privately.

National Historic Preservation Act: A 1966 federal law that established a National Register of Historic Places and the Advisory Council on Historic Preservation, and that authorized grants-in-aid for preserving historic properties.

National Register of Historic Places: The official list, established by the National Historic Preservation Act, of sites, districts, buildings, structures, and objects significant in the nation's history or whose artistic or architectural value is unique.

Natural State: The condition existing prior to development.

Neighborhood: A planning area commonly identified as such in a community's planning documents, and by the individuals residing and working within the neighborhood. Documentation may include a map prepared for planning purposes, on which the names and boundaries of the neighborhood are shown.

Neighborhood Park: City- or county-owned land intended to serve the recreation needs of people living or working within one-half mile radius of the park.

Neighborhood Unit: According to one widely-accepted concept of planning, the neighborhood unit should be the basic building block of the city. It is based on the elementary school, with other community facilities located at its center and arterial streets at its perimeter. The distance from the school to the perimeter should be a comfortable walking distance for a school-age child; there would be no through traffic uses. Limited industrial or commercial would occur on the perimeter where arterials intersect. This was a model for American suburban development after World War II.

Neotraditional Development: An approach to land use planning and urban design that promotes the building of neighborhoods with a mix of uses and housing types, architectural variety, a central public gathering place, interconnecting streets and alleys, and edges defined by greenbelts or boulevards. The basic goal is integration of the activities of potential residents with work, shopping, recreation, and transit all within walking distance.

Nitrogen Oxide: Primarily consists of nitric oxides (colorless, odorless gas formed from atmospheric nitrogen and oxygen when petroleum combustion takes place under high temperatures and/or pressure) and nitrogen dioxide (a reddish-brown irritating gas formed by the combination of nitric oxide with oxygen).

Noise: Any sound that is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. Noise, simply, is "unwanted sound."

Noise Attenuation: Reduction of the level of a noise source using a substance, material, or surface, such as earth berms and/or solid concrete walls.

Noise Contour: A line connecting points of equal noise level as measured on the same scale. Noise levels greater than the 60 Ldn contour (measured in dBA) require noise attenuation in residential development.

Non-attainment: The condition of not achieving a desired or required level of performance. Frequently used in reference to air quality. (See "Attainment")

Non-conforming Use: A use that was valid when brought into existence, but by subsequent regulation becomes no longer conforming. "Non-conforming use" is a generic term and includes (1) non-conforming structures (by virtue of size, type of construction, location on land, or proximity to other structures), (2) non-conforming use of a conforming building, (3) non-conforming use of a non-conforming building, and (4) non-conforming use of land. Thus, any use lawfully existing on any piece of property that is inconsistent with a new or amended general plan, and that in turn is a violation of a zoning ordinance amendment subsequently adopted in conformance with the general plan, will be a non-conforming use. Typically, non-conforming uses are permitted to continue for a designated period of time, subject to certain restrictions.

Notice (of Hearing): A legal document announcing the opportunity for the public to present their views to an official representative or board of a public agency concerning an official action pending before the agency.

Open-Space Land: Any parcel or area of land or water that is essentially unimproved and devoted to an open-space use for the purposes of (1) the preservation of natural resources, (2) the managed production of resources, (3) outdoor recreation, or (4) public health and safety.

Ordinance: A law or regulation set forth and adopted by a governmental authority, usually a city or county.

Outdoor Advertising Structure: Any device used or intended to direct attention to a business, profession, commodity, service, or entertainment conducted, sold, or offered elsewhere than upon the lot where such device is located.

Outdoor Recreation Use: A privately or publicly owned or operated use providing facilities for outdoor recreation activities.

Overlay: A land use designation on the General Plan Land Use Map, or a zoning designation on a zoning map, that modifies the basic underlying designation in some specific manner.

Ozone: A pungent, colorless, toxic gas. Close to the earth's surface, it is produced photochemically from hydrocarbons, oxides of nitrogen and sunlight and is a major component of smog. At very high altitudes it protects the earth from harmful ultraviolet radiation.

Parcel: A lot in single ownership or under single control, usually considered a unit for purposes of development.
Park Land; Parkland: Land that is publicly owned or controlled for the purpose of providing parks, recreation, or open-space for public use.

Parking, Shared: A public or private parking area used jointly by two or more uses.

Parking Area, Public: An open area, excluding a street or other public way, used for the parking of automobiles and available to the public, whether for free or for compensation.

Parking Management: An evolving TDM technique designed to obtain maximum utilization from a limited number of parking spaces. Can involve pricing and preferential treatment for HOVs, non-peak period users, and short-term users. (See "High Occupancy Vehicle" and "Transportation Demand Management")

Parking Ratio: The number of parking spaces provided per 1,000 square of floor area (e.g., 2:1 or "two per thousand.")

Parking Space, Compact: A parking space (usually 7.5 feet wide by 16 feet long when perpendicular to a driveway or aisle) permitted in some localities on the assumption that many modern cars are significantly smaller, and require less room, than a standard automobile. A standard parking space, when perpendicular to a driveway or aisle, is usually 8.5 feet wide by 18 feet long.

Parks: Open-space lands whose primary purpose is recreation. (See "Open-Space Land," "Community Park," and "Neighborhood Park")

Parkway: An expressway or freeway designed for non-commercial traffic only; usually located within a strip of landscaped park or natural vegetation.

Parkway Strip: A piece of land located between the rear of a curb and the front of a sidewalk, usually used for planting low ground cover and/or street trees, also known as "planter strip."

Particulate Matter (PM): Atmospheric paniculate made up of finely divided solids or liquids such as soot, dust, aerosols, fumes and mists. Commonly classified into two categories, PM_{10} (particles between 2.5 and 10 micrometers in length) and $PM_{2.5}$ (particles less than 2.5 micrometers in length).

Performance Standards: Zoning regulations that permit uses based on a particular set of standards of operation rather than on particular type of use. Performance standards provide specific criteria limiting noise, air pollution, emissions, odors, vibration, dust, dirt, glare, heat, fire hazards, wastes, traffic impacts, and visual impact of a use.

Plan Line: A precise line that establishes future rights-of-way along any portion of an existing or proposed street or highway and which is depicted on a map showing the streets and lot line or lines and the proposed right-of-way lines, and the distance thereof from the established centerline of the street or highway, or from existing or established property lines.
Planned Unit Development (PUD): A description of a proposed unified development, consisting at a minimum of a map and adopted ordinance setting forth the regulations governing, and the location and phasing of all proposed uses and improvements to be included in the development.

Planning Area: The area directly addressed by the general plan. A city's planning area typically encompasses the city

limits and potentially annexable land within its sphere of influence.

Planning Commission: The Riverside County Planning Commission, a five-member body appointed by the Board of Supervisors to perform various development review and planning functions and make recommendations to the Board, in accordance with Riverside County Ordinance No. 348 and California Government Code Section 65100.

Pollution, Non-Point: Sources for pollution that are less definable and usually cover broad areas of land, such as agricultural land with fertilizers that are carried from the land by runoff, or automobiles.

Pollution, Point: In reference to water quality, a discrete source from which pollution is generated before it enters receiving waters, such as a sewer outfall, a smokestack, or an industrial waste pipe.

Poverty Level: As used by the U.S. Census, families and unrelated individuals are classified as being above or below the poverty level based on a poverty index that provides a range of income cutoffs or "poverty thresholds" varying by size of family, number of children, and age of householder. The income cutoffs are updated each year to reflect the change in the Consumer Price Index.

Private Road/Private Street: Privately owned (and usually privately maintained) motor vehicle access that is not dedicated as a public street. Typically the owner posts a sign indicating that the street is private property and limits traffic in some fashion. For density calculation purposes, some jurisdictions exclude private roads when establishing the total acreage of the site; however, aisles within and driveways serving private parking lots are not considered private roads.

Pro Rata: Refers to the proportionate distribution of something to something else or to some group, such as the cost of infrastructure improvements associated with new development apportioned to the users of the infrastructure on the basis of projected use.

Public and Quasi-public Facilities: Institutional, academic, governmental and community service uses, either owned publicly or operated by non-profit organizations, including private hospitals and cemeteries.

Public Services: See "Municipal Services"

Reclamation: The reuse of resources, usually those present in solid wastes or sewage.

Reconstruction: As used in historic preservation, the process of reproducing by new construction the exact form and detail of a vanished structure, or part thereof, as it appeared during a specific period of time. Reconstruction is often undertaken when the property to be reconstructed is essential for understanding and interpreting the value of an historic district and sufficient documentation exists to insure an exact reproduction of the original.

Recreation, Active: A type of recreation or activity that requires the use of organized play areas including, but not limited to, softball, baseball, football and soccer fields, tennis and basketball courts and various forms of children's play equipment.

Recreation, Passive: Type of recreation or activity that does not require the use of organized play areas.

Redevelop: To demolish existing buildings; or to increase the overall floor area existing on a property; or both; irrespective of whether a change occurs in land use.

Regional: Pertaining to activities or economies at a scale greater than that of a single jurisdiction, and affecting a broad geographic area.

Regional Housing Needs Plan/Share: A quantification by a COG or by HCD of existing and projected housing need, by household income group, for all localities within a region.

Regional Park: A park typically 150-500 acres in size focusing on activities and natural features not included in most

other types of parks and often based on a specific scenic or recreational opportunity.

Rehabilitation: The repair, preservation, and/or improvement of substandard housing.

Residential, Multiple Family: Usually three or more dwelling units on a single site, which may be in the same or separate buildings.

Residential, Single-family: A single dwelling unit on a building site.

Retrofit: To add materials and/or devices to an existing building or system to improve its operation, safety, or efficiency. Buildings have been retrofitted to use solar energy and to strengthen their ability to withstand earthquakes, for example.

Rezoning: An amendment to the map and/or text of a zoning ordinance to effect a change in the nature, density, or intensity of uses allowed in a zoning district and/or on a designated parcel or land area.

Richter Scale: A measure of the size or energy release of an earthquake at its source. The scale is logarithmic; the wave amplitude of each number on the scale is 10 times greater than that of the previous whole number.

Right-of-way: A strip of land occupied or intended to be occupied by certain transportation and public use facilities, such as roads, railroads, and utility lines.

Sanitary Landfill: The controlled placement of refuse within a limited area, followed by compaction and covering with a suitable thickness of earth and other containment material.

Sanitary Sewer: A system of subterranean conduits that carries refuse liquids or waste matter to a plant where the sewage is treated, as contrasted with storm drainage systems (that carry surface water) and septic tanks or leech fields (that hold refuse liquids and waste matter on-site). (See "Septic System")

Santa Ana Winds: Warm, dry winds that blow from the east or northeast (offshore) occurring predominantly between the months of December and February. The winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra Mountains and west of the Rocky Mountains including most of Nevada and Utah) and move locally across the Mojave Desert and then over and through passes in the San Gabriel, San Bernardino and San Jacinto Mountains.

Second Unit: A self-contained living unit, either attached to or detached from, and in addition to, the primary residential unit on a single lot. "Granny Flat" is one type of second unit intended for the elderly.

Section 8 Rental Assistance Program: A federal (HUD) rent-subsidy program that is one of the main sources of federal housing assistance for low-income households. The program operates by providing "housing assistance payments" to owners, developers, and public housing agencies to make up the difference between the "Fair Market Rent" of a unit (set by HUD) and the household's contribution toward the rent, which is calculated at 30 percent of the household's adjusted gross monthly income (GMI). "Section 8" includes programs for new construction, existing housing, and substantial or moderate housing rehabilitation.

Seismic: Caused by or subject to earthquakes or earth vibrations.

Seniors: Persons age 62 and older. (See "Elderly")

Senior Housing: See "Elderly Housing"

Septic System: A sewage-treatment system that includes a settling tank through which liquid sewage flows and in which solid sewage settles and is decomposed by bacteria in the absence of oxygen. Septic systems are often used for individual-home waste disposal where an urban sewer system is not available. (See "Sanitary Sewer")
Settlement: (1) The drop in elevation of a ground surface caused by settling or compacting. (2) The gradual downward

movement of an engineered structure due to compaction. Differential settlement is uneven settlement, where one part of a structure settles more or at a different rate than another part.

Shared Living: The occupancy of a dwelling unit by persons of more than one family in order to reduce housing expenses and provide social contact, mutual support, and assistance. Shared living facilities serving six or fewer persons are permitted in all residential districts by Section 1566.3 of the California Health and Safety Code.

Siltation: (1) The accumulating deposition of eroded material. (2) The gradual filling in of streams and other bodies of water with sand, silt, and clay.

Single-family Dwelling, Attached: A dwelling unit occupied or intended for occupancy by only one household that is structurally connected with at least one other such dwelling unit. (See "Townhouse.")

Single-family Dwelling, Detached: A dwelling unit occupied or intended for occupancy by only one household that is structurally independent from any other such dwelling unit or structure intended for residential or other use. (See "Family.")

Single Room Occupancy (SRO): A single room, typically 80-250 square feet, with a sink and closet, but that requires the occupant to share a communal bathroom, shower, and kitchen.

Site: A parcel of land used or intended for one use or a group of uses and having frontage on a public or an approved private street. A lot.

Smog: A combination of smoke, ozone, hydrocarbons, nitrogen oxides, and other chemically reactive compounds which, under certain conditions of weather and sunlight, may result in a murky brown haze that causes adverse health effects. The primary source of smog in California is motor vehicles.

Solar Access: The provision of direct sunlight to an area specified for solar energy collection when the sun's azimuth is within 45 degrees of true south.

Solar System, Active: A system using a mechanical device, such as a pump or a fan, and energy in addition to solar energy to transport a conductive medium (air or water) between a solar collector and the interior of a building for the purpose of heating or cooling.

Solar System, Passive: A system that uses direct heat transfer from thermal mass instead of mechanical power to distribute collected heat. Passive systems rely on building design and materials to collect and store heat and to create natural ventilation for cooling.

Solid Waste: Any unwanted or discarded material that is not a liquid or gas. Includes organic wastes, paper products, metals, glass, plastics, cloth, brick, rock, soil, leather, rubber, yard wastes, and wood, but does not include sewage and hazardous materials. Organic wastes and paper products comprise about 75 percent of typical urban solid waste.

Specific Plan: A tool authorized by Government Code §65450 et seq. for the systematic implementation of the general plan for a defined portion of a community's planning area. A specific plan must specify in detail the land uses, public and private facilities needed to support the land uses, phasing of development, standards for the conservation, development, and use of natural resources, and a program of implementation measures, including financing measures.

Sphere of Influence: The probable physical boundaries and service area of a local agency, as determined by the Local Agency Formation Commission of the County.

Standards: (1) A rule or measure establishing a level of quality or quantity that must be complied with or satisfied. Government Code ¤65302 requires that general plans spell out the objectives, principles, "standards," and proposals of the general plan. Examples of standards might include the number of acres of park land per 1,000 population that the community will attempt to acquire and improve, or the "traffic Level of Service" (LOS) that the plan hopes to attain. (2)

Requirements in a zoning ordinance that govern building and development as distinguished from use restrictions - for example, site-design regulations such as lot area, height limit, frontage, landscaping, and floor area ratio.

Stock Cooperative Housing: Multiple-family ownership housing in which the occupant of a unit holds a share of stock in a corporation that owns the structure in which the unit is located.

Street Tree Plan: A comprehensive plan for all trees on public streets that sets goals for solar access, and standards for species selection, maintenance, and replacement criteria, and for planting trees in patterns that will define neighborhood character while avoiding monotony or maintenance problems.

Streets, Local: See "Streets, Minor"

Streets, Major: The transportation network that includes a hierarchy of freeways, arterials, and collectors to service through traffic.

Streets, Minor: Local streets not shown on the Circulation Plan, Map, or Diagram, whose primary intended purpose is to provide access to fronting properties.

Streets, Through: Streets that extend continuously between other major streets in the community.

Structure: Anything constructed or erected that requires location on the ground (excluding swimming pools, fences, and walls used as fences).

Subdivision: The division of a tract of land into defined lots, either improved or unimproved, which can be separately conveyed by sale or lease, and which can be altered or developed. "Subdivision" includes a condominium project as defined in §1350 of the California Civil Code and a community apartment project as defined in §11004 of the Business and Professions Code.

Subdivision Map Act: Section 66410 et seq. of the California Government Code, this act vests in local legislative bodies the regulation and control of the design and improvement of subdivisions, including the requirement for tentative and final maps.

Subregional: Pertaining to a portion of a region.

Subsidence: The sudden sinking or gradual downward settling and compaction of soil and other surface material with little or no horizontal motion. Subsidence may be caused by a variety of human and natural activity, including earthquakes. (See "Settlement")

Subsidize: To assist by payment of a sum of money or by the granting of terms or favors that reduce the need for monetary expenditures. Housing subsidies may take the forms of mortgage interest deductions or tax credits from federal and/or state income taxes, sale or lease at less than market value of land to be used for the construction of housing, payments to supplement a minimum affordable rent, and the like.

Substandard Housing: Residential dwellings that, because of their physical condition, do not provide safe and sanitary housing.

Sulfur Dioxide: A colorless, odorless, pungent, irritating gas formed primarily by the combustion of sulfur-containing fossil fuels.

Sustainability: Community use of natural resources in a way that does not jeopardize the ability of future generations to live and prosper.

Sustainable Development: Development that maintains or enhances economic opportunity and community well-being

while protecting and restoring the natural environment upon which people and economies depend. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. (Source: Minnesota State Legislature)

Tax Increment: Additional tax revenues that result from increases in property values within a redevelopment area. State law permits the tax increment to be earmarked for redevelopment purposes but requires at least 20 percent to be used to increase and improve the community's supply of very low- and low-income housing.

Telecommuting: An arrangement in which a worker is at home or in a location other than the primary place of work, and communicates with the workplace and conducts work via wireless or telephone lines, using modems, fax machines, or other electronic devices in conjunction with computers.

Townhouse; Townhome: A one-family dwelling in a row of at least three such units in which each unit has its own front and rear access to the outside, no unit is located over another unit, and each unit is separated from any other unit by one or more common and fire-resistant walls. Townhouses usually have separate utilities; however, in some condominium situations, common areas are serviced by utilities purchased by a homeowners association on behalf of all townhouse members of the association. (See "Condominium.")

Traffic Model: A mathematical representation of traffic movement within an area or region based on observed relationships between the kind and intensity of development in specific areas. Many traffic models operate on the theory that trips are produced by persons living in residential areas and are attracted by various non-residential land uses. (See "Trip")

Transfer of Development Rights: Also known as "Transfer of Development Credits," a program that can relocate potential development from areas where proposed land use or environmental impacts are considered undesirable (the "donor" site) to another ("receiver") site chosen on the basis of its ability to accommodate additional units of development beyond that for which it was zoned, with minimal environmental, social, and aesthetic impacts.

Transit: The conveyance of persons or goods from one place to another by means of a local, public transportation system.

Transit, Public: A system of regularly-scheduled buses and/or trains available to the public on a fee-per-ride basis. Also called "Mass Transit"

Transit-dependent: Refers to persons unable to operate automobiles or other motorized vehicles, or those who do not own motorized vehicles. Transit-dependent citizens must rely on transit, para-transit, or owners of private vehicles for transportation. Transit-dependent citizens include the young, the handicapped, the elderly, the poor, and those with prior violations in motor vehicle laws.

Transit-oriented Development (TOD): A mixed-use community within an average 2,000-foot walking distance of a transit stop and core commercial area. TODs mix residential, retail, office, and public uses in a walkable environment, making it convenient for residents and employees to travel by transit, bicycle, foot, or car.

Transitional Housing: Shelter provided to the homeless for an extended period, often as long as 18 months, and generally integrated with other social services and counseling programs to assist in the transition to self-sufficiency through the acquisition of a stable income and permanent housing. (See "Homeless" and "Emergency Shelter")

Transportation Demand Management (TDM): A strategy for reducing demand on the road system by reducing the number of vehicles using the roadways and/or increasing the number of persons per vehicle. TDM attempts to reduce the number of persons who drive alone on the roadway during the commute period and to increase the number in carpools, vanpools, buses and trains, walking, and biking. TDM can be an element of TSM (see below).

Transportation Systems Management (TSM): A comprehensive strategy developed to address the problems caused by additional development, increasing trips, and a shortfall in transportation capacity. Transportation Systems Management

focuses on more efficiently utilizing existing highway and transit systems rather than expanding them. TSM measures are characterized by their low cost and quick implementation time frame, such as computerized traffic signals, metered freeway ramps, and one-way streets.

Trees, Street: Trees strategically planted - usually in parkway strips, medians, or along streets to enhance the visual quality of a street.

Trip: A one-way journey that proceeds from an origin to a destination via a single mode of transportation; the smallest unit of movement considered in transportation studies. Each trip has one "production end" (or origin - often from home, but not always), and one "attraction end" (destination). (See "Traffic Model")

Trip Generation: The dynamics that account for people making trips in automobiles or by means of public transportation. Trip generation is the basis for estimating the level of use for a transportation system and the impact of additional development or transportation facilities on an existing, local transportation system. Trip generations of households are correlated with destinations that attract household members for specific purposes.

Truck Route: A path of circulation required for all vehicles exceeding set weight or axle limits, a truck route follows major arterials through commercial or industrial areas and avoids sensitive areas.

Uniform Building Code (UBC): A national, standard building code that sets forth minimum standards for construction.

Uniform Housing Code (UHC): State housing regulations governing the condition of habitable structures with regard to health and safety standards, and which provide for the conservation and rehabilitation of housing in accordance with the Uniform Building Code (UBC).

Urban: Of, relating to, characteristic of, or constituting a city. Urban areas are generally characterized by moderate and higher density residential development (i.e., three or more dwelling units per acre), commercial development, and industrial development, and the availability of public services required for that development, specifically central water and sewer, an extensive road network, public transit, and other such services (e.g., safety and emergency response). Development not providing such services may be "non-urban" or "rural" (See "Urban Land Use") CEQA defines "urbanized area" as an area that has a population density of at least 1,000 persons per square mile - (Public Resources Code ¤21080.14(b)).

Urban Design: The attempt to give form, in terms of both beauty and function, to selected urban areas or to whole cities. Urban design is concerned with the location, mass, and design of various urban components and combines elements of urban planning, architecture, and landscape architecture.

Urban Land Use: Residential, commercial, or industrial land use in areas where urban services are available.
Urban Services: Utilities (such as water, gas, electricity, and sewer) and public services (such as police, fire, schools, parks, and recreation) provided to an urbanized or urbanizing area.

Utility Corridors: Rights-of-way or easements for utility lines on either publicly or privately owned property. (See "Right-of-way" or "Easement")

Vehicle-Miles Traveled (VMT): A key measure of overall street and highway use. Reducing VMT is often a major objective in efforts to reduce vehicular congestion and achieve regional air quality goals.

Very Low-income Household: A household with an annual income usually no greater than 50 percent of the area median family income adjusted by household size, as determined by a survey of incomes conducted by a city or a county, or in the absence of such a survey, based on the latest available eligibility limits established by the U.S. Department of Housing and Urban Development (HUD) for the ¤8 housing program.

View Corridor: The line of sight Ð identified as to height, width, and distance Ð of an observer looking toward an object of significance to the community (e.g., ridgeline, river, historic building, etc.); the route that directs the viewers

attention.

Viewshed: The area within view from a defined observation point.
Volume-to-Capacity Ratio: A measure of the operating capacity of a roadway or intersection, in terms of the number of vehicles passing through, divided by the number of vehicles that theoretically could pass through when the roadway or intersection is operating at its designed capacity. Abbreviated as ÒV/C.Ó At a V/C ratio of 1.0, the roadway or intersection is operating at capacity. If the ratio is less than 1.0, the traffic facility has additional capacity. Although ratios slightly greater than 1.0 are possible, it is more likely that the peak hour will elongate into a "peak period." (See "Level of Service")

Water-efficient Landscaping: Landscaping designed to minimize water use and maximize energy efficiency.

Watercourse: Natural or once natural flowing (perennially or intermittently) water including rivers, streams, and creeks. Includes natural waterways that have been channelized, but does not include manmade channels, ditches, and underground drainage and sewage systems.

Watershed: The total area above a given point on a watercourse that contributes water to its flow; the entire region drained by a waterway or watercourse that drains into a lake, or reservoir.

Waterway: See "Watercourse"

Williamson Act: Known formally as the California Land Conservation Act of 1965, it was designed as an incentive to retain prime agricultural land and open space in agricultural use, thereby slowing its conversion to urban and suburban development. The program entails a 10-year contract between the City or County and an owner of land whereby the land is taxed on the basis of its agricultural use rather than the market value. The land becomes subject to certain enforceable restrictions, and certain conditions need to be met prior to approval of an agreement.

Zero Lot Line: A detached single family unit distinguished by the location of one exterior wall on a side property line.

Zone, Combining: A special purpose zone that is superimposed over the regular zoning map. Combining zones are used for a variety of purposes, such as airport compatibility, floodplain or wetlands protection, historic designation, or special parking regulations. Also called "overlay zone."

Zone, Interim: A zoning designation that temporarily reduces or freezes allowable development in an area until a permanent classification can be fixed; generally assigned during general plan preparation to provide a basis for permanent zoning.

Zone, Traffic: In a mathematical traffic model the area to be studied is divided into zones, with each zone treated as producing and attracting trips. The production of trips by a zone is based on the number of trips to or from work or shopping, or other trips produced per dwelling unit.

Zoning: The division of a city or county by legislative regulations into areas, or zones, that specify allowable uses for real property and size restrictions for buildings within these areas; a program that implements policies of the General Plan.

Zoning District: A designated section of a city or county for which prescribed land use requirements and building and development standards are uniform.

Zoning, Exclusionary: Development regulations that result in the exclusion of low- and moderate-income and/or minority families from a community.

Zoning, Incentive: The awarding of bonus credits to a development in the form of allowing more intensive use of land if public benefits (such as preservation of greater than the minimum required open-space; provision for low- and moderate-income housing; or plans for public plazas and courts at ground level) are included in a project.

Zoning, Inclusionary: Regulations that increase housing choice by providing the opportunity to construct more diverse and economical housing to meet the needs of low- and moderate-income families. Often such regulations require a minimum percentage of housing for low- and moderate-income households in new housing developments and in conversions of apartments to condominiums.

Appendix B-1:
General Planning Principles

Appendix B: General Planning Principles

I. COMMUNITY DEVELOPMENT PRINCIPLES

A. Required Knowledge Base

1. The County must invest in the development and acquisition of the underlying knowledge base required to complete and maintain the General Plan. The overall context for the General Plan is encompassed in the Vision statement which underpins it. The Vision identifies the relevant questions in connection with the knowledge base which is to be developed. Essential database elements include:

    - Future potentials, including market trends;
    - Demographics analysis;
    - GIS mapping and analysis;
    - Environmental conditions and analysis;
    - Adaptation of emerging planning and regulatory tools and techniques; and
    - Impacts and mitigations.

2. Included in this research must be an assessment of the applicability of various planning and regulatory tools and techniques and a determination as to which are particularly appropriate for Riverside County.

B. Regional Issues

1. We must cooperate regionally to deal with the issues of mobility, transportation systems development, traffic congestion reduction, clear air, clean water, watershed management and habitat linkages. The County should coordinate with the cities, other local and regional agencies, and Indian nations to the maximum extent practicable to provide a comprehensive guide to economic and physical development, transportation and multi-purpose open space in the entire County.

C. Maturing Communities

1. The General Plan Vision acknowledges that every community in the County is maturing in its own way, at its own pace and within its own context. Policies and programs should be tailored to local needs in order to accommodate the particular level of anticipated maturation in any given community.

D. Housing Element

1. The Housing Element should be revised to adopt policies that address the real-world projections of overall housing growth and demands for housing of varied type, style, price and density, while encouraging a wide range of choices and opportunities within the framework of the larger economy and the realities of the marketplace.

2. We recommend a program of innovative planning combined with effective incentives for those housing types and community forms which are most efficient in land consumption and extension of infrastructure and are adaptive to transit. We further recommend incentives to promote the conversion of existing legal parcels that are currently configured in inefficient lotting patterns to more efficient configurations, through such mechanisms as density transfer and clustering.

3. The policies that govern the development of housing must be framed with a fundamental understanding of the residential market in Riverside County. That understanding has to acknowledge that housing affordable to the mainstream buyer must continue to be

developed within the context of non-subsidized market economics to meet the purchasing ability of local residents. Housing policies must also be responsive to the special housing needs of persons who cannot afford market-rate housing, such as those of persons with disabilities, elderly, large families, farmworkers, families with female heads of households, and families and persons in need of emergency shelter.

4. Provisions should be made in housing policies and programs for preservation and rehabilitation of existing housing stock as well as new housing.

E. Area Plans

1. The County should build on the active Community Plan process and encourage community participation in the creation of additional Area Plans, setting forth the overall design and planning principles as well as the basic nature of the community.

2. Refinement of existing Community Plans and development of new Area Plans must be done in parallel with the General Plan update, with any required reconciliation between them to be accomplished prior to General Plan adoption.

F. Regulatory Policies

1. The fundamental notions of increased densities and compact and mixed use development require a major overhaul of the current zoning standards and zoning code provisions. It must be a policy of the General Plan to develop zoning and other land use regulations that implement and permit such development types. Specific Plans, Planned Community Zoning, Planned Development Zoning and Site Planning each provide customized zoning and other development regulations, and are appropriate planning and regulatory vehicles for achieving local control over development quality and type.

2. It is critical that these new and alternative development types be permitted without additional review and regulation. Compliance with performance standards should be used to facilitate use of flexible regulations in place of exhaustive review procedures. Additional incentives in the form of economic benefits (fee reductions, permit fast tracking, density bonuses, etc.) must be developed to encourage desirable development.

G. Efficient Land Use

1. The County should encourage compact and transit-adaptive development on regional and community scales. The policy goal is to permit and encourage increased densities and intensities, and to reduce the land required for public infrastructure by reducing street widths (subject to emergency access requirements) and other such requirements, excepting land that the public has exercised its prerogative to purchase at fair market value.

2. Implementation of the General Plan Vision and its supporting policies is desirable for development and deserving of support by public institutions. Incentives should be used to encourage higher density/intensity development in appropriate areas, within the context of the General Plan, and taking market forces into consideration. These preferred development patterns must be clearly and accurately defined so that compliance with the policy to earn incentives will be neither misinterpreted nor misunderstood.

3. Provision of mobility to an expanding population requires the integration of land use and transportation through transit-adaptive development and infrastructure. Efficient use of land as well as mobility goals will therefore be fostered through the following:

    a. Create community centers with mixed or integrated commercial, residential, employment, parks, and civic, recreational and cultural uses within walking distance of transit stops (bus and rail).

b. Create street networks, directly connecting local destinations, that are friendly to pedestrians, bicyclists and others using non-motorized forms of transportation.

c. Direct further subdivision of ranchettes and very low density development (less than 2 units/acre) to appropriately planned and sited properties.

d. For existing legal parcels which are at low densities, consider transfer of development credit programs or other mechanisms to achieve more efficient use of land.

e. Re-plan existing urban cores and specific plans for higher density, compact development.

f. In new towns, accommodate compact, transit-adaptive infrastructure (based on modified standards that take into account transit systems facilities or street network).

H. Public Acquisition

1. Public acquisition of land must be accomplished through legal and constitutionally mandated means.

II. ENVIRONMENTAL PROTECTION PRINCIPLES

A. Environmentally Sensitive Community Design

1. Environmental protection is built into the General Plan at the Countywide and Area Plan level. This sensitivity to environmental conditions is also desirable at the community level and should be carried out as appropriate to that scale. Community design should be aimed at preserving significant environmental features wherever possible, particularly where they can provide continuity with more extensive regional systems. Examples include unique natural terrain (e.g, rock outcroppings), drainage ways (e.g. natural swales rather than versus concrete channels), and superior examples of native vegetation (e.g., stands of oak trees contained within parks or common areas).

2. Water conservation practices should also be encouraged by promoting groundwater recharge through increased use of porous pavement, on site and neighborhood water capture, drought tolerant landscaping, and water recycling.

3. Programs should be created to ensure historic preservation.

4. Energy efficiency should also be pursued wherever possible though street configuration, building orientation and landscaping to capitalize on shading and facilitate solar energy.

B. Habitat Preservation

1. Preservation of natural systems (e.g. multi-species habitat, watersheds, landforms) is an integral part of these principles. At the initiation of the General Plan process, it is the multi-species habitat conservation plan (MSHCP) effort around which natural systems planning should begin. Further, the investment in the Stephen's Kangaroo Rat habitat program ought to be protected and leveraged, so that the time and energy already spent on it is not wasted. While the primary purpose of multi-species habitat is the permanent preservation of this portion of the natural environment, carefully managed access by humans should be considered in some locations as a means of enabling people to experience and better appreciate these resources.

A. Community Open Space

1. Provision of community open space is a fundamental principle of community planning. Open space in this context means usable open space, available for residents to enjoy in a manner appropriate to its design, acceptance of human impacts and consistency with the aims of the General Plan.

B. Multi-purpose Open Space

1. Designation of open spaces in the General Plan and Area Plans conveys the intent of creating a comprehensive open space system that provides a framework for community development and encompasses the needs of humans for active and passive recreation, as well as the needs of multiple species for survival and sustenance. Within that overall designation, the functional areas of community open space and habitat preservation should be clearly delineated.

2. Moreover, the types of uses to be accommodated within components of the multi-purpose open space system should be clearly spelled out in the General Plan, based on sound community planning principles. Where the function of open space areas is not diminished by linkages to other open spaces, those linkages should be established wherever possible.

III. TRANSPORTATION PRINCIPLES

A. Optimize Existing Systems

1. Existing circulation infrastructure should be optimized, while adding new sub-systems that interface naturally with the freeway system. Rubber tire transit systems (conventional or articulated buses) as a component of an integrated system ought to be initially addressed for their low first cost and ease of system integration.

B. Transportation Corridors

1. The need for new transportation corridors, and their optimal modal mix, should be assessed. Any alignments chosen must reflect environmental constraints. Any such new transportation corridors should be planned to provide an additional supporting framework, so that future community growth develops naturally and economically along these routes. Transit infrastructure requires advance dedication or set-asides consistent with regional transportation infrastructure plans to ensure adequate opportunity when the time for construction arrives. Transit equipment, distinct from rights-of-way and infrastructure systems, is a public responsibility and its provision should not be used as a condition of approval or a requirement of entitlement. However, this does not preclude voluntary action in response to incentives.

C. Mass Transit

1. The Circulation Element should put in place an integrated transportation system, for both people and goods, which creates a regional transit framework (which may accommodate rail or rubber-wheeled technologies) around which the great majority of housing, commercial and industrial development will be focused and served. The regional service base must support the development and operation of the transit network. Varied forms of transit systems should be considered, based on service potential, cost, flexibility and reinforcement of more efficient land use. Applications of this principle include:

    a. Improving transportation and public transit access to downtowns and other activity centers from other areas.

    b. Providing convenient access to transit, so this becomes an amenity used to market the community.

    c. Capitalizing on existing rail or road rights-of-way or rail links that are unused or underused.

    d. Locating as many community activities as possible within easy walking distance of transit stops.

2. Development proposals, however, must be planned and regulated so they can stand alone, independent of the transit service which is much more likely to follow, rather than lead, such development.

D. Street Standards

1. Local street standards warrant a review. In particular, the utilization of narrow streets, traffic circles and roundabouts, traffic calming at intersections, parkway "bulbs", etc., need careful assessment. Grid street patterns, and other traditional neighborhood design features including alleys, should be permitted. Other treatments that enhance livability at the street level include landscaping and streetscaping. In general, creative street design should be permitted, subject to safety considerations.

E. Pedestrian, Bicycle and Equestrian Friendly Communities

1. Compact development patterns and location of higher density uses near community centers should allow services to be safely accessed by walking, bicycling or other non-motorized means. Typically, walking is a feasible option within a one-quarter to one-half mile distance. Streets, pedestrian paths and bicycle paths should contribute to a system of fully-connected and intersecting routes. Their design should encourage safe pedestrian and bicycle use. Bicycle and pedestrian paths should be conveniently located and linked to commercial, public, educational and institutional uses.

F. Air Transportation

1. Air transportation facilities, commercial, military and general aviation, need to be integrated into the County's overall transportation system. In particular, the relationship between airports and surrounding land uses as well as connections with arterial highway and transit systems require careful coordination.

IV. COMMUNITY DESIGN PRINCIPLES

The following principles are suggested as the basis for developing zoning standards, design guidelines, incentive programs and land use policies.

A. Community Variety, Choice And Balance

1. It is the intent of the General Plan to foster variety and choice in community development, particularly in the choice and opportunity for housing in various styles, of various densities, of a wide range of prices and accommodating a range of life styles in equally diverse community settings, emphasizing compact and higher density choices.

2. Incentives should be used within the General Plan to expand the range of choices available and to support the development of desired development types and strategies. Nothing in these principles is to be interpreted as forcing residents of the County into development options for which there is no potential market, nor is there any intent to mandate either the life style or housing choices of the populace.

3. Balanced growth is achieved in more than one way by:

    a. Distributing growth in a rational way between urban, suburban and rural spheres with an appropriate allocation of resources to meet necessary infrastructure requirements;

    b. Fostering communities varying in size, type and environmental setting, recognizing that some patterns of development are appropriate for incentives and some patterns should be discouraged; and

    c. Ensuring a balance of jobs, housing and services within communities.

4. Communities should range in location and type from urban to suburban to rural, and in intensity from dense urban centers to small cities and towns to rural country villages to ranches and farms. Low density residential development should not be the predominant use or standard by which residential desirability is determined.

a. Each of the following should be considered, in no order of priority, as appropriate types of urban form and development:
   (1) Municipal boundary build-out;
   (2) New towns, villages, neighborhoods and aggregated specific plan areas;
   (3) lnfill development and redevelopment;
   (4) Compact and transit oriented developments; and
   (5) Suburban development exclusive of the Very Low Density designation.

5. The creation of new cities/towns, villages and aggregated specific plan areas should be considered. The process of planning for new communities should be started so that when they are built they will have the infrastructure, the facilities, services, and economic sustainability to make them viable into the next century.

6. Existing communities should be revitalized through development of under-used, vacant, redevelopment and/or infill sites within existing urbanized areas. To the extent possible, attention should be focused on brownfields and other urban sites whose rehabilitation provides not only economic benefits but also environmental improvements. Steps to implement this principle include:

   a. Preserving and enhancing existing pedestrian and transit-adaptive neighborhoods by pursuing redevelopment that retains pedestrian orientation and promotes transit use.

   b. Preparing neighborhood revitalization plans for areas suited for infill development. Assure public participation throughout the planning process. Streamline the permitting process, provide incentives as part of the process, and encourage public-private ventures to carry out these plans.

   c. Re-designating vacant land for higher density uses or mixed use, and providing incentives for assemblage of smaller parcels to create feasible infill projects that meet community goals and objectives.

7. High density, urbanized villages should be created surrounding existing and projected commercial and industrial clusters, with priority given to ensuring adequate transit access to such villages.

8. Where continuing development of existing Specific Plans and tracts proceeds, provide incentives for reconfiguring such specific plans and tracts to form more efficient communities. Incentives should be provided to owners of such properties who are willing re-plan their properties in accordance with these principles and incentives.

B. Unique Communities

1. The General Plan should promote development of a "unique community identity" in which each community exhibits a special sense of place by retaining distinct edges and sufficient open space between scattered urbanized areas. This will facilitate the build-out of existing communities, as well as the creation of new towns, each of which have distinct boundary and edge conditions.

2. A further aspect of community character and identity is the natural topography and unique landforms that must be respected in the pattern of development. Each community or cluster of communities should have distinct edges, parks and open space connections.

C. Community Centers

1. Where appropriate, each community should be encouraged to develop a "community center" as the focus and place of concentrated civic activity.

   a. Downtown and community centers should be promoted as primary commercial and

financial centers, and social, institutional, and financial incentives should be provided to builders and businesses locating there.

b. Mixed-use districts should be created that encourage the combination of residential, commercial, civic, cultural, recreational and office uses essential to the daily life of residents, on the same site.

c. Existing, underutilized developments, such as shopping centers, should be redeveloped or reused to provide activity, mixed uses and housing nodes.

d. Existing neighborhoods should be retrofitted to create activity centers or nodes that give each neighborhood an identity and a civic focus, and provide services such as day care.

e. Public spaces and parks should be made the focus of building orientation and neighborhood activity.

f. School districts should incorporate school sites into centrally located activity centers that serve multiple civic purposes.

g. Institutional and public land uses should be incorporated into downtown redevelopment and neighborhood revitalization plans.

h. Public spaces should be designed to encourage the attention and presence of people at extended hours.

D. Transportation Linkage

1. Each community should be integrated into the regional transit/transportation system, with appropriate planning for transit terminals and high density clustered housing in the immediate vicinity. When appropriate, this area should be developed as the community center and a transit hub.

E. Integrated Use

1. Integrated use takes the notion of “mixed use" another step and both permits and encourages a careful integration of urban uses, appropriately planned and located within the overall urban setting, with sufficient flexibility remaining to encourage the blending of unplanned, yet equally beneficial, uses that contribute to the dynamic vitality of urban life.

F. Fine Grain Mix of Housing

1. Land use policies should permit a fine grain mix of housing types, densities and prices. This means that neighborhoods and development projects may contain a mix of several housing types, densities and price ranges, subject to carefully crafted standards of design (e.g. regulating lot coverage, setbacks, and landscaping).

G. Parks and Recreation

1. An ample system of specialized open space and recreational facilities should be provided which are pedestrian, bicycle and equestrian oriented and accessible to persons of all ages, and whose frequent use is encouraged through placement and design.

2. Public spaces and parks should be made the focus of building orientation and neighborhood activity, particularly in community centers.

3. Parks should be connected with schools, the regional trails system and the open space and multi-species habitat areas, where the functions of these areas are not diminished by the connections.

V. AGRICULTURAL PRINCIPLES

1. Agriculture should be treated as an economic land use, to include the following:
   a. Long and medium term agricultural lands devoted to field, row, or orchard crops or grazing that reflect investment and operational commitments to agricultural production; and

   b. Rural industrial agricultural lands, such as those devoted to dairies or poultry farms, involving uses that function as a farm-produce related industrial activity, usually are more intensive than, but not as extensive as, most agricultural activities. They are typically surrounded by low intensity rural uses and vacant land and require significant remediation before they can be converted to another use.

2. The General Plan, through its Area Plans, should provide for these categories of agricultural lands in map and narrative form. This will be accomplished in the following way:
   a. Agricultural lands should be designated as Agriculture (A) on the General Plan. This denotes that agriculture is the current development form for these lands. The characteristics of this use include, but are not limited to:

      (1) Farmers invested in agricultural pursuits;
      (2) Agriculture is the predominant surrounding use, although urban encroachment may be occurring in some cases;
      (3) Infrastructure is designed to support agricultural uses;
      (4) The quality of soils, cost and supply of water, and other factors support agricultural production;
      (5) Williamson Act Contracts are common, although some non-renewals may be initiated;
      (6) There is general recognition that this land is in an agricultural district, whether it is gradually contracting over the long term, stable, or expanding; and
      (7) This use may, in some situations, be combined with an overlay that offers other options for the property owner, such as a voluntary agreement to preserve certain open space areas or characteristics in exchange for fair compensation.

   b. Rural agricultural uses that have industrial characteristics will be designated Agricultural Industrial (AI) on the Plan, denoting that these uses, because of their intensity and character, set them apart from other agricultural uses. They have unique requirements and impacts that make them particularly incompatible with urban uses. The characteristics of this category may include the following:

      (1) Farmers have made a long-term investment in the use;
      (2) The use is highly intensive and requires specialized improvements to conduct the use;
      (3) Impacts of the use are highly industrial in character, involving noise, odor, dust and truck traffic highly incompatible with urban residential development;
      (4) The surrounding area is generally devoted to rural development or grazing lands;
      (5) Infrastructure generally in the area is not supportive of urban development;
      (6) Conversion to urbanization would require significant environmental remediation; and

3. Because of its significant economic and other indirect benefits (e.g., visual open space), incentives should be put in place to stimulate continued agricultural production where conditions permit it to flourish. This includes opportunities to expand agriculture in some areas, including the possibility of using the new “Super-Williamson Act” as a means of accomplishing this.

4. Policies and measures should be included to protect the long-term agricultural areas from urban encroachment by means of a strong right-to-farm ordinance and restrictions on new development that could prematurely induce a loss of agriculture. The responsibility for

providing buffering between urban, suburban or conservation uses that encroach upon existing agriculture/agricultural industrial uses rests with the urban/suburban development. The responsibility for providing buffering between expanding agricultural lands or agricultural/industrial uses and adjacent development rests with the agricultural use.

5. Policies and measures should be included to manage the transition from agricultural uses to urban uses within the time horizon of the General Plan. This will entail use of the RCIP Certainty System by reviewing this Foundation Component as part of a periodic comprehensive General Plan review.

6. New tools may have to be developed to avoid undue pressure on existing agriculture, accomplish a transition smoothly where that is intended, and address the long term implications of the interface between agricultural and other uses. These could include, but not be limited to, such concepts as buffer zones, phasing programs, disclosure agreements, transfer of development rights, and other methods of fairly and equitably managing the interface between agricultural and other lands.

7. Policies and measures should be included to allow agricultural uses to continue on lands designated for Community Development until the land is redeveloped or agricultural production ceases.

8. Policies in the RCIP Certainty System and RCIP Monitoring Program should address the means to be used to account for unanticipated events or conditions that may substantially alter the status of agricultural lands in the County (e.g. significant economic shifts, water availability or cost).

VI. RURAL DEVELOPMENT PRINCIPLES

1. Rural land use designations should be established that accommodate a rural lifestyle generally within existing rural towns and rural residential neighborhoods. Additional rural towns and residential neighborhoods should be minimized because of the need to provide more efficient community development opportunities.

2. Existing rural towns and residential neighborhoods should be clearly mapped and identified as the basis for further review and possible refinement of this aspect of the General Plan.

3. Areas in which the rural character is clearly established, its nature is such that intensification is impractical, and current residents/property owners strongly prefer a continued rural lifestyle, should be retained as rural in the General Plan.

4. These principles do not preclude the addition of small-scale villages of a contrasting character, even those that might include a mix of more intensive residential development, as a component of the rural landscape.

VII. ECONOMIC DEVELOPMENT PRINCIPLES

A. Preface

1. The Vision encompasses a robust economy serving a full range of job needs, offers housing choices covering the complete spectrum from entry level to estate living environments, and provides a solid economic base to support needed public services and facilities.

2. The following principles guide preparation of land use maps and General Plan policies for the RCIP. They must be interpreted in the context of two major economic themes. The first is recognition of Riverside County's unique present and future economy. The second is the aspiration, even though it may not be completely achievable, to stimulate enough jobs in Riverside County to enable the workers who reside here to choose also to work in this County. This is particularly applicable to basic, higher wage employment that strengthens the structure of the County's economic base, and not to simply adding more jobs

irrespective of their nature (such as low paying service industry jobs).

3. This County is emerging as a rapidly growing force in the Southern California economy, with strong population, housing and employment growth. While the County's initial economic character has been understandably dominated by responsiveness to local markets, there is a definite intent to become a major participant in the regional, national and international markets. That direction is so desirable that the RCIP seeks to stimulate the diverse economic mix, land availability and access capabilities to operate effectively at those economic scales. In short, the intent is to implement the economic portions of the Riverside County Vision.

B. General

1. Provide employment-generating uses in Riverside County, with capacity for enough jobs to employ the workers who live in Riverside County to the maximum extent possible.

2. Stimulate the growth of businesses focused on national and international markets.

3. Stimulate cooperative arrangements with adjacent cities, counties, regions and states where programs and projects of mutual benefit can be undertaken.

4. Stimulate use of practical incentives for business development, and avoid disincentives.

5. Promote the development and dissemination of marketing information to make business enterprises aware of the opportunities and advantages of location/expansion in Riverside County.

C. Commerce and Industrial Development

1. Stimulate industrial/business-type clusters that facilitate competitive advantage in the market place, are appropriate for this County, provide attractive and well landscaped work environments, and fit with the character of our varied communities.

2. Provide for a range of uses in major transportation/employment centers that:

   a. Accommodate embryo industries and small business start-up operations;

   b. Offer housing responsive to the range of needs by the workforce; and

   c. Promote a mix of uses, especially including high employment uses such as commercial and office development as well as mixed-use projects.

3. Provide for the continued and even expanded production of agricultural products by conserving areas appropriate for agriculture and related infrastructure and supporting services.

4. Stimulate the growth of small businesses.

5. Promote the focus of venture capital in our employment centers and economic clusters.

6. Stimulate home enterprise and home occupation activities as much as possible, consistent with preserving the quality of the residential environment in which they are located.

D. Land and Development Activity

1. Focus on availability of vacant, developable land that can accommodate a variety of economic enterprises.

2. Locate job centers so they have convenient access to the County's commercial and general

aviation airports. In parallel with this strategy, facilitate improvements in the County's access to local commercial air transportation facilities as well as those outside the County.

3. Establish sufficient acreage of well distributed industrial sites and business park uses, so that workers and employers have more locational options in the County and, because of convenience, allow a choice of making shorter commutes.

4. In locating job centers, consider the potential leverage provided by designated redevelopment project areas, enterprise zones and empowerment zones as a means of stimulating economic development and assembling land parcels to facilitate more competitive business development projects.

E. Leadership and Employment

1. Provide for increased levels of higher paying employment opportunities.

2. Benefit from and reinforce existing and expanded educational centers by:

   a. Establishing proximity of job centers to educational facilities wherever possible;

   b. Facilitating college/university/trade school/secondary school partnerships with businesses, industries and labor groups; and

   c. Stimulating development of educational facilities and programs that are supportive of job training and technical capabilities, not only in traditional high technology fields such as software development, but in innovative assembly, skilled manufacturing and related trades.

3. Encourage the involvement of business leaders in overall economic development strategies.

4. Promote ways of expanding and retaining our trained and educated work force in the County, including especially bringing businesses into the County that can use the talents of our existing workforce.

F. Infrastructure Support

1. Locate industrial uses in proximity to existing and planned rail lines, freeways, arterial highways and utilities.

2. Stimulate cooperative programs between utility suppliers and businesses to assure adequate infrastructure support and develop leading edge communication systems.

Appendix C:
Public Opinion Survey

RIVERSIDE COUNTY
PUBLIC OPINION SURVEY REPORT

July 30, 1999

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SUMMARY DESCRIPTION OF METHODS

DATES AND TIMES: *Sunday, June 20 through Wednesday, June 23, 1999. Sunday interviewing hours are from 1:00 PM to 9:00 PM, weekday hours are from 5:00 PM to 9:00 PM.*

SAMPLE: *600 completed interviews with a sample of registered voters in Riverside County, including 120 from each of the supervisorial districts. For the desert communities, the far eastern areas were excluded.*

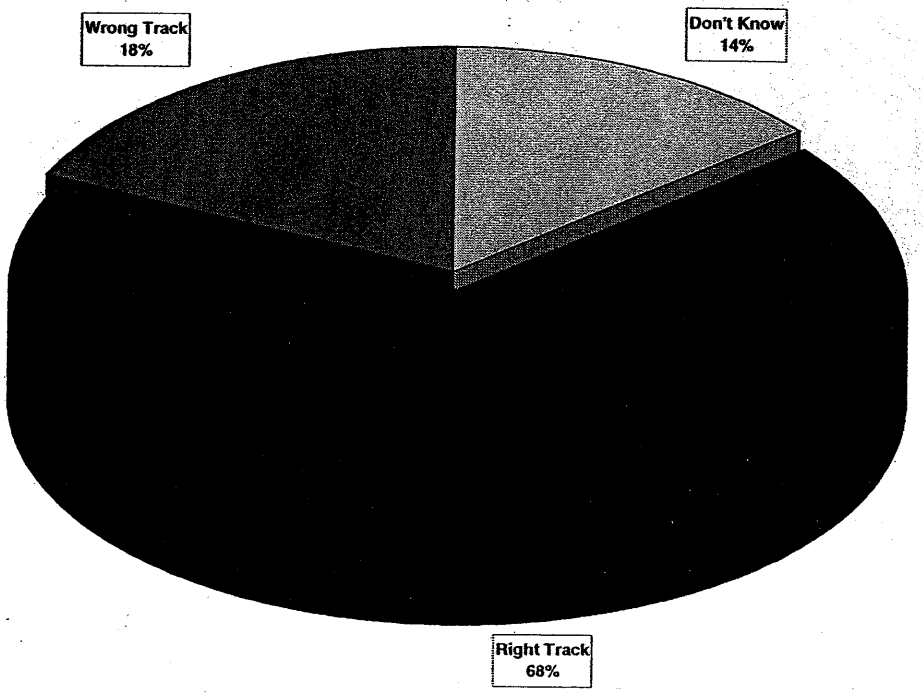
PROCEDURES: *Professional interviewers familiar with standard telephone interviewing procedures were trained specifically for this survey prior to beginning the interviews. All interviews were conducted from The Parker Group's central telephone facility and were observed by an on-duty supervisor at all times.*

SAMPLING ERROR: *In a scientifically selected sample of 600 respondents, normal statistical error is plus or minus 4% for the sample as a whole. That is to say, in 95% of all samples drawn from the same population, the findings would not differ from the findings reported here by more than 4%. Sampling error for subgroups or each Supervisorial District in the cross-tabulated analysis is greater.*

LIMITATIONS OF THE METHODS: *The sampling and research procedures employed here are subject to the normal statistical and non-statistical errors in survey research. Non-statistical errors result from dishonest responses, inconsistency between expressed attitudes and actual behaviors, and misunderstood questions. Public opinion data are not meant to be predictive of future attitudes or behaviors, but are designed to measure attitudes at the time data are collected.*

THE DIRECTION OF RIVERSIDE COUNTY

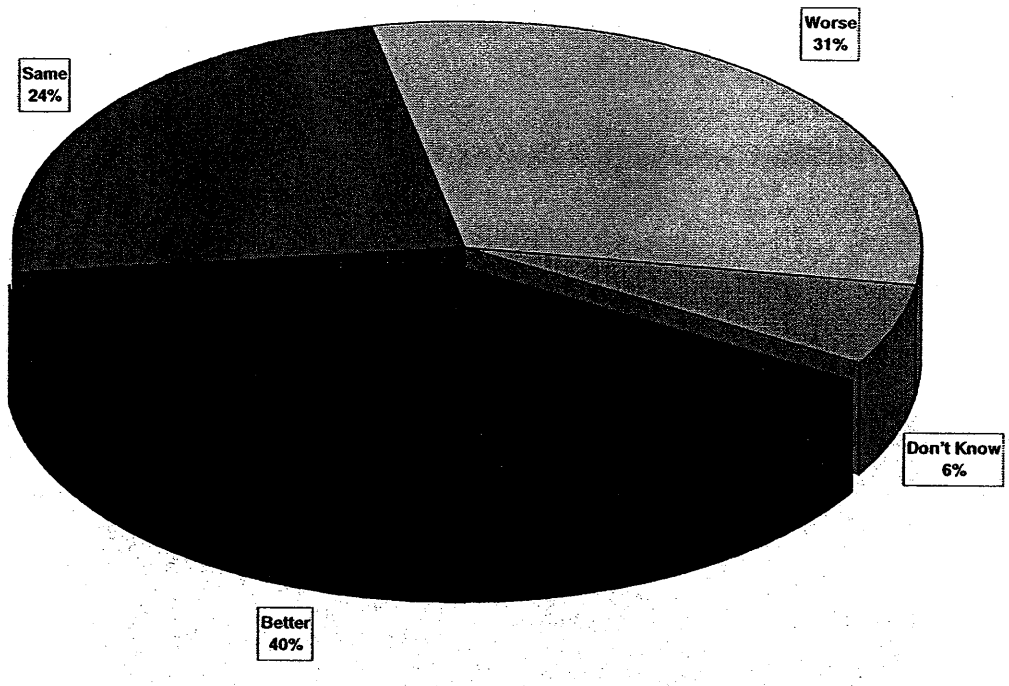
THINGS IN RIVERSIDE COUNTY ON RIGHT OR WRONG TRACK



Key Findings:

☞ *By nearly a four-to-one ratio, voters say that things in Riverside County are on the right track. This reflects a more positive view than in other areas of the state.*

EXPECTATIONS ON FUTURE QUALITY OF LIFE



☞ *Riverside residents are not necessarily optimistic about the future. While 40% say the quality of life will be better, nearly two-thirds say that it will be the same or worse than at present.*

KEY CROSS-TABULATED FINDINGS

People under 40 tend to be the most likely to say things are on track in Riverside County, with those in Districts 2 and 4 more likely to say things are on track than voters in the other districts. People with children are also more likely to say things are going well than are those without. Latinos and Asian-Americans are the most likely to say things are on track, while African-Americans are least likely.

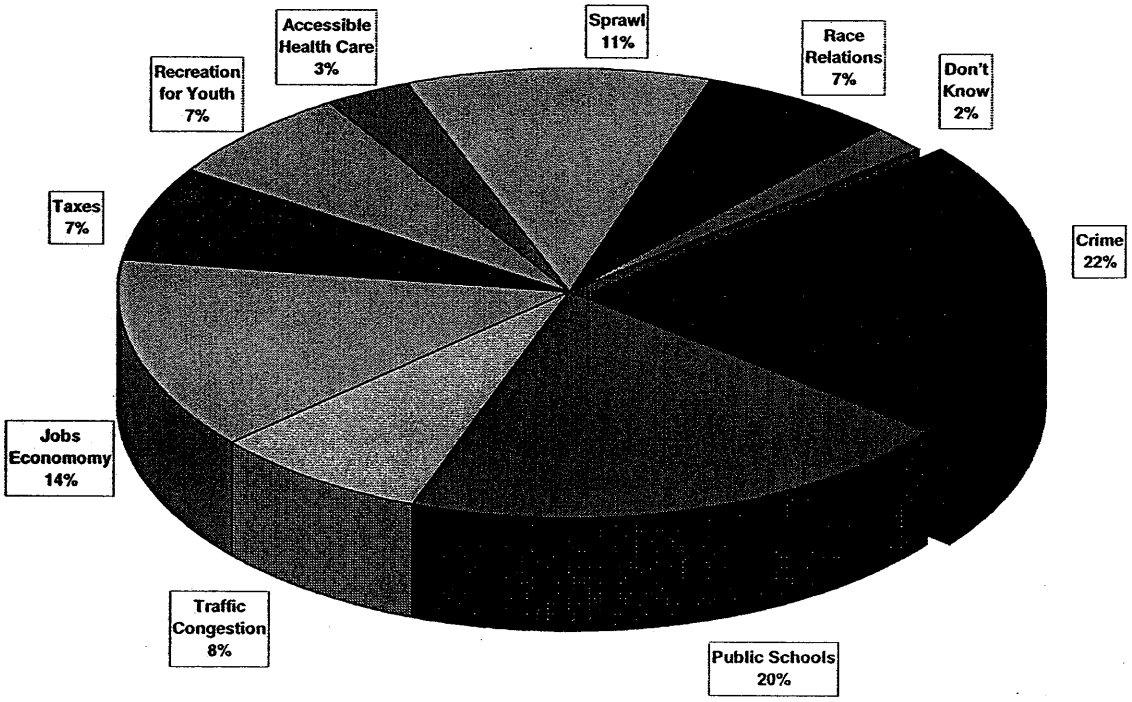
In terms of the future, the most optimistic are younger people, including those with children, and residents of District 4, as well as those living in incorporated areas. Those most likely to say things will get worse are older, long-term residents of District 3, people who live in the unincorporated areas, those with the least education, and white/Anglos.

ISSUES FACING RIVERSIDE COUNTY

Key Findings:

☞ *In an open-ended question, voters say the most important issues facing Riverside County are the rate of growth, crime, violence and gangs, schools and education, traffic congestion, police issues and jobs. Other issues ranged from children's issues to pollution to economic growth.*

MOST IMPORTANT ISSUE FACING RIVERSIDE COUNTY



☞ *With more limited response options, two issues dominate as the issues which should be the top priority for the county's elected officials: reducing crime, gangs and drugs, and improving public education. Other top issues are creating new jobs and strengthening the local economy, and controlling residential growth and preserving open space. Lower priorities include reducing traffic congestion and improving transportation, lowering taxes and reducing government waste, providing recreation and after-school programs for youth, and improving race relations. The lowest priority is making health care more affordable and accessible.*

SERIOUSNESS OF DIFFERENT PROBLEMS

Statement	% Serious	% Not Serious	Score	% Net Serious
Crime, gangs and drugs	87%	11%	1.75	76%
Traffic congestion	78%	21%	2.11	57%
Poor air quality	74%	26%	2.21	48%
Overcrowded public schools	67%	20%	2.21	47%
Racial tensions	70%	27%	2.36	43%
Rapid rate of growth in county	64%	34%	2.54	30%
Quality of public education	59%	31%	2.55	28%
Availability of good jobs	57%	34%	2.63	23%
High taxes	58%	39%	2.69	19%
Ensuring access to quality health care	52%	41%	2.87	9%
Protecting open space	50%	45%	2.96	5%

NOTE:
The "Very Serious/Not A Problem" and "Somewhat Serious/Not Too Serious" categories have been collapsed into the "% Serious/Not Serious" categories, respectively. Scores are calculated on a 1 to 5 scale, with 1indicating a **very serious problem** and **5** indicating no problem Scores under 3.00 represent a serious rating, while those over 3.00 represent not serious. Net serious percentages are calculated before rounding.

☞ *When asked to rate the seriousness of problems, there is a parallel between the issue rankings and the seriousness of the problem. Most serious was crime, gangs and drugs, followed by traffic congestion, poor air quality and overcrowded public schools.*

☞ *Somewhat less serious, although still serious, were racial tensions, the rapid rate of growth, the quality of public education, high taxes, and the availability of good jobs.*

☞*Least serious were ensuring access to quality health care and protecting open space, which nearly half said was not a serious problem.*

KEY CROSS-TABULATED FINDINGS

Crime, gangs and drugs is a higher priority for those with less education, and for women under 40 and men 65 and older, and those in Districts 2 and 4. Although these are seen as serious problems to all voters, they are especially problematic for long-term residents, in District 5, and among Latino voters.

Women in general, as well as men under 40, tend to be more focused on **improving the public schools** than other voters. District 3 voters, as well as those with at least some college education, are most likely to point to the need to improve schools. As a serious problem **school overcrowding** is especially important to women under 40, those with children, Latinos, residents of the incorporated areas, and District 3 and 5 voters, with those in District 4 saying it is not much of a problem. **Educational quality** is more of an issue for voters under 50, long-term residents, District 5 voters, renters, and those with children, although newer residents say it is not a problem at all.

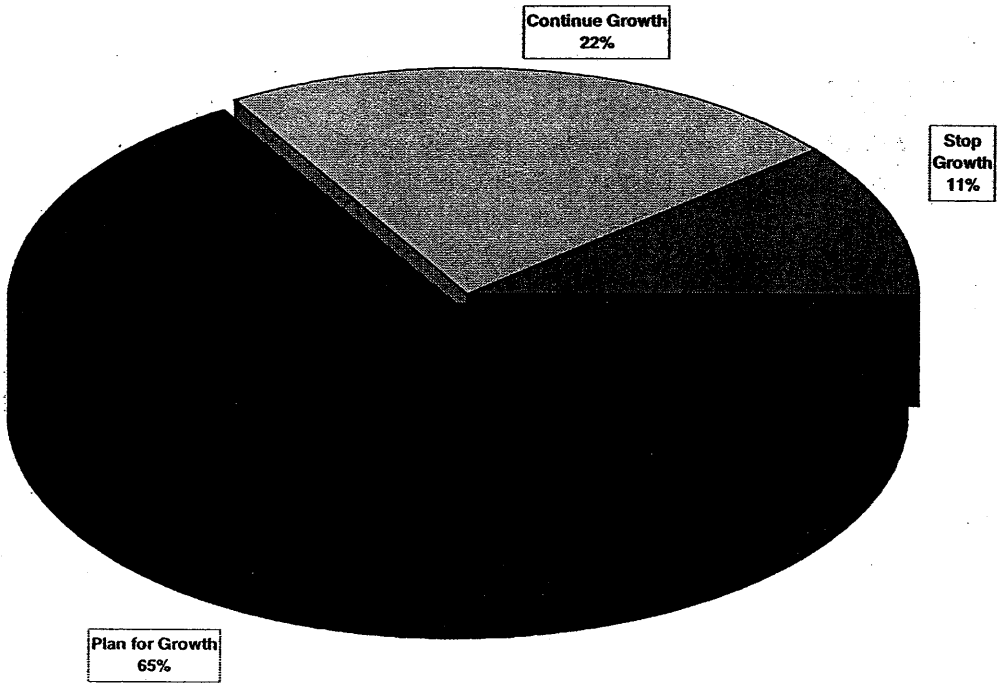
Creating new jobs is a special concern for men under 40, voters in District 5, those with long commutes, and African-American and Latino voters. **Job availability** is most likely to be cited as a serious problem by men 40-64, District 3 and 5 voters, divorced respondents, those with less education, and African American and Latino respondents.

KEY CROSS-TABULATED FINDINGS (cont.)
For women 40-64 and newcomers, as well as non-commuters, controlling growth is unusually important. Only white/Anglo voters care about **controlled residential growth**. The **growth rate** is seen as a more serious problem by women, and men 40-64, District 2 voters, renters, and white/Anglo voters.
Traffic congestion is more of a concern to men than women, with voters in Districts 2 and 5 most likely to see traffic as an issue. Of course, the longer the commute, the greater the concern about traffic. Minorities are especially troubled by traffic congestion. Despite the higher ranking of **traffic congestion** by men, women under 65 are more likely to say it is a serious problem, as are newer voters, and those in Districts 1, 2 and 5, and those with the most education.
Improved recreational opportunities for youth is most important to women under 65, Democratic voters, those in District 5, renters, those with children, divorced voters, and African-American and Latino voters.
Newcomers are the only voters unusually focused on **improved race relations.** As a problem, **racial tensions** are more serious to women than men, to voters 40-64, Democrats, longer-term residents, District 2 and 5 voters, and African-Americans.
High taxes are not much of an issue compared to other issues, but for independent women voters, District 1 and 3 voters, African-American and Latino voters, and those with less education, it is more of a problem. Those who are very highly educated do not see high taxes as a problem at all.
The longer someone has lived in Riverside County, the more serious they say is the **air quality** problem. District 5 voters, Latinos, and to a lesser extent, those in District 2, say it is a serious problem.

KEY CROSS-TABULATED FINDINGS (cont.)
Seniors and Asian-Americans do not say **that access to health care** is a problem at all, nor do newer residents or those in District 4. Health care access is more of a problem in District 5, to African-Americans and Latinos, and among renters and those with children.
Protecting open space is seen as a serious problem by women, but not by men, and by voters over 40, but not younger voters. Republicans say it is not a problem, while other voters see it as a problem. Districts 2 and 5 see the issue as serious, while those in Districts 1 and 4 do not. Minorities do not see the issue as serious; white/Anglos do.

TRAFFIC AND GROWTH

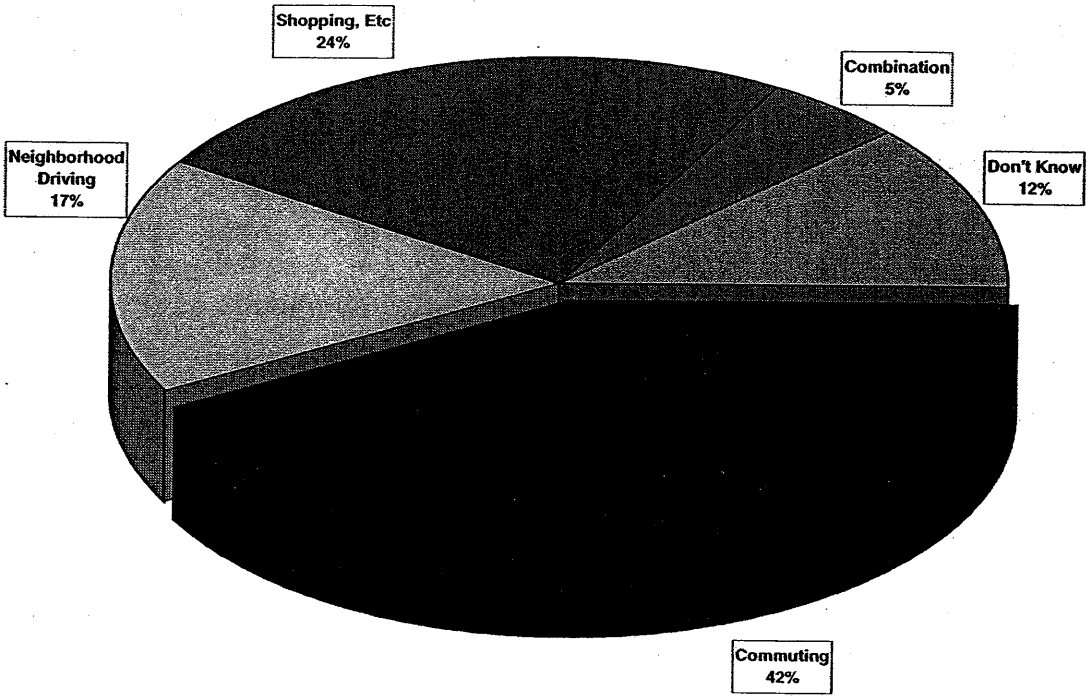
ATTITUDES TOWARD GROWTH IN RIVERSIDE



Key Findings:

☞ *There is a clear sense of a need for planned growth in Riverside County. Although twice as many voters would say that rapid growth should continue as say growth should be stopped, two-thirds want planned growth for the future.*

WORST TYPE OF TRAFFIC CONGESTION



☞ *Traffic concerns revolve largely around commuting, although some are concerned about traffic driving to shopping centers and recreational areas in Riverside County. Fewer people are concerned about increased traffic around their neighborhoods.*

KEY CROSS-TABULATED FINDINGS

Men are more aggressively pro-growth than are women, with men 40-64 more moderate than the oldest and youngest voters. Voters in District 1 and those with the least education, as well as African-American and Latino voters, are a little more likely to be pro-growth, but on balance, there is a consensus that planning is needed.

KEY CROSS-TABULATED FINDINGS (cont.)
There are some differences in terms of traffic concerns, with men under 65 and women 40-64, District 2 and 5 voters, those with children, and voters with long commutes focused on commuter traffic. Older voters and those living in unincorporated areas tend to focus more on traffic in shopping and recreation areas, while District 4 voters are the most likely to identify driving in the neighborhoods as a problem.

RATING RIVERSIDE COUNTY

RATINGS OF RIVERSIDE LEADERS AND ORGANIZATIONS

Leader/Organization	Excellent	Good	Fair	Poor
Riverside County Business Community	3%	40%	31%	8%
Your Local School District	7%	36%	29%	17%
Your local Congressional Representative in DC	6%	34%	30%	18%
Federal Agencies such as Fish and Wildlife, EPA	4%	36%	31%	17%
Your Local City Council	4%	32%	30%	21%
Your Representative in the State Legislature	3%	32%	32%	13%
Local Environmental Organizations	3%	31%	32%	19%
Riverside County Board of Supervisors	2%	28%	38%	12%
Riverside County Transportation Commission	3%	24%	35%	20%

NOTE:
Leaders and organizations ranked by collapsed score of "Excellent" plus "Good".

Key Findings:

☞ *None of the groups and leaders tested are rated as doing an excellent job, although some are rated as doing better than others. Only the Riverside County Business Community is rated as doing a good to fair job. Most are rated as doing a fair to good job, including local school districts, congressional representatives, city councils, federal agencies, state legislators, the Board of Supervisors and local environmental agencies. The Riverside County Transportation Commission is seen as doing only a fair job.*

RATING QUALITY OF LIFE IN RIVERSIDE

Organization	Excellent	Good	Fair	Poor
Fire protection	22%	60%	11%	3%
Retail shopping facilities	15%	55%	22%	7%
Overall quality of life	13%	57%	26%	3%
Emergency medical care	16%	53%	17%	6%
Police and sheriff protection	14%	48%	25%	13%
Public libraries	9%	49%	26%	10%
Parks and recreational opportunities	9%	48%	29%	10%
Overall county services	3%	50%	35%	7%
Freeway Maintenance	7%	47%	27%	18%
Protection of open space and wilderness	7%	42%	31%	13%
Entertainment and cultural opportunities	10%	38%	33%	17%
Public schools	8%	36%	30%	16%
Public transit	4%	31%	30%	19%
Job opportunities	5%	29%	34%	20%
Road Maintenance	4%	30%	35%	30%
Planning for growth	4%	29%	37%	21%
Activities and opportunities for youth	5%	26%	36%	23%
Air Quality	4%	25%	31%	39%
Access to child care	2%	23%	23%	13%

NOTE:
Organizations ranked by collapsed score of "Excellent" plus "Good".

☞ *The services and amenities which contribute to the quality of life in Riverside County fare better than the political groups and leaders when voters are asked to evaluate them. Fire protection services are ranked as good to excellent. Solidly good services include emergency medical care, retail shopping facilities, overall county services and the overall quality of life.*

☞ *Ranked as good to fair are police and sheriff protection, parks and recreational opportunities, public libraries, freeway maintenance and protection of open space and wilderness.*

☞ *Other services and amenities ranked as only fair to good include the public schools, entertainment and cultural opportunities, job opportunities, public transit and access to child care.*

☞ *At the bottom of the list, ranked as only fair, are planning for growth and road maintenance, with air quality ranked as fair to poor.*

KEY CROSS-TABULATED FINDINGS

There is some partisanship to criticism of **the Board of Supervisors**, with Democrats and independents more critical than Republicans. In general, long-term residents are more familiar with the Board of Supervisors, with fully half of the new arrivals unable to rate the Board. Long-term residents are also more critical of their **city councils**, while District 4 voters are most satisfied with them. Interestingly most of those living in an unincorporated area are able to rate "their" local city council. District 1 voters and African-Americans are the most critical of the **County Transportation Commission**, but there is no consistent relationship based on length of commute.

KEY CROSS-TABULATED FINDINGS (cont.)
Men tend to rate the **business community** more favorably than do women. Voters in Districts 3 and 4 and in the unincorporated areas are less able to provide a rating than are voters in other areas.
Voters 50 and older are less able to rate the **school district** than are younger voters, and newcomers are largely unfamiliar with the schools. Those in District 5 provide the most critical ratings, while those in Districts 2 and 3 are least critical of the schools. African-Americans are more critical of the school district than are other voters.
For the two main Congressional Districts, District 44 voters are more satisfied than are those in District 43. They are also more likely to be able to evaluate **their member of Congress**.
Voters in Senate District 37 are most familiar with their State Senator, and provide the most favorable ratings. Differences across **the state legislative districts**, however, are not significant.
Voters in District 4, those with children, and those with more education are most likely to have a good rating **of local environmental organizations**; those in District 3 and with less education are most critical.
Voters 50 and older, as well as those with the most education, are much less able to **rate activities and opportunities** for youth than are younger voters. Newcomers are also less able to provide ratings. Those in District 3 are much more critical of the limited opportunities than are voters in the other areas. Voters in the incorporated areas are more likely to say opportunities are good than are voters in the unincorporated areas. African-Americans are very critical of opportunities for youth.

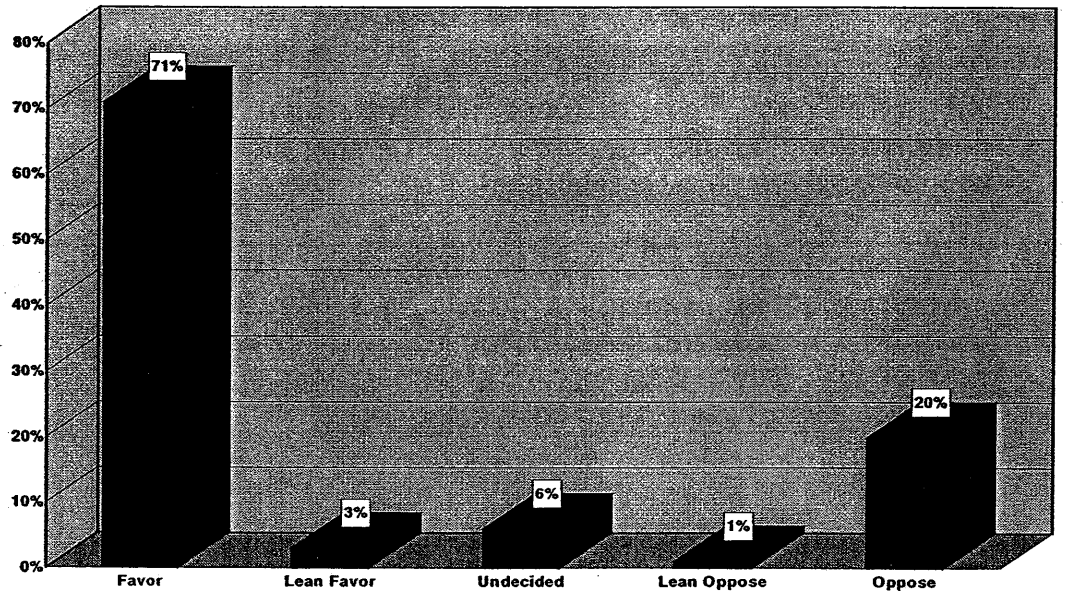
KEY CROSS-TABULATED FINDINGS (cont.)
Job opportunities are seen as more problematic among voters under 30 than older voters. Those 65 and older, as well as new residents of the county, are often unable to provide a rating. Voters in Districts 3 and 4 are less able to rate job opportunities, while those in District 2 are most likely to praise local job opportunities. African-Americans say job opportunities are poor.
Senior citizens are most likely to rate **police and sheriff services** as good or excellent, with voters in District 4 especially likely to say they are good. District 5 voters were least content with police and sheriff services. City residents were more likely to praise police services than were those from unincorporated areas. African-Americans were very critical of police and sheriff protection. **Fire protection** was rated well everywhere, with those in Districts 4 and 5 especially likely to provide good ratings. **Emergency medical care** is especially highly rated among voters 65 and older.
Men rate **parks and recreational opportunities** more favorably than do women. Those under 50 are a little more critical than those 50 and older, although on balance, all see them as good. District 4 voters praise the opportunities the most, and those in the unincorporated areas are less likely to provide high ratings than are city residents. The lower the level of education, the lower the rating of parks and recreational opportunities. Again, African-Americans are most critical.
Younger respondents and those with children under 18 are a little more critical of the **schools** than are voters 50 and older and those without children under 18. Nearly half the newcomers are unable to rate the schools. Schools in District 5 are rated lower than the schools in other areas. Asian and Latino respondents rate schools the best, African-Americans the poorest.

KEY CROSS-TABULATED FINDINGS (cont.)
District 4 voters rate **public transit, road maintenance** and **freeway maintenance** better than do voters in the other areas of the district; those in unincorporated areas are most critical of road maintenance. Voters with long commutes are most likely to rate freeway maintenance as poor. In District 1, public transit is rated worse than in other areas. African-Americans provide the lowest evaluation of public transit.
Overall county services are rated highest in District 2, and lowest in District 1. In the incorporated areas, ratings of county services are higher than for the unincorporated areas. County services are least well-rated by African-Americans. For overall **quality of life,** seniors provide the highest ratings, as do newer residents, District 4 voters, and white/Anglo voters.
Seniors are the least likely to say **air quality** is poor; younger voters are most likely to be critical of air quality. District 4 voters do not have a problem with air quality, while those in District 5 say it is poor.
Newcomers to the area are especially pleased with **shopping facilities,** and in general, older voters are more satisfied than are younger voters. District 4 voters are most satisfied. African-Americans are least satisfied with retail shopping facilities.
Public libraries are rated best in District 4, and worse in Districts 1 and 5. Those with children tend to rate them better than those without. Highly educated respondents provided the most favorable ratings of the libraries.
Men rate **entertainment and cultural opportunities** more favorably than do women, with men 65 and older the most favorable. District 4 voters rate them best, while District 5 voters rate them the poorest. Those without children provide more favorable ratings than do those with children. African-Americans are least content.

KEY CROSS-TABULATED FINDINGS (cont.)
Older voters know little about **access to child care**, as do long-term residents.
Older voters are also a little more likely to say the county has done only fair or poor job with **open space preservation** than are younger voters. Democrats are also less satisfied than are Republicans.
Longer-term residents, as well as middle-aged voters, are the most critical of planning for growth. Voters in District 4 generally are satisfied, while those in District 5 are least satisfied with growth planning. Voters in the unincorporated areas are less satisfied than those in the cities.

THE PLANNING PROCESS

POSITION ON PLANNING PROCESS



Key Findings

☞ *There is overwhelming support for Riverside County undertaking a comprehensive master planning process.*

☞ *Voters who favor the planning process indicate:*
- ➨ A plan is needed to deal with growth
- ➨ It is needed for the future
- ➨ It is a good idea
- ➨ Open space needs to be preserved
- ➨ It is good that the community is involved in the decision

☞ *Voters who oppose the planning process say:*
- ➨ It will raise taxes
- ➨ There are more important issues
- ➨ The environmentalists have gone too far
- ➨ It is redundant
- ➨ A new bureaucracy will be created
- ➨ Too many restrictions already
- ➨ It will cost too much

AGREEMENT STATEMENTS

Statement	% Agree	% Disagree	Score	% Net Agree
Riverside needs a long-range plan	93%	5%	1.47	88%
The time is now to plan for the county's future	92%	6%	1.44	86%
With planning, we avoid problems of LA and Orange Co.	90%	7%	1.53	83%
We need other forms of transportation besides freeways	85%	12%	1.69	73%
Too often decisions made without consulting public	76%	18%	1.97	58%
It is worth spending millions for a long-range plan	66%	31%	2.55	35%
We already have a plan and don't need any more	51%	42%	2.81	9%

NOTE:
The "Strongly Agree/Disagree" and "Somewhat Agree/Disagree" categories have been collapsed into the "% Agree/% Disagree" categories, respectively. Agreement scores are calculated on a 1 to 5 scale, with **1** indicating the **most agreement** and **5** indicating the **least agreement**. Scores under 3.00 represent agreement, while those over 3.00 represent disagreement (*italic red type*). Net agree percentages are calculated before rounding.

☞*There is a consensus that Riverside needs a long range plan, and that time to plan for the future is now. Voters agree that with planning, the problems of Los Angeles and Orange Counties can be avoided. Even when the price tag of planning is noted, two-thirds say it is worth spending millions of dollars to plan for the future. Despite this general support for planning, the voters say there is no need for expensive planning programs to tell Riverside residents what they already know.*

KEY CROSS-TABULATED FINDINGS
Voters in all groups are very supportive of the planning process in Riverside County, although Republicans are less enthusiastic than others. Support is greatest in District 4, and least in Districts 2 and 3. People with children are more in favor than those without, and city residents are more enthusiastic than are those in the unincorporated areas. The higher the level of education, the higher the support for the planning process.
Democrats, more than Republicans, are more enthusiastic about spending the money for long-range planning, as are new arrivals, and voters in District 3, renters, and those in the unincorporated areas.
Women and District 4 voters are especially likely to say that the problems of LA and Orange Counties can be avoided by better planning. Young women and new arrivals, more than others, say the time to start the planning process is now.
Republicans and District 3 and 5 voters, as well as African-Americans and those with the least education, are most likely to say that expensive planning programs are not needed.

GENERAL ATTITUDES

Key Findings:

☞*Taking the pulse of the public is a worthwhile exercise. Voters agree that too often decisions in Riverside County are made without consulting the public.*

KEY CROSS-TABULATED FINDINGS

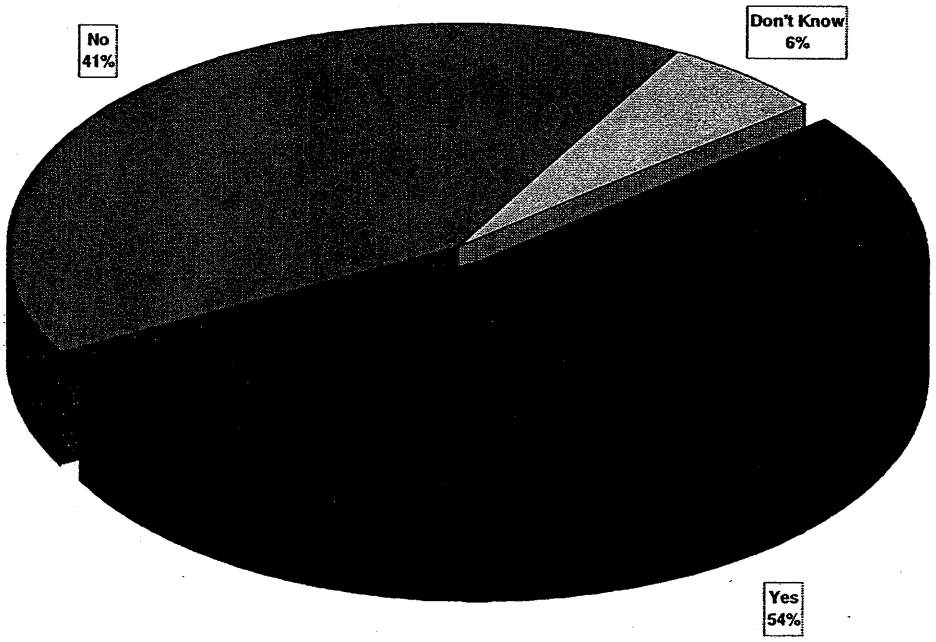
Long-term residents, those in Districts 2 and 5, African-Americans and Latinos are especially likely to say decisions have been made without consultation.

TRANSPORTATION ISSUES

Key Findings:

☞*Given the concern with traffic congestion, it is not surprising that voters strongly agree that new forms of transportation are needed to improve mobility in Riverside County.*

POSITION ON HALF PERCENT SALES TAX FOR TRANSPORTATION

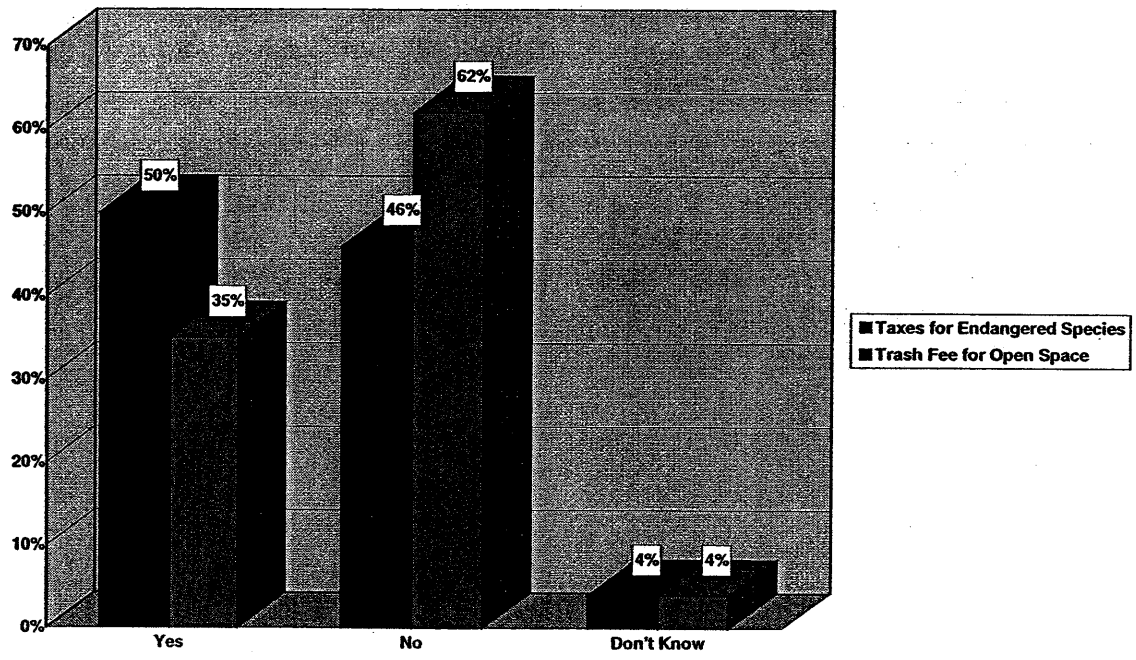


☞*Riverside's voters indicate they would support extending the special half-cent sales tax for transportation in all counties for another twenty years.*

KEY CROSS-TABULATED FINDINGS
Men 40-64 are most enthusiastic about new freeways, as are those with the longest commutes and Latino and African-American voters.
Voters 65 and older are least enthusiastic about extending the sales tax for transportation, and Republicans are opposed. Voters in District 5 are also not in favor of extending the sales tax, while those in District 4 wholeheartedly support it. Those with long commutes are among the most supportive.

ENVIRONMENTAL ISSUES

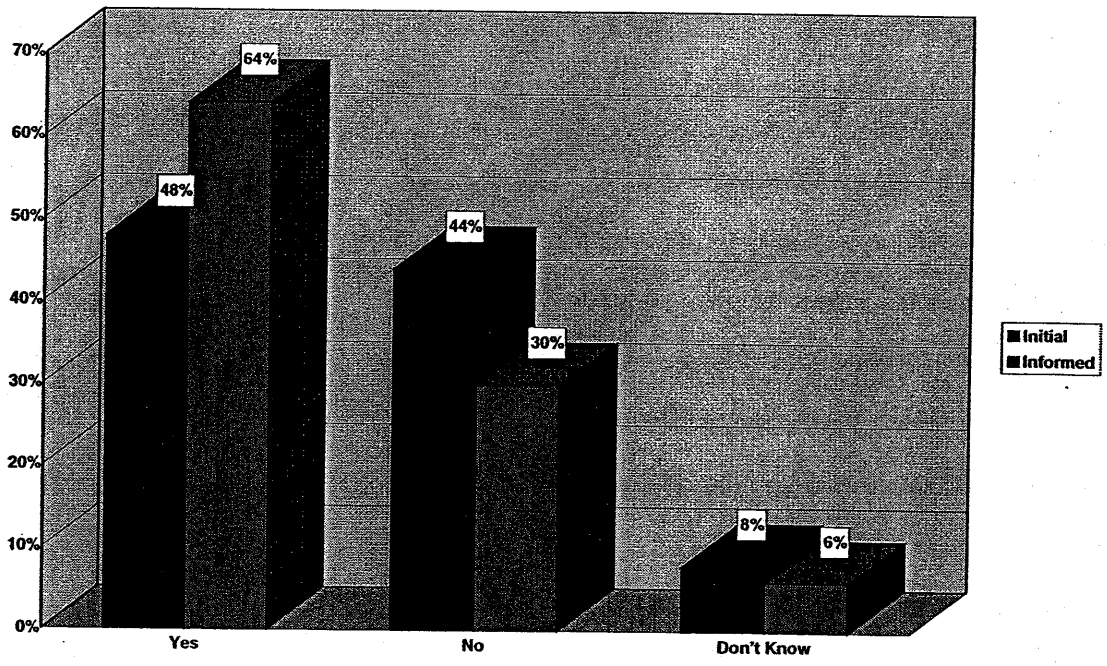
WILLINGNESS TO PAY FOR WILDLIFE AND OPEN SPACE



Key Findings:

☞Given that voters do not find protecting open space to be a serious problem, it comes as no surprise that voters are closely divided on whether to spend tax money to acquire open space in Riverside County. By nearly a two-to-one margin, voters would not be willing to pay higher fees for trash collection to finance acquisition of open space. On balance, they disagree with the idea that they would pay slightly higher taxes to limit residential growth.

WILLINGNESS TO PAY MORE TAXES–INITIAL VERSUS INFORMED



☞*Support for open space acquisition increases substantially when voters are told that it would enhance property values and provide permanent protection and recreational opportunities.*

AGREEMENT STATEMENTS

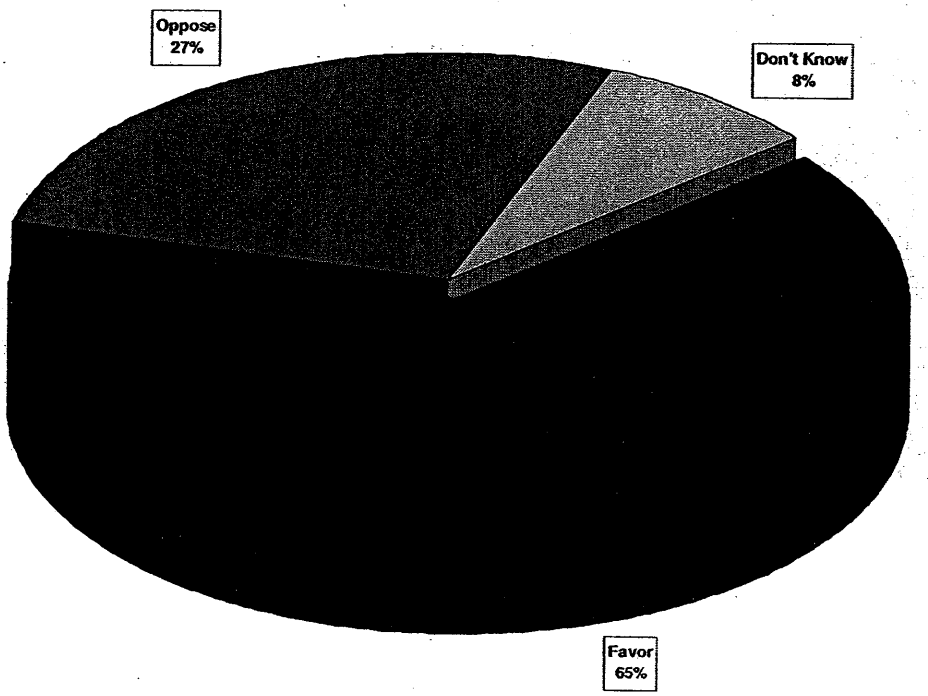
Statement	% Agree	% Disagree	Score	% Net Agree
Planning and protecting open space only way to avoid LA's fate	83%	16%	1.87	67%
Everybody benefits from habitat and open space protection	75%	23%	2.21	52%
Obtaining fair market value is no violation of private owners' rights	72%	21%	2.21	52%
Open space protection plan will maintain air and water quality	72%	21%	2.24	51%
Protect habitats only if compensate private owners immediately	73%	23%	2.15	50%
We need to preserve sensitive areas so as not to lose them forever	72%	23%	2.22	49%
Protecting habitats will enhance property values	68%	26%	2.41	42%
Govt. should protect nature even at expense of property rights	50%	45%	3.00	5%
I would pay slightly higher taxes to limit residential growth	*45%*	*53%*	*3.23*	*-8%*
Without govt. programs, private owners will protect open space	*35%*	*59%*	*3.50*	*-24%*

NOTE:
The "Strongly Agree/Disagree" and "Somewhat Agree/Disagree" categories have been collapsed into the "% Agree/% Disagree" categories, respectively. Agreement scores are calculated on a 1 to 5 scale, with **1** indicating the **most agreement** and **5** indicating the **least agreement**. Scores under 3.00 represent agreement, while those over 3.00 represent disagreement (*italic red type*). Net agree percentages are calculated before rounding.

☞*Voters tend to offer general support for open space that is not matched by a willingness to pay for it. They strongly agree that planning and protecting open space is the only way to avoid the same fate as Los Angeles, and that everyone benefits from the protection of open space and habitat protection. They also agree that protecting habitats will enhance property values, that open space protection will maintain air and water quality, and that sensitive areas need to be preserved so they are not lost forever.*

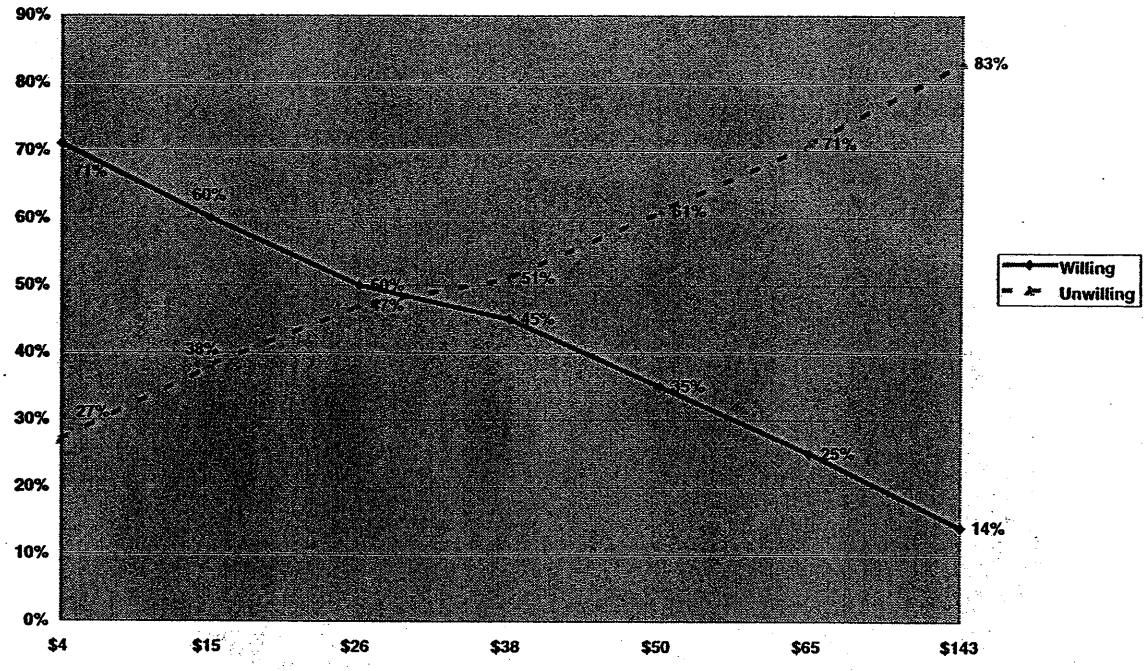
☞*As is the case for open space, voters are closely divided on their willingness to spend tax money to protect endangered species.*

POSITION ON MULTIPLE SPECIES HABITAT CONSERVATION PLAN



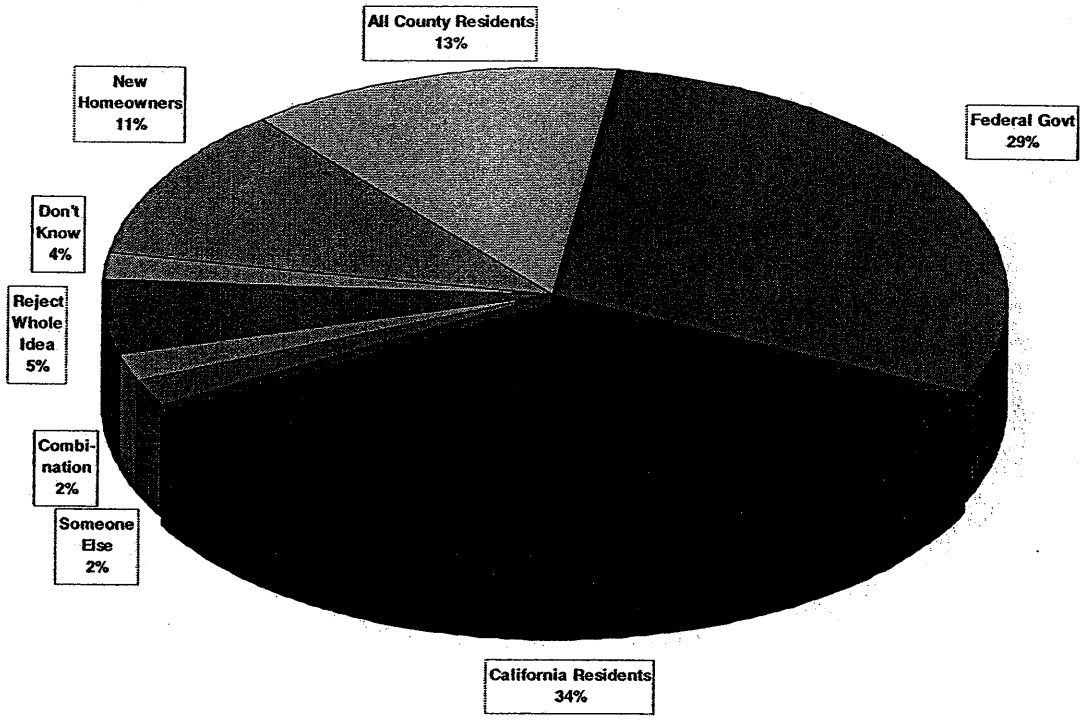
☞*By more than a two-to-one margin, voters favor the Multiple Species Habitat Conservation Plan when they are told what it is. However, voters are only committed to saving more popular species, such as mammals or birds, with majorities supporting spending tax dollars to protect big horn sheep and birds such as the Least Bells Vireo, but not the Coastal Sage or the Quino Checkered Spot Butterfly.*

AMOUNT WILLING OR UNWILLING TO PAY FOR PRESERVATION



☞ *There are strict limits on how much the voters are willing to pay to purchase open space to protect endangered species. Support falls off dramatically at amounts over $25 per year, with only about one-third of the voters willing to pay $50 more per year to purchase additional open space.*

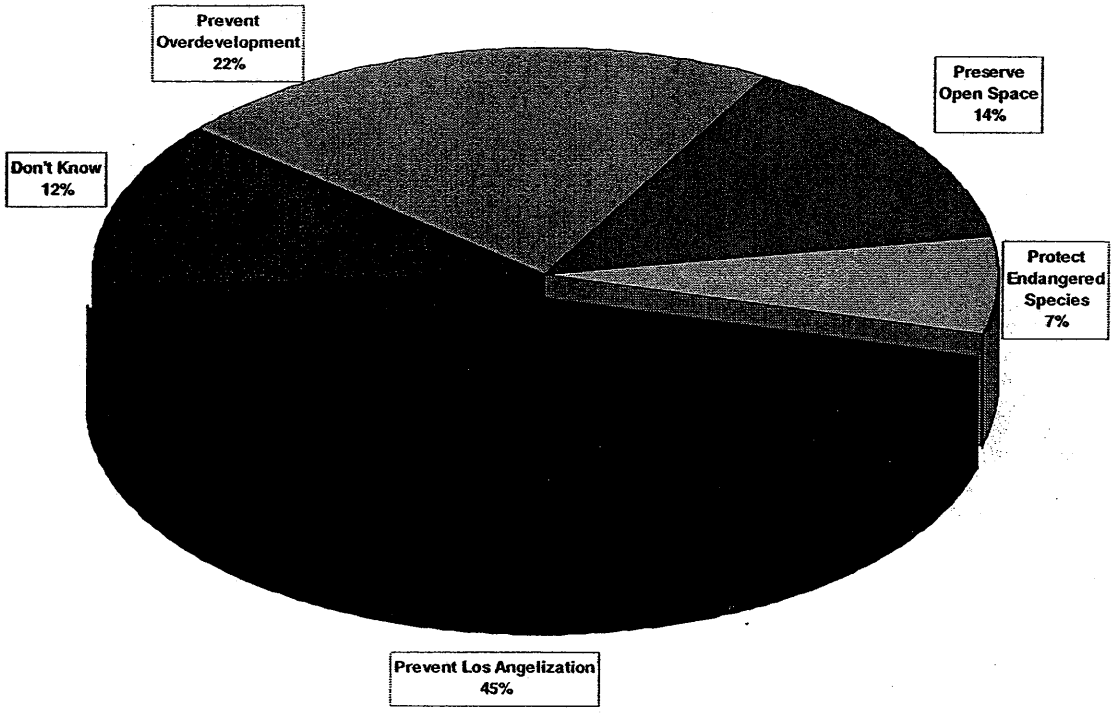
POSITION ON WHO SHOULD PAY TO PROTECT ENDANGERED SPECIES



☞*Not surprisingly, voters say that the federal government or all Californians, not new homeowners or Riverside County residents, should pay the cost of protecting species endangered by new developments.*

☞*Voters are sensitive to the implications of acquiring open space. While they agree that paying fair market value for private property is not a violation of property owners' rights, they insist that habitats can be protected only if private land owners are immediately compensated. They also are fairly certain that private owners would not protect endangered species without a publicly financed protection plan. However, they are divided on the question of whether government should protect natural habitat if it means restricting property rights.*

HOW BEST TO SPEND TAX DOLLARS



☞*The vocabulary that makes voters most willing to spend tax dollars is not to preserve open space or protect endangered species and plants, but to prevent Riverside County from becoming another Los Angeles.*

KEY CROSS-TABULATED FINDINGS

Men are willing, but women are unwilling, to spend tax money on open space acquisition. Most supportive are men under 40. There is also a partisan split, with Republicans opposed and Democrats in favor of land acquisition. New arrivals are supportive, while long-term residents are divided. Opposition is especially strong among District 5 voters and African-Americans. These profiles shift when voters are told that property values will be enhanced through open space acquisition, although Republicans are still less willing than others to finance open space purchases.

KEY CROSS-TABULATED FINDINGS (cont.)
Spending tax money to protect open space appeals to women and men under 40, but not to voters 65 and older. Republicans are largely opposed, while independents and others are for it. There is also a split based on length of residence in Riverside County, with newcomers in favor and long-term residents opposed. District 4 and 1 voters are in favor, those in Districts 2 and 5 are opposed. Renters are strongly in favor, while home owners are closely divided. African-Americans are opposed, white/Anglos are divided, and Latinos are in favor of the expenditures. The findings are generally consistent in terms of support for the Multiple Species Habitat Conservation Plan, with women, younger voters, Democrats, new voters, renters, those with children, and white/Anglos most in favor of the plan.
No one wants to pay higher trash fees except men under 40 and renters (who rarely pay the fee), with strong opposition among Republicans, voters 50 and older, and among homeowners and African-Americans.
Support for protecting endangered species and protecting sensitive areas now is greatest among the voters with an "environmental" profile, including voters under 50, Democrats and independents, newer arrivals in Riverside County, District 4 voters, renters, those with children, and residents of the incorporated areas. The gap between those with an environmental profile and the others is greatest with respect to the Coastal Sage.
In general, younger voters are more willing to pay additional taxes for open space than are those 50 and older, Democrats and independents more than Republicans, renters more than owners, those with children more than those without, city more than unincorporated area residents and newer residents more than long-term residents. District 4 voters are most willing, while District 5 voters are least willing. African-Americans are among those least willing to pay higher taxes for open space. These patterns hold whether the voters, overall, are willing to pay (under $25) or whether they are overall unwilling.

KEY CROSS-TABULATED FINDINGS (cont.)
The responsibility of government to protect open space is more supported by younger women, new arrivals, Democrats and independents, voters in Districts 2 and 4, renters, those with children, city residents, and Latinos and African-Americans. Most of these same voters are most in agreement that open space enhances the quality of life and that property values and water quality are enhanced by protecting open space and species habitats.
Older voters and Republicans, as well as voters in District 5 and long-term residents, owners and those without children, feel particularly strongly about the need to compensate owners for any protected open space. These voters, as well as minority voters, are least willing to pay slightly higher taxes to limit growth.

ANALYSIS

A. Voters Are Cautious About the Future

While things are generally seen as going well at present, voters hint at a cautious optimism about the future:

✔At the present time, more than two-thirds of the voters say that things in Riverside County are on the right track.

✔Despite the indications that things are moving in the right direction, most voters do not say that the quality of life will be better in the future, and one-third think things will get worse.

B. Planning for Growth is Essential

As is the case in most of California, voters in Riverside County are concerned about growth. Often there is a conflict between an ideology of free enterprise, limited government, and the desire for limits and controls on growth:

✔ In response to an open-ended question on the most important issue facing Riverside, a significant percentage mention growth and growth-related issues.

✔Controlling residential growth and preserving open space are ranked higher than lower taxes or reducing traffic as issues for the county's elected officials to address.

✔While voters do not want to stop growth, they also do not want unbridled growth. Voters seek better planning for growth.

✔Despite this concern with growth, voters are not willing to pay higher taxes to limit growth.

C. Riverside's Leadership is Rated Moderately

When asked to evaluate civic leadership, none of the groups or individuals tested are rated as doing an excellent job, and none are rated as performing poorly:

✔The private sector is rated slightly more highly than public agencies or government leaders.

✔The Riverside County Board of Supervisors is rated as doing a fair to good job, about average in comparison to other groups tested.

D. Riverside's Quality of Life

There is a general sense that the quality of life in Riverside County is good, although there are a few areas where there could be improvements:

✔ Most government services in Riverside are considered to be good, with the basics such as fire, police and sheriff services, and emergency medical care generally well-regarded.

✔Public facilities and amenities, such as parks and libraries, as well as private amenities, such as shopping, are generally considered good in the county, but there are concerns about the schools and cultural opportunities.

✔Air quality remains a problem in most of the county, outside the desert area, and one of the most fundamental issues in the quality of life—crime—remains an issue.

E. There is Strong Support for the Planning Process

In a number of different ways, voters were asked about their level of support for the planning process, and in virtually every case they enthusiastically endorsed more planning. This is consistent with their views concerning better-planned growth in Riverside County, and a recognition that the best way to avoid the problems of neighboring counties is to plan for the future:

✔There is broad and wide support for the overall master planning process.

✔There is a sense that planning for the future should not be delayed.

✔Even when told of the substantial cost of the process, voters are supportive of it, although they have to be reassured that the new planning process is not redundant.

F. Transportation Remains a Complex Issue

Riverside County depends on a good transportation system, but there is no clear consensus on what makes the system good:

✔Traffic problems are generally not seen as neighborhood problems, but involve either commuting to work or to recreation and leisure destinations. Because travel patterns are so varied, different constituents have different transportation priorities.

✔Despite a constant criticism of traffic, it ranks well below other issues as the top priority which the voters want Riverside County's elected officials to address. Nonetheless, it is seen as a very to somewhat serious problem.

✔Although many voters are unable to rate public transit in the county, it is rated more favorably than road maintenance. There is a strong consensus that other forms of transportation besides freeways are needed.

✔Although voters rarely like to tax themselves, there is majority support for extending the sales tax to fund local highway and public transportation projects.

G. Voters Seek Low-Cost Environmental Protections

There is a clear consensus that preservation of Riverside's open spaces and natural environment is important. However, voters are not necessarily willing to pay for the environmental protections they seek. There are other inconsistencies in their environmental orientation, especially when environmental values come into conflict with other values:

✔Voters are closely divided on whether or not to spend tax money to acquire open space in Riverside County, and are similarly divided on whether to spend money to protect endangered species. There is a clear hierarchy of what species to protect, with mammals and birds ahead of insects, trees and plants.

✔When environmental protections are tied to tax and fee increases, voters become very cautious, unwilling to pay higher trash collection fees, and capping their tax increases at about $25 per year. They would prefer to spread the cost of environmental protections around, hoping that "others" such as the federal or state government, will pay for environmental protection.

✔One reason they may not be enthusiastic in their desire to spend money is that they do not necessarily see the need to protect open space as an especially serious problem.

✔If environmental values conflict with other values, support for environmental protections declines. While voters do not trust private property owners to exercise good stewardship over the land, they do believe their private property rights should be strongly protected, and that owners should be compensated when their land is used for open space or habitat protection.

✔Voters are much more responsive to the need to pay to acquire open space when they are told of the quality of life and economic benefits and value of open space acquisition.

✔There is strong support for the Multiple Species Habitat Conservation Plan when it is explained to the voters. Even with the explanation, however, voters are reluctant to spend significant amounts of money and would prefer that 'someone else' pay for it.

VOTER PROFILES

Although there is some variation, depending on the questions asked, the following tables describe a general profile of the voters who are more concerned or less concerned about environmental issues as evidenced by responses on open space acquisition and the planning process. Groups not listed either vary or fall in between these extremes.

VOTER GROUPS LEAST CONCERNED ABOUT ENVIRONMENTAL PROTECTION	*VOTER GROUPS MOST CONCERNED ABOUT ENVIRONMENTAL PROTECTION*
Women 65 and older	Women under 65
Men 40 and older	Men under 40
Republicans	Democrats and independents
Districts 3 and 5	District 4
10 years or more in Riverside	5 years or less in Riverside
Home owners	Renters
Children under 18	Have children under 18
Middle income	Very low or very high income
African-American	Not African-American or Asian-American
Unincorporated area	Incorporated area
Not employed	Employed

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

There are three key findings in our research. First, our data indicate that **voters are relatively satisfied with the quality of life in Riverside County.** On virtually all dimensions of the quality of life, Riverside is given a good to fair rating, indicating that the voters are fundamentally satisfied with living in the County. While there certainly is room for improvement, there is no indication of broad dissatisfaction which requires short-term attention. Some of the areas most in need of attention, such as air quality and public education, are out of the hands of the Board of Supervisors. Others, such as growth and transportation, are being addressed through the planning process.

The second broad finding is that **Riverside County is supportive of a long-range planning process.** Although voters are always reluctant to spend tax dollars, they feel that the long range planning process is a worthwhile investment. Nonetheless, our data do suggest that the voters will have to be reassured that the long-range planning process does not duplicate other efforts. The focus of planning, for most voters, is on planning for residential growth. Aside from crime, voters tend to see increased population and overcrowding and the traffic that comes with it as the most potent threat to their quality of life.

Third, **Riverside voters have environmental concerns.** Through virtually every indicator, voters describe themselves as "environmentalists". They are willing to set aside open space, and they are willing to protect endangered species. Our data show that there is, however, a tension between the desire of the voters to do

what is best for the environment and the limited willingness of the voters to pay the cost of environmental protection. In addition, the voters are very protective of property rights. For any environmental initiatives to succeed, there have to be assurances that property rights are protected.

In addition to the observations and recommendations made earlier in this report, the following are our key observations:

◆ **VOTERS PUT ASIDE THE EVERYDAY PROBLEMS TO EVALUATE RIVERSIDE COUNTY:** Voters are least content with the quality of life problems they confront every day—crime, air quality, and traffic. They appear to put these aside because they like living in Riverside County because of other elements of the quality of life. As the planning process moves forward with those elements which enhance some elements of the quality of life, such as open spaces, recreational opportunities and cultural amenities, it is important not to lose sight of the genuine concerns voters do have as they confront traffic or crime or poor schools. If voters are worried about someone breaking into their home because there are not enough police, spending tax dollars to protect big horn sheep seems like a luxury.

◆ **MAINSTREAM THE PLANNING TEAM:** Voters have to understand that the planning process is not driven by environmental extremists or a government mandate but by mainstream planners, business people, government officials and ordinary citizens who are looking out for the future generations of Riverside residents. For ordinary voters to buy into the process, they have to understand that this is not a "special interest" tool, but a process in which everyone can participate.

◆ **EMPHASIZE THE DIFFERENCE OF THIS PLANNING PROCESS:** The voters expressed a willingness to spend money on planning for the future. However, they have to know that they are not just getting something they already have, or simply a report which will be buried in a file cabinet or be placed on a shelf somewhere. They have to know that this is a comprehensive environmental plan to enhance the quality of life, not an engineering document or something useful only for developers. Voters have to be reassured that this is not redundant.

◆ **THE ENVIRONMENT IS AN INVESTMENT, NOT AN EXPENDITURE:** Taking strong environmental positions costs money. The data suggest that Riverside County is populated with "lip service environmentalists", voters who are looking for "free" environmental solutions, or solutions which are paid for by someone else. The case has to be made to the voters that environmental improvements cost money, but they are investments in the future (and in enhanced quality of life and property values), not simply expenditures. If the environment is not to take a back seat to other concerns, voters must know the case has to be made how much the future of Riverside depends on long-term environmental planning.

◆ **MAKE ENVIRONMENTAL PROTECTION COMPREHENSIVE:** There are different preferences between men and women, with men disproportionately focused on open space and the recreational use of open space, and women disproportionately focused on protection of endangered species. Each has to know that a comprehensive environmental plan requires both, and that they are not mutually exclusive environmental issues.

◆ **BE ATTENTIVE TO MINORITY CONCERNS:** Minority groups all have different concerns, but our data consistently show that African-Americans feel somewhat disenfranchised within Riverside County, and point to racial tensions far more than do other voters. Consistently, African-Americans rate the County as performing poorly on key dimensions such as jobs, schools, and youth opportunities. They are less satisfied with police and other services. Environmental concerns take a back seat to these more economically based issues. Our data point to a special need for increased outreach to the black community to speak to their concerns.

◆ **RIVERSIDE IS A DIVERSE COUNTY:** Not only is there cultural diversity, but geographic diversity as well. Our data consistently show that Districts 2 and 5, and to a lesser extent, District 3 have different concerns, and lower levels of satisfaction, than voters in District 4. To be accepted county-wide, the planning process must take into account the unique needs of each area.

◆ **EXPLORE THE DIFFERENCES IN ENVIRONMENTAL ATTITUDES ACROSS THE COUNTY:** We have presented data which show a profile of those voters who are more supportive of environmental activism, and those who are less supportive. Additional outreach and explanation to those with lower levels of environmental consciousness may be warranted.

HOW TO READ A TABLE

The tables in the main cross-tabulated tables section contain the results for the total sample (indicated by "ALL RESPONDENTS"), while examining each question on the poll by various demographic variables. The cross-tabulated data in the main cross-tabs should be read across, and compared to the total of "ALL RESPONDENTS" identified across the top of the first page of each table, and to the immediately adjacent rows for the same variable such as sex (compare men and women) or age (compare ages 18-29, 30-39, 40-49, 50-64 and over 65).

Appendix D:
Community Workshops

Riverside County Integrated Plan

A Summary of the First Round of
Community Workshops June/July 1999

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RIVERSIDE COUNTY INTEGRATED PLAN
COMMUNITY MEETINGS

INTRODUCTION

Between June 17 and July 16, 1999, the County of Riverside, with the assistance of technical and community outreach consultant team members, held a series of twelve community meetings designed to find out issues that residents would like to see considered in planning for Riverside County's future.

The community meetings were held between 5:30 and 8:00 p.m. in twelve locations throughout Riverside County:

June 12	Temecula
June 21	Riverside (Raincross)
June 22	Riverside (Jurupa)
June 24	Corona
June 28	Moreno Valley
June 29	Palm Desert
July 1	Beaumont
July 6	Lake Elsinore
July 8	Perris
July 13	Blythe
July 15	Hemet
July 16	Sun City

MEETING PROCESS AND DESIGN

The meetings were designed to engage the public in dialog with County staff and the consultants – and with each other – about issues critical to the success of the Plan and to Riverside County's future in general. The meetings had four distinct parts: an open house, a brief presentation, small group discussions and group summaries.

Open House and Interactive Exercises

During the first hour of the meetings, participants were invited to circulate among exhibits explaining the overall planning process as well as the individual elements: General Plan, Conservation and Habitat, and Transportation. In addition to learning and asking questions about the plan elements, participants were engaged in interactive exercises designed to get the dialog started on current issues and future possibilities for Riverside County. These included: a "postcard home" written from a future time in Riverside County; identifying favorite open space and recreational activities; and the "bests and worst" awards for transportation, among others. During this time, participants were also invited to fill out more detailed surveys at each booth, or to mail them back later in the postage-paid envelopes provided.

Presentation

After the initial workshop period, participants were invited to listen to a brief presentation on the Plan by the Sverdrup Team.

Small Group Discussions and Summary

After the presentation, small group discussions were held to explore specific issues and possibilities under the individual Plan areas (General Plan, Conservation and Habitat, Transportation) in more detail. Using the interactive exercises as a resource, the technical consultants and facilitators took the groups through a series of questions designed to engage participants in discussion of issues facing Riverside County and their community area in particular. MIG assisted in the group facilitation and graphically recorded the group's discussion.

The sessions concluded with a report by the MIG facilitator/recorders on the results of the group discussions and a summary of next steps by the Sverdrup project manager.

MEETING RESULTS – SYNOPSES AND DETAILED REPORTS

The following sections include:

- An overview of common issues
- A review of the correlation between issues raised in the community meetings and issues raised in a separate opinion poll
- A synopsis of issues by community area and Plan area and
- Detailed community meeting reports, including a summary of comments and results of the interactive exercises

NEXT STEPS

The results of these workshops, along with opinion poll and focus group results will be used to develop a draft Vision for the Riverside County Integrated Plan. This draft Vision will be taken out for review and comment to a similar series of workshops to be held throughout Riverside County in September/October, 1999.

Riverside County Integrated Plan
Community Workshop Summary

COMMON THEMES

Appreciation of Open Space
People in all areas appreciate the open space and rural character of many parts of Riverside County and want to preserve it.

Support for Planned Growth
Growth is generally supported but at varied levels around the County, with more concern being expressed in Temecula, Lake Elsinore and Moreno Valley than in other areas. In all areas, people were concerned with the need for planning housing and infrastructure together.

Support for Infill Development
Infill development was supported in several areas – specifically Temecula, Hemet and Riverside. It was seen as a way to preserve open and green space while continuing to grow.

Concern for Jobs and Support for Clean Industry
Jobs are a key social issue with many community areas. Specifically, residents are asking for creation of "clean industry" jobs so that people can pursue opportunities close to home.

Air Quality
Poor air quality was a consistent theme in the workshops. All areas were concerned with general air quality issues and areas with truck-related issues (such as Jurupa and Moreno Valley) were particularly concerned with diesel emissions.

Opportunities for Youth
Participants expressed a need for opportunities for youth, especially in rapidly growing areas with many young families such as Corona, Moreno Valley, Hemet, Jurupa and Perris. Some were also concerned that lack of opportunity would exacerbate problems with crime, gangs and drugs.

Range of Housing Variety and Opportunity
Residents want a variety of housing types and are concerned about the sameness of housing being developed. In addition, they are asking for variety of housing opportunities for various income levels, especially in Blythe, the Moreno Valley, the Coachella Valley, Perris and Sun City.

Need for Buffers and Green Space
People in all areas would like more green space and many would like to have buffer zones -- but residents in certain areas feel particularly impacted by industry and freight. These include Riverside, Jurupa and Corona.

Private Property Rights
Most would like to see recognition and preservation of private property rights and would like to see a focus on incentives rather than regulations or penalties.

Balance
Most people expressed interest in balancing the rural area's character with infrastructure needs and protection of rural quality of life while also protecting individual rights.

Public Transportation Access
Public transportation is important to people – especially in areas with large elderly or aging populations. Dial-a-ride is a particular concern in Jurupa, Moreno Valley, Palm Desert, Beaumont, Lake Elsinore, Perris, Hemet and Sun City.

Need for Cooperation among Cities and Agencies
Several participants saw lack of cooperation among cities, towns and agencies as a significant barrier to getting things done. Residents at the Beaumont and Jurupa workshops saw this as a particularly serious problem.

Regional Transit Access
Access to regional public transportation was a specific issue for people present at the Palm Desert and Beaumont workshops.

Support for Metrolink Expansion
Metrolink service was widely supported at the public workshops. Residents of Riverside, Moreno Valley, Palm Desert, Beaumont, Lake Elsinore, Perris and Hemet were particularly interested in Metrolink extensions or expansion.

Preservation and Exploration of Corridor Options
Key north-south and east-west corridors need to be preserved and expanded. Specifically, participants were concerned with the lack of alternatives to the 91 corridor, the lack of direct access to Orange County from the Temecula-Elsinore area and indirect and unsafe access between the Beaumont-Coachella and Elsinore-Temecula areas. There was general support for advance planning and preservation of corridors.

Environmental Impact of Trucking Corridors
In most workshop areas, people were concerned with the impacts of freight traffic and noise – from both trucks and trains. Residents in the Jurupa and Moreno Valley areas had particularly strong concerns.

Lack of Alternative Corridors and Emergency Access
Workshop participants in several areas – including Temecula, Beaumont and Hemet were concerned with lack of emergency access and availability of alternative corridors, especially during fires and floods.

A CORRELATION OF COMMUNITY COMMENTS WITH SURVEY RESULTS

Comments made by community members who attended the Riverside County Integrated Plan Community Meetings reflect many of the opinions expressed by Riverside voters in a recent survey conducted June 20 – 23, 1999. Please note that a close correlation seems to exist between the qualitative data captured through the community meetings and the quantitative information gained through the statistically-correct (with a 4% margin of error) survey.

Rate of Growth, Traffic, and Open Space

At all 12 community meetings, audience members consistently expressed concern about the rate of growth in their communities, traffic congestion, and the need to preserve open space. Creating new jobs was cited as an important issue at most of the meetings, also. Reducing crime, gang activity, and the need to provide recreation or diversion programs for youth were stated as key concerns at meetings in Corona, Moreno Valley and Hemet. In general, concerns stated at RCIP meetings correspond to a Key Finding of the survey in which respondents, in an open-ended question, describe the most important issues facing Riverside County as: the rate of growth; crime, violence and gangs; schools and education; traffic congestion; police issues; and jobs.

Air Quality and Overcrowded Schools

Another important parallel between concerns stated in the survey and in the community meetings was poor air quality. In closed survey questions, crime, gangs and drugs were ranked as the most serious problems in Riverside County. (Threats to personal safety rank as most important, of course.) The next serious issues were traffic congestion, poor air quality and overcrowded public schools. In most community meetings, (9 out of 12) poor air quality was described as a significant issue. Concern about the inadequacy of school facilities to meet the growing youth population was stated at several community meetings as well.

Planned Growth

A solid sixty-five percent (65%) of survey respondents support planned growth for the future. This support seems consistent with sentiments expressed by meeting participants for the Integrated Plan efforts undertaken by the County. At meetings throughout the County, most community members expressed support for planned growth. Many participants also expressed gratitude to the County for giving them the opportunity to express their views through the Community Meetings.

Riverside County Integrated Plan
Synopsis of Key Community Workshop Issues
July, 1999

Community Area	Synopsis of Issues		
	General Plan	**Conservation & Habitat**	**Transportation**
Temecula	▪ Support infill development ▪ Balance preservation and growth ▪ Concern with job development ▪ Concern with development in surrounding County unincorporated areas – outside City's control	▪ Support incentive-based rather than regulatory approach ▪ Concern with species and boundaries ▪ Look at "lessons learned" from others	▪ Need for public transportation options and a viable public transportation system ▪ The freeway presents a barrier ▪ Concern with impact of transportation on habitats
Riverside	▪ Support incentives for infill development to preserve open space ▪ Concern with preserving community appearance and feel ▪ Need for resource management ▪ Increase buffers ▪ Do resource management	▪ Natural and open space areas are assets that need to be preserved ▪ Need to plan for development ▪ Concern with impact of habitat plans on private property rights ▪ Concern with Riverside's environmental image	▪ Need for public transportation options, including bike lanes ▪ Increased Metrolink service ▪ Linkages to San Bernardino County ▪ Corridor improvement needed: 91, 60/215 interchange, HOV-Fastrak linkage
Jurupa	▪ The Community is considered a "dumping ground"- warehousing and trucks ▪ Buffers needed – no industry next to housing ▪ Improved housing affordability and less density ▪ Beautification needed ▪ Improved inter-jurisdictional coordination	▪ Open space and hills are assets that need to be preserved ▪ Consider environment as part of the planning process ▪ Need incentives to preserve the environment and preserve/shepherd resources	▪ Consider cumulative impact of developments and transportation projects ▪ Better public transportation including fixed route and dial-a-ride ▪ Poor surface street condition ▪ Area is a "sacrifice zone" with truck and freight traffic

Community Area	Synopsis of Issues		
	General Plan	**Conservation & Habitat**	**Transportation**
Moreno Valley	▪ Conserve agriculture and view sheds ▪ Provide low-cost and elderly housing ▪ Concern with overcrowding of facilities – safety, infrastructure, schools ▪ Jobs, gangs and crime are social issues ▪ Value rural atmosphere, parks and open space	▪ Preserve open space ▪ Need wildlife link to protect animals ▪ Clear understanding of impact of habitat areas on zoning, real estate agreements needed ▪ Need for trails and equestrian facilities	▪ Concern with SCAG models and impact on area ▪ North/south connections to San Bernardino and other regional links are needed ▪ Need accessible transportation and dial-a-ride ▪ Concern with trucks and intermodal facilities ▪ Need Metrolink extension ▪ Bike and pedestrian facilities are needed
Palm Desert	▪ Interjurisdictional issues get in the way of implementation ▪ Concern with Riverside County dichotomies – Western vs. other parts of County, rich vs. poor (especially Coachella Valley) ▪ Need to plan for development ▪ Concern with water conservation ▪ Appreciation of open space and concern with encroachment on agricultural land ▪ Concern with benefit gained by outside development interests ▪ Manage trash, landfill and recycling issues	▪ Protection of open space ▪ Preserve desert ecology ▪ Debate on extent to which habitats are preserved – especially single-species habitats	▪ Plan infrastructure to meet needs of development ▪ Interagency disagreements interfere with corridor improvement ▪ Public transportation including regional linkages and local dial-a-ride

Community Area	Synopsis of Issues		
	General Plan	**Conservation & Habitat**	**Transportation**
Beaumont	▪ Preserve rural areas ▪ Improve downtowns and preserve old buildings ▪ Regional approach is needed to planning and development, including sharing economic gains ▪ Towns should be merged into one city ▪ Balance jobs and housing ▪ Reduce pollution and improve air quality	▪ Preserve open spaces ▪ Improve water and air quality ▪ Protect wildlife ▪ Protect and preserve the natural terrain	▪ Improve regional transportation – access and coordination ▪ Improve transportation for the elderly ▪ Government fragmentation impacts implementation of improvements ▪ Improve the 79 corridor ▪ Provide for emergency transportation access ▪ Improve maintenance ▪ Need to plan ahead and preserve transportation corridors ▪ Provide access to jobs
Lake Elsinore	▪ Concern with sprawl – consider moratorium on development; reduce miscellaneous annexations, do cost-benefit analysis ▪ Special concern with Liberty development ▪ Implement development consistent with General Plan ▪ Preserve open space ▪ Concern with level of services financed by new development ▪ Need for a variety of shopping opportunities ▪ Need for buffers, barriers and greenbelts ▪ Protection against natural hazards needed ▪ Need clean industry	▪ Maintain open space and country lifestyle ▪ Concern on Metropolitan Water District ownership and development ▪ Lake runoff ▪ Importance of trails ▪ Need for park policy and development, including user fee structure and developer responsibility	▪ Community is neglected in public transportation access ▪ Concern with land use-transportation connections ▪ Dial-a-ride is needed in many areas ▪ Rail extensions are needed ▪ Concern with roadway conditions ▪ Highway 74 improvements needed ▪ Questions on Measure A uses

Community Area	Synopsis of Issues		
	General Plan	**Conservation & Habitat**	**Transportation**
Perris	▪ Address loss of agricultural land ▪ Buffers and transition areas needed ▪ Provide for adequate lot sizes ▪ Create varied styles and types of housing ▪ Increase density but increase amount of open space also ▪ Need jobs in rural areas and jobs-housing balance	▪ Support habitat conservation in general but: ▪ Provide clear explanation on why habitat areas are needed ▪ Preserve waterways and riverbeds ▪ Willing to commit resources to preserve open space and rural areas ▪ Need to create habitat with freeway/arterial construction	▪ Need to improve east-west corridor access ▪ Improve dial-a-ride for the elderly ▪ Increase Metrolink service ▪ Improve road maintenance ▪ Question if Measure A implemented (specifically Highway 74)
Hemet	▪ Support integrated planning ▪ Need to preserve green space ▪ Concern with restrictiveness of large parcel zoning ▪ Support infill development ▪ Need to protect private property rights ▪ Need to plan infrastructure along with development ▪ Increased coordination and joint planning are needed ▪ Provide job training and improved social services	▪ Concern with erosion and flooding ▪ Concern with Eastside Reservoir and impacts ▪ Preserve the natural environment and increase the amount of green space	▪ Concern with mass transit capacity and needs ▪ Dial-a-ride service needs significant improvement ▪ Extend passenger rail ▪ Consider and improve emergency transportation access ▪ Improved maintenance is needed ▪ Consider freight rail extension ▪ Need explanation of use of Measure A funding

Community Area	Synopsis of Issues		
	General Plan	**Conservation & Habitat**	**Transportation**
Sun City	▪ Balance progress and growth – preserve the natural beauty and open space ▪ Consider urban limit lines for growth ▪ Increase availability of jobs ▪ Provide a mix of housing styles and purposes ▪ Decrease crowding ▪ Increase connections with the County – the area feels disenfranchised	▪ Preserve wildlife ▪ Balance preservation with property rights ▪ Create observation as well as recreation areas ▪ Plan for diversity of habitats and habitat requirements ▪ Build on existing recreational and trail resources ▪ Consider development's impact on the food chain	▪ Road plans should be detailed ▪ Concern with area's status as unincorporated area and plans ▪ Public transit service needs improvement – fixed route service has been cut and dial-a-ride is poor ▪ Concern with local arterial expansion – especially impact of development ▪ Maintenance needs to be improved ▪ Traffic and development impacts of Eastside Reservoir need to be considered
Blythe	▪ Increase amount of affordable housing ▪ Decrease restrictions on land use to encourage mix of housing types ▪ Preserve Native American sites ▪ Mitigate hydrocarbons – impacts development in key areas of Blythe ▪ Increase job opportunities – provide for self-sufficiency in the area	▪ Open space and habitat preservation	

Riverside County Integrated Plan
Community Workshop Summary

TEMECULA
June 17, 1999

General Plan Discussion

Land Use

- There is a demand for growth but residents want a County that reflects the values of the community.

Housing

- Inner-city redevelopment is important, we need to work from inner-out
- Housing in Riverside County is market driven. Condominiums have not worked in Riverside County; they are too densely populated.
- Development is a concern – especially to the east of Temecula in unincorporated County areas and on the Pechanga Indian reservation

Other Comments

Economic Development

- Riverside County needs jobs that attract growth.

Transportation Discussion

Overall Issues and Observations

- Problems don't end at the County line – we share problems with San Diego County, specifically
- The mall and Eastside Reservoir and Rogerdale are also concerns
- The issue is how to accommodate this development and take transportation into consideration
- Southern Bell is a good example
- Isolation of our youth is a concern – they don't interact because they're in cars
- We need to look at commercial activities that are implemented – especially sports bars

Transportation and Access Issues

- We need a choice of modes
- We need to change the auto paradigm and provide a network of transportation alternatives – currently, alternatives are lacking
- Pedestrian and bike transportation should also be a focus -- bike paths should be differentiated for safety
- There should be a viable public transportation system
- We should decrease dependence on the freeway
- We should promote carpools – right now there's a lack of incentives
- School buses and public transit should be integrated as one system

- Low farebox return is a problem
- The freeway presents a physical barrier
- There should be on- and off-ramps every 2 miles
- Southwest County congestion causes air quality problems
- There needs to be infrastructure for low-emission vehicles
- Temecula traffic is getting better
- We should look at the impact of transportation on habitats – specifically wildlife movement
- A key issue is how to get the resources:
- Improve farebox recovery
- Get bond support
- Make the auto and petroleum industries part of the solution
- Do not study things to death!

Multiple Species Habitat Conservation Plan Discussion

Overall Issues and Observations

- The challenge is to find a balance between Preservation and Growth/Development -- the RCIP plan is balancing both sides
- One common goal is to preserve Riverside County for the future
- Is there a way to retain current species? Growth boundaries might work and can have open space benefits but how do we utilize boundaries when species do not recognize boundaries?
- The Alamo Hills Area is an area with political and biological issues. We can create an island but what do we do with the island? Will creating islands only create more problems since it disrupts the natural chain of events?
- We need to recognize a shared responsibility in preserving open space and multiple species.
- We need to look at other plan models to learn what has worked in other places and what could work here.

Mitigation Banking Issues

- We need to find an incentive based program for landowners and farmers
- There needs to be a defined set of standards and criteria for conservation easements and mitigation banking and should not be on a case-by-case basis.
- The public and individual landowner needs to know who the competitors are when working on mitigation banking.
- The process needs to be a fair.
- Want some local control within federal guidelines.
- Want to know at the local level if there is a conflict of interest.
- The mitigation banking process is a frustrating process.

Housing and Redevelopment Issues

- Inner-city redevelopment is important, we need to work from inner city outward
- Housing in Riverside County is market driven. Condominiums have not worked in Riverside County; they are too densely populated.

Growth Issues

- Riverside County needs jobs that attract growth.
- There is demand for growth but people want a County that reflects the values of the community.

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"If I could change one thing about Riverside County, it would be . . .

- We need jobs in Riverside County.

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
Transportations "Winners" and "Losers"

Winners

- Metrolink
- Traffic Directors at 79 South and I-15
- Individual staff contract coordination skills (Gary McKinsey)
- All government Agencies (under the circumstances)
- State of California allowing private enterprise to build roads

Losers

- Fastrak ends at Highway 71 – why can't it extend to the HOV lane?
- Construction costs too high for local CSAs to fund
- Driver courtesy

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"When I spend time outdoors, I enjoy doing..."

- Hiking (3) Quiet, uncrowded
- Landscape photography
- Enjoying solitude
- Camping

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- Temecula/Mur Creek and Santa Margarita River
- Murrieta Creek bottom and Oaks
- Santa Rosa Plateau

"What do you like about this special place?"

- Beautiful habitat – peaceful

"Why is this place important to you?"

- One of the last of its kind in Southern California
- Beauty

Riverside County Integrated Plan
Community Workshop Summary

RIVERSIDE
June 21, 1999

General Plan Discussion

Land Use

- Too much emphasis on new development and not enough on developing existing resources and areas.
- Use existing infrastructure and infill ---no more stripmalls, fill up the Plaza.
- Add urban limit lines like they have in Oregon and Washington
- Change regional emphasis from consumption to conservation.
- Communities lack a sense of space
- Loss of agricultural land
- Garden communities feel friendlier, safer –We'd like that.
- Diesel truck centers are located next to high school . . .leads to bad air quality, traffic dangers for students

Housing

- New develop should look like old development
- Buildings look temporary –little sense of longevity
- Needs to be better building/community fit

Traffic

- We need options to using the car; like trolleys
- Need bike lanes
- Need different distribution systems (besides diesel trucks) and emission controls

Natural Resources

- Water resources need to be considered, along with conservation, recycling, demonstration projects, flood management.

What an Ideal Community would be like . . .

- Sense of community; sense of soul
- Have porous pavement

Transportation Discussion

Overall Issues and Observations

- Can we accommodate the expected population increase with proposed solutions?
- We need to link up with San Bernardino County and others
- Things we support with our taxes are not necessarily picked up at the county line

- We need to educate people about how their transportation dollars are spent

Transportation and Access Issues

- There has been a history of citizens being distanced from transportation information
- I don't know whom to ask about transportation information – how to get from here to there
- We need an alternate route to the 91 but the best alternative is through a kangaroo rat area
- There are no surface alternatives to the 91
- The portion of I-15 between Baseline Road and Route 60 is a recent hotspot
- 60/215 weaving causes a hazardous situation
- The image is that access to Los Angeles is the problem
- The HOV linkage to the Fastrak is underused
- We need alternative access – maglev, more Fastrak, congestion pricing
- Not just freeways but arterials, too
- Ports, airports and trains should be linked
- Freight issues are key in this area
- Truck delivery schedules should be changed to nighttime deliveries – trucks cause daytime congestion
- Railroads, especially the Colton terminal, cause pollution
- Freight up I-10 to Banning is a problem
- There is a conflict between Metrolink and freight
- Metrolink is infrequent – the freight conflicts add to this problem
- Any alternative needs to be assessed for air quality impact
- Incentives for clean fuel conversion are needed

Multiple Species Habitat Conservation Plan Discussion

Area Image

- Historically Riverside County was seen as an oasis with its ideal winters and opportunities for citrus. It was not the wasteland that many view it as today.
- We need to work on changing the public image of Riverside County and highlight its positives
- We need to highlight natural abundance of Riverside County -- it is a commodity

Community Involvement

- We need to address apathy of citizenry
- People in the County need to be part of the solution
- Riverside Neighborhood Partnership and the Mayor's "Night-Out" have worked well to get the community involved

Area Assets

- The diversity in Riverside County is a benefit
- Trees are an area asset
- Positive features of Riverside County are its natural qualities

- The City of Riverside has quality of life benefits: citrus areas, university, mountains, Victorian homes

Open Space and Development

- We need to prioritize open space
- Planning and management of open areas needs to be continuous – it cannot be piecemeal
- Open space is seen as a positive
- There are empty buildings now, why are we building more?
- We need to get funds from development to acquire and preserve land
- People want to know if the government will buy their land at fair market value to preserve species
- Places to avoid development and protect include San Jacinto Hills and Gavilan Hills
- Riverside County needs collaborative partnerships to preserve and maintain open space and habitat
- Open space increases air quality and can be a solution for other concerns
- Needs to be a reward for private land owners for management of large chunks of open space
- Wildlife corridors should be multi-use corridors

RESPONSES TO THE INTERACTIVE EXERCISE QUESTION:
"If I could change one thing about Riverside County, it would be . . ."

- Keep diesel trucks way from neighborhoods. Establish buffer zones so our community is safe --in terms of transportation and air quality
- Use existing infrastructure. Establish urban limit lines. Infill vacant areas. No more stripmalls, fill up the Plaza!
- There's too much emphasis on new development and not enough on developing existing resources and areas.
- Use urban line limits like they have in Oregon and Washington
- Change regional emphasis from consumption
- Eliminate apathy

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
Transportations "Winners" and "Losers"

Winners

- Metrolink

Losers

- Riverside doesn't incentivize jobs and small business like Orange County does
- The auto-oriented society
- Not getting information to voters
- The 60/215/91 interchange

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"When I spend time outdoors, I enjoy doing..."

- Hiking
- Camping
- Gardening (2)
- Breathing clean air!
- I like walking, horseback riding, and raising children with healthy lungs
- Birdwatching

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- . Citrus Heritage Park
- UCR Botanical Gardens
- San Jacinto Valley
- Santa Ana River area (the whole length)
- San Jacinto wildlife area

"What do you like about this special place?"

- Quiet, inspiring
- Openness
- It is natural
- Open space / wetlands / birds

"Why is this place important to you?"

- Need for meditation
- Development is a great threat
- It feels wild and far away from civilization, when I ride the trail or camp.
- I keep working to add to it

Riverside County Integrated Plan
Community Workshop Summary

JURUPA
June 22, 1999

General Plan Discussion

Land Use

- Industry has built huge warehouses; semi-trucks (making deliveries) are too close to our homes, schools, and areas where children play
- We'd like a new community plan. Too much mixed land use ---high school students and large hauling diesels don't mix.
- No buffer between homes and industries
- Loss of rural appearances ---and life style (ability to ride horses and walk without dodging traffic) as a consequence of industries moving in
- Need to balance "big business' concerns with community values and wishes
- We need coordinated planning to include living conditions for residents.

Housing

- More affordable housing
- Less density

Circulation

- Need to improve the land use and transportation relationship, to generate an efficient public (mass) transit system.

Open Space

- Local parks are poorly maintained; dirty, poorly lit
- Horse trails are not maintained.

Air Quality

- County needs to honor the "No truck/diesel moratorium". We want clean air. Risk assessment is 1700 cancer deaths per 1,000,000.

Other Comments

Community Identity

- Glen Avon has its own identity that of a friendly, (tree-lined), peaceful small town.
- Need beautification and clean up. "Feels like beautification (efforts) stops at the edge of our area."
- Again, about beautification: "Beautify that part of Rubidoux that needs to be improved. The improvements made to Rubidoux in '96 were basically pointless. That part of Mission was in great condition but farther down the road, the street is in bad condition."
- We need to incorporate.

Coordination Between Agencies

- "Poor coordination and too much infighting between agencies, schools, and parks leads to inefficiency."

Social Issues

- Address the needs of poor and elderly. They are a large percentage of the population.

Public Participation

- Community members believe they must become more involved to ensure their views are heard and respected.

Transportation Discussion

Overall Issues and Observations

- Is Jurupa a "sacrifice zone"? We're losing green space and air quality is decreasing
- Other environmental issues are the dust from gravel and aircraft noise

Transportation and Access Issues

Trucks

- Truck traffic/depots
- Being a "sacrifice zone"
- Cumulative impact of local projects
- Trucks are a major issue
- Big trucks transport hazardous waste, cause diesel hot spots and accidents
- Truck safety around schools is a concern
- Trucks damage our streets
- Truck depots cause traffic

Traffic and Speed

- Speed and traffic enforcement
- Why do we have a policy to increase speed? To move more traffic?
- The Highway patrol are our only local traffic cops but they're busy on the freeways

Noise

- Noise is a problem
- Freeway, train and truck noise all impact our area
- There is "soundwall spillover", where noise carries across soundwalls to houses located inside the noise barrier
- Soundwall promises were made and not kept
- Ontario Airport's night policy causes noise problems for the area

Surface Street Issues:

- Pedley Road – curves and underpass create a dangerous situation. Speed causes safety and driveway access problems
- Congestion and slow speeds on Valley Way impacts traffic on Granite Mill Drive – it becomes a commuter bypass
- The Van Buren Curve needs re-engineering
- Schools are endangered by traffic, especially on Valley Way. Potholes are also a problem on this street

Public Transportation

- Buses are a problem but Metrolink service is good.
- There are no buses on Etiwanda or Sunnyslope – you have to go to Country Village to connect to Riverside
- Bus stops are not in safe pedestrian locations – stops should be at intersections/corners – not mid-block
- School transportation affects both safety and traffic
- Bike lanes are few and far between but they're not a good idea on main streets
- School bus loading zones, especially at Jurupa Valley School, cause traffic and safety problems
- The freedom to select your own school has increased transportation problems

Multiple Species Habitat Conservation Plan Discussion

Open Space

- Hills, grass, cows and nature are all assets to area
- Conservation important to preserve open space
- Historically in the 1980's open space was not as high of a priority as growth, development and employment
- People in the area have an appreciation for nature and for things that are not "man made"
- Santa Ana River, Jurupa Hills, Mountains are all important areas to maintain

Planning and Development

- Residential areas need buffers
- Industrial areas should not be right next to residential areas There is a concern with exploitation of open spaces
- People recognize that the zoning code is interrelated with some density concerns
- Residents need information on zoning restrictions i.e. "area can be no less than ½ acre parcels"

Environment

- Historically environmental concerns were low on the priority list
- Environment now has a place at the table and is part of the planning process
- There should be financial incentives to preserve and maintain environment

Requirements for the Plan

- The plans need to consider what is best for people
- Community involvement is important in planning process
- There needs to be a look at the long term, not a focus on short-term gain
- The area needs to be maintained and preserved for our children and their children
- It is a matter of money; we spend money on what is important to us. Need to keep environment in mind
- Need a regional view, it is the best way to protect reserves and corridors
- We need to recognize that resources are not unlimited
- The Plan needs to balance the rural area's character with infrastructure needs

RESPONSES TO THE INTERACTIVE EXERCISE QUESTION:

"If I could change one thing about Riverside County, it would be..."

- Incompatible land uses
- Haphazard planning
- Traffic congestion
- Inadequate public transportation exists – "Need up-to-date transportation"
- Need recreation opportunities for youth (such s skate-boarding parks)- Opportunities for youths would help deter them from crime."
- Poor air quality – "We need clean air." (4)

WHAT RESIDENTS VALUE...

GROUP DISCUSSIONS COMMENTS AND WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"

"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ."

- Fewer people living in our area (than L.A. or Orange County)
- Nature preserves

You really have to see:

- Acres of green zones set aside to retain the area's rural nature

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:

Transportations "Winners" and "Losers"

Winners

- None Mentioned

Losers

- Only two bridges for street use from Western Riverside (Jurupa Valley) to Riverside City. If the Van Buren Bridge is down over the Santa Ana River, getting to work is a nightmare
- The 60/215/91 interchange

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:

"When I spend time outdoors, I enjoy doing..."

- Driving
- Walking (4) Maybe a walking trail just for walkers in the Glen Avon area
- Relaxing in a lawn chair
- Hiking (4)
- Camping (2)
- Fishing
- Rock-hounding
- Bird watching
- Horseback riding (2)
- Running (4) (in open areas with the dogs)
- Basketball (2)
- Gardening (2)
- Bike riding
- Just being with my family
- Playing tennis, softball, soccer

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- Rancho Jurupa Park
- The environment along the Santa Ana River – It is one of the few remaining actual rivers in Southern California in a growing area. We have already lost the L.A. River.
- There are not enough natural places in West Riverside. If there were, I would enjoy a park that had more grassy areas or recreational places.
- Jurupa Mountains – north of 60 freeway
- Jurupa Hills – north of Limonite Ave, near Valley Way / Jurupa Road and 60 freeway
- Jurupa – Joshua Natural Park
- No, but I feel parks should be improved and added and kept clean
- Louis Rubidoux Nature Center

"What do you like about this special place?"

- It's amazing to be in Rubidoux, it is very serene
- It is natural
- It is nearby. Fairmount Park is crawling with derelicts that make it an unsafe place.
- Undeveloped – grasslands, wildlife, especially the birds, (hawks, etc.)
- The lay of the land
- Accessible to public

"Why is this place important to you?"

- It is a family area. It is clean and feels like your in the mountains
- My children can grow up seeing rivers as they should be, not surrounded by concrete
- There are no lighted tennis courts for people that are only able to practice at night. No places for children to play safely
- For the horseback riding and hiking
- I live here
- Because there isn't such a place
- It's function in educating the public about nature

Riverside County Integrated Plan
Community Workshop Summary

CORONA
June 24, 1999

General Plan Discussion

Land Use

- Zoning needs to be sure uses are compatible

Open Space

- Need open space between cities. It provides a sense of place, social character and provides connections between cities.

Other Comments

Social Issues

- We need to provide more free services for youth –diversion programs, mentoring.
- Schools (facilities) need to be improved.

Transportation Discussion

Overall Issues and Observations

- Where does the funding come from?
- How do we get to sustainability?
- Environmental issues are important – all the way from CO_2 generation to dust and dirt from gravel pits
- Temecula-Murrieta buildup impacts our area – land use and transportation policy should be linked

Transportation and Access Issues
Corridor Alternatives and Linkages

- There need to be more alternate routes
- Specifically, an east-west connection to Orange County other than the 91
- Cut-through traffic makes impacts worse -- problems on the freeway create local problems
- There is concern that projects may not match up – specifically the Route 91 auxiliary lanes
- There should be a link with Route 241
- Emergency vehicle delay is a concern – especially if they close 91 – where do emergency vehicles go?
- Can the southbound 15 connection to the 215 be metered?
- Temescal Canyon is congested -- especially with trucks
- Impact of development on traffic and impact of traffic on ability to develop further are both concerns in our area –developments have been turned down because of congestion
- Roadway maintenance funding is inadequate

Truck Issues

- Truck speed
- We should time truck delivery better or move to just-in-time delivery
- Trash haulers are a problem for our area
- There should be more grade crossings for trains

Public Transit

- Bus service needs improvement
- There are no direct bus routes
- Bus stops are far away
- There is concern with CNG bus expense

Bike Issues

- There should be more infrastructure for bikes
- Bike safety should be improved
- Topography gets in the way of bike use
- We should bring Amsterdam bike policies here – have more bike paths and parkways

Other

- Can transportation funding be used for economic development – specifically supporting structure for small businesses?
- Freeway beautification should be pursued

Multiple Species Habitat Conservation Plan Discussion

Open Space

- We need to slow down progress
- We like the arm-stretching aspect of this area
- We need to address people dumping odds and ends in open space areas
- It is important to maintain open space
- We need open space between cities. It provides a sense of place, social character and provides connections between cities
- Concrete is just not as attractive as open space
- It is important to preserve and value open space. Agricultural land and open space needs to be valued for its open space qualities and not for its "potential development value".

Habitat Preservation

- We should keep streams as natural entities
- There is question on where the animals will go when there is growth and development
- We need to respect species territories.
- The overall concern is for animal population, not a specific species
- Species are changing
- Cities are their own ecosystem

Values

- If we can promote human respect we can encourage respect of natural items
- We value interaction and close connections with natural world
- The outdoors helps social structures and helps teach peace and understanding
- Zoning needs to be sure uses are compatible

Property Issues

- Property ownership rights need to be factored into the preservation equation
- The dollar amount spent in county fees is not indicative of infrastructure services.

RESPONSES TO THE INTERACTIVE EXERCISE QUESTION:
"If I could change one thing about Riverside County, it would be..."

- Plant more trees and have a nice park in El Cerrito to have friends and family meet.
- Supervisors should get the word out about these meetings to organizations
- I would make economic development easier to achieve in the unincorporated areas to bring in more tax base, which in turn brings better things to El Cerrito.
- Why must all areas be made to look alike? In the uniquely special area of El Cerrito, we are striving to save our plants, animals and quality of life. It is fast disappearing due to massive developments surrounding us.
- Keep it as it is on east of 15 on Ontario Boulevard.

WHAT RESIDENTS VALUE...

GROUP DISCUSSIONS COMMENTS AND WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"
"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ."

- Slow living life style
- Open spaces – not housing tracts
- Help widen Ramon Road Bridge in Thousand Palms

Please Note: (This is a message to Ed Studor)

"Dear Ed Studor:
I am living in beautiful El Cerrito. I am still living here because I love it when you visit. Let's go down to scenic Temescal Canyon." (Unsigned)

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"When I spend time outdoors, I enjoy doing..."

- Looking at other people's gardens
- Picnic with church group
- Camping
- Backpacking

- Canoeing
- Kayaking
- Hiking (2)
- Fishing
- Bird watching (2)
- Spending time with my registered quarter horses. I used to enjoy the blue sky and clean water before it became polluted. I used to ride in the chaparral areas before things changed vastly and are still changing adversely
- Walking, nice parks, natural streams, etc.

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- San Jacinto Wildlife Area (2)
- Gavilan Hills
- Potrero
- Vail Lake
- San Timoteo Creek
- Badlands
- Mystic Lake
- The mining open space area about 4000 acres could co-exist with the mines as a preserve and harbor and protect sensitive and endangered species that still live there
- Temecula
- The hill with the rocks on the very top at Cajalco
- Lake Matthews
- Santa Rosa Plateau (2)

"What do you like about this special place?"

- No traffic – no houses (2)
- Lots of wildlife
- Animals and plants either adapt migrate or die. Many are adapting to stay away from hordes of people
- View of the lake and surrounding
- I was told that it is a sacred Indian burial ground
- Peace and quiet
- Open, clean air a wonderful place to ride my horse
- It is natural – Keep it that way

"Why is this place important to you?"

- Love the quiet and the birds
- The wildlife is able to survive because of little urbanization

- Because I have lived there for over 35 years, I have observed many plants and animals. There is a quiet, peacefulness when the mines are not blasting. Even the mining activity is tolerable when you compare it to the vast impacts of the fast developing areas.
- I think, it has to do with our drinking water
- Childhood favorite place
- Birds can fly in and the beauty of the water and trees
- I live there – I moved there to get away from the city and crowds.
- It is kept up that way people can enjoy it.

Riverside County Integrated Plan
Community Workshop Summary

MORENO VALLEY
June 28, 1999

General Plan Discussion

Land Use

- Important to control patterns of growth. We need coherent patterns of growth.
- Too much private property is poorly maintained
- Land use policies have to make it profitable for people to stay in agriculture --We need agricultural protection.
- Scenic impact of windmills has to be considered.
- View sheds --We need protection and understanding of implications for landowners.
- Beware! Land use restrictions and its impacts may have unintended restrictions (pertaining to the taking of private property and the cost.)

Circulation

- How will traffic be accommodated?

Housing

- We need low cost housing for elderly, and better coordination between City and County for this.

Conservation

- Water availability and cost is a concern.

Other Comments

Social Issues

- Overcrowding is increasing crime rate.
- Negative media hurts Moreno Valley.
- Police/public safety, and infrastructure demands are already at a pivotal spot--How are we going to meet additional demands?
- Important to consider current patterns and levels of public services. We need available information to make decisions about development.

Transportation Discussion

Overall Issues and Observations

- How do our plans mesh with SCAG's plans?
- Moreno Valley development is not in SCAG's model – the model needs to match Moreno Valley's reality. Moreno Valley industrial development and March Air Force Base need specific attention
- Can we get a development moratorium while we plan?

Transportation and Access Issues

Regional Linkages

- The north-south connection with San Bernardino County is key
- Is San Bernardino County being considered in the plan?
- Regional linkage with San Bernardino, San Diego and Orange Counties are important

Congestion and Corridors

- Overall, congestion is a great concern
- Congestion from accidents is especially bad because alternate routes, when they exist, are congested also – this needs to be considered in the plans
- Route 60 lane drops cause a problem – it goes from 4 to 3 back to 4 lanes
- Should Route 60 improvements be mixed flow or HOV?
- If the grade is fixed it increases Moreno Valley congestion.

Interjurisdictional Coordination

- Interjurisdictional continuity is needed on circulation plans
- There should be incentives for consistency (as there are in Orange County)

Truck Issues

- We need to get truck traffic off the freeway
- We need a truck climbing lane on Routes 15 and 215

Rail Needs

- Rail and inter-modal
- Rail service expansion is important – all the way from a Joint Powers Authority for rail service to freight to high-speed rail
- Consultants should look at the San Jacinto line extension study
- Truck-Rail inter-modal transfers should consider the existing major east-west rail corridor
- Is it possible to do inter-modal transfer at March Air Force Base?
- Is it possible to have rail service along Route 60 into the city?

Metrolink

- Metrolink bypasses Moreno Valley – plans are to go from Riverside to Hemet and not stop in Moreno Valley
- Lack of Metrolink service from Moreno Valley adds to route 91 congestion

Bus Service

- Accessible public transportation, especially for disabled people, is lacking
- The system is overbooked but only one person is on board – is this a contradiction?
- Tie-down abilities for wheelchairs are inconsistent, as is driver training
- Bus service stops too early, especially for special events such as the fireworks
- Bike and Pedestrian train connections are important – equestrian trails, too

Multiple Species Habitat Conservation Plan Discussion

Special Places in Riverside County That Need To Be Maintained

Anza Valley	Moreno Valley	4000 Acres of "Cycle Park"
Open Space	San Jacinto (2)	Unincorporated Northern Hills of Moreno Valley
Golf Courses	Davis Road	San Jacinto Wildlife Area (Hills Adjacent to San Jacinto Hills)
Tree Mound	Santa Rosa Plateau	

Wildlife Corridors

- Want wildlife corridor linkages
- Animals and plants can not protect themselves
- We enjoy knowing that species are around us

Trails and Equestrian Use

- Would it be possible to create a trail circle around the county for horse riding?
- We want multiple-use trails
- We do not like motorcycles -- they are invasive and scar the area
- Could be possible to create a trail circle around the County for horse riding?
- An east-west trail connection is possible
- Fire and utility roads are good equestrian trails
- We want more equestrian trails

Development and Open Space

- It is harder to preserve open space once development starts
- People want a "no surprises" agreement and a pre-listing agreement in real estate transactions
- We need to increase awareness of zoning codes and restrictions
- When people build next to open space they need to be aware of neighboring species and sign a waiver they understand the conditions
- Cluster homes impact infrastructure. These developments tend to want urban amenities
- Larger lot homes are important to maintain the lifestyle of the Moreno Valley

General Issues

- People in the area value a sense of community
- We have an opportunity to do something now to preserve for the future
- Balance is the key
- We need to increase understanding

RESPONSES TO THE INTERACTIVE EXERCISE QUESTION:
"If I could change one thing about Riverside County, it would be..."

- Gangs
- Lack of employment
- Kids need more free activities and opportunities

- Poor condition of roads

WHAT RESIDENTS VALUE…

GROUP DISCUSSIONS COMMENTS AND WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"
"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ." (Interactive exercise comments are noted with an asterisk*)

- Rural atmosphere – It's a city away from the City
- Natural parks
- No smog at higher altitudes
- Open spaces free of signage
- Parks and programs for kids
- Easy drive to San Diego or Orange County
- Proximity to deserts, mountains, ocean and urban areas
- Open spaces *

You really have to see:

- Victoria Avenues, Palm Springs Museum, Mission Inn *

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
Transportations "Winners" and "Losers"

Winners

- None mentioned

Losers

- The 60/215/91 interchange (additional mention)

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"When I spend time outdoors, I enjoy doing…"

- Horseback riding (2)
- Bicycling
- Hiking (3)
- Multi-use trails
- Open space
- Yardwork
- Gardening
- Enjoying the wildlife and natural settings I can find

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- Santa Rosa Plateau (2)
- Bogart Park
- Idyllwild
- Whitewater
- San Jacinto Wildlife area
- Santa Ana River Park, horse trails and bike trails

"What do you like about this special place?"

- Trails, wildlife

"Why is this place important to you?"

- I live here
- All open space is important
- It keeps people off the streets and safe

Riverside County Integrated Plan
Community Workshop Summary

PALM DESERT
June 29, 1999

Note: At this workshop, there was a combined discussion of General Plan, Multiple Species Habitat Conservation Plan and Transportation issues.

Overall Issues and Observations

- Palm Desert, the Coachella Valley and Riverside County are all one system
- Interjurisdictional issues get in the way of implementation
  - For example, on I-10 Caltrans, trucking Coachella Valley Association of Governments, Federal Agencies (including Fish and Wildlife) and local cities all get into the act
  - We need to get commitments to put improvements on the fast track
- We need to mesh idealism with financial and political reality – there are no "quick fixes"
- There are dichotomies in Riverside County:
  - One is a dichotomy of regions – those on this side of the mountain (Coachella Valley and beyond) and those on the other side of the mountain (western Riverside County)
  - The other is a financial dichotomy – especially in this area. We have the high-end vs. the working people
    - The working people need "working wage" jobs
    - We need balance in societal values

General Plan Issues

- We need to recognize a plan's vision vs. its reality
- We don't need any more Hollywood glitz. However, visitors maintain vitality. One idea is to maintain Palm Springs' eclecticism
- There is a need for more land use planning – we need to recognize what's happening in Orange County
- The question is how to accommodate a plan when change is rapid
- We need to prevent encroachment on agricultural land
- We also need to manage trash, landfill and recycling issues
- Development is pushing southeast to Thermal but is also increasing in developed areas – we need to plan for infrastructure requirements in both
- Water control is an issue
  - We need to look at the Arizona model and use of xeriscapes
  - Conservation education and practice are key
  - We need to keep the desert a desert – the look and the ecology – and preserve natural beauty. There should be less golf course watering and a more natural landscape
- Bighorn sheep need to be protected
- In general, there is an appreciation of open space
- There is debate on the extent to which we preserve natural habitats, especially large single-species habitats

- We need to look to "lessons learned" from Orange County and Los Angeles County – prevent ecological issues

- There is question on who benefits from development – do the people in the area benefit or do "carpetbagger" developers?
- There need to be more opportunities for kids

The Best Things about the Coachella Valley Are…

- The people – the diversity, the residents themselves and our guests
- Its beauty
- The climate
- The lifestyle
- It's a great place to raise kids
- The quality of life
- The open space
- The cost of living
- Agriculture
- Good health care
- Active philanthropic organizations

RESPONSES TO INTERACTIVE EXERCISE,
"If I could change one thing in Riverside County, it would be . . ."

- Get rid of blowing sand, small particles are unhealthful
- Control west side air pollution to our valley
- Where will all the water come from?
- Convert the Salton Sea into a major water resort area
- Preserve the mountain slopes in the Coachella Valley
- Affordable electricity for seniors and low income citizens. SCE us a monopoly and rates exorbitant.
- Have a major university in Coachella Valley
- Create a medical university in the Coachella Valley
- Will a train system like the monorail be good for the valley?
- Support Amtrak
- More alternatives for travel destinations via Amtrak
- Better public transportation to and from Coachella Valley
- Ample provisions for bus turnouts and shelters during development review process
- Not have our area turn into L.A. – specifically we need plan for water
- Better schools and more education – maybe a big university in the area
- Improve our cultural and economic mix – stress the importance of a multicultural environment
- Deal with waste issues
- Get rid of slumlords

WHAT RESIDENTS VALUE . . .

WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME," *"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ."*

- The climate
- The beauty and peacefulness of the desert

You really have to see:

- Civic Center and Palm Desert

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION: *Transportations "Winners" and "Losers"*

Winners

- None Mentioned

Losers

- Hadley trucking uses surface streets at high speed
- Trucks on Highway 60—too scenic for dangerous trucks
- Number of trucks and diesel
- Road maintenance and drainage in Meadowbrook
- Traffic lights not coordinated at streets adjacent to Freeway onramps
- Transportation within Coachella Valley
- No synchronized traffic lights in Coachella Valley
- Uncovered bus stops with no water in Coachella Valley – no wonder people don't take public transport
- Public transportation to and from Coachella Valley to Riverside and Los Angeles

Riverside County Integrated Plan
Community Workshop Summary

BEAUMONT
July 1, 1999

Note: At this workshop, the Multiple Species Habitat Conservation Plan discussion was combined with the General Plan and Transportation issues.

General Plan Discussion

Land Use

- Cabazon needs a modernized downtown.
- In Calimesa, we need to limit growth to preserve rural life style.
- Need to limit expansion of cities.
- Planning should encompass regions. Important to recognize linkage between Beaumont, Banning, Cherry Valley, Calimesa, and Cabazon. (Collectively called San Gregorio Pass).
- C.O.I.s are important in this area.
- Old buildings need to be preserved and remodeled.
- Prevent piecemeal annexation.

Circulation

- Regional transportation doesn't extend past city boundaries.
- Transportation needs to be addressed better before high-density development takes place.
- Elderly needs should be addressed --especially lack of public transportation--before senior housing is developed.

Conservation

- Providing enough water for growth is a problem. May need tertiary-treated water.
- Quality of water should be considered.
- Entire Pass needs to be preserved.

Safety

- Housing is built in flood zones.

Air Quality

- Air pollution is a serious problem.

Other Comments
Economic Development

- Jobs to housing ratio are too low.
- Pass should consider establishing a Joint Power Agreement to increase revenue sharing, and shared services to capture economic benefits.
- Need jobs that create greater disposable income (income that's left after paying taxes)

Transportation Discussion

Overall Issues and Observations

- Beaumont is the industrial hub – the Pass is the gateway to the East
- People in the area have a strong belief in the future
- Identity is an issue – we need one name and one Mayor – this workshop title is an indicator of this: it's called the Beaumont workshop but covers Cherry Valley, Banning, Cabizon and Calamesa as well.
- There are too many small governments and connections are lost
- Fragmentation of governments makes it difficult to develop corridors and to determine what's compatible in the area – for example, a proposed Magic Mountain-like theme park and a GM plant may be incompatible uses
- Without government cooperation we can't determine impacts of transportation, development and industrial location decisions

Transportation and Access Issues

Significance of the Area

- The Pass is the gateway to the East
- All travel decisions are made in Beaumont

Corridor Preservation

- Five highways converge in Beaumont
- Transportation corridors are important
- We need to take advantage of the opportunity to preserve transportation corridors – this is the last frontier for open land that still has the ability to access the Los Angeles basin
- If we develop transportation corridors now, industry will go where it should

Transportation and Jobs

- We need to tie transportation decisions to access and economic development opportunities. We need jobs for young people and the ability for them to access jobs in other areas. Specifically:
- Open up the 79 corridor to San Diego – that's where the high-tech jobs are
- Consider a passenger airport in this area – this is key to development of technical jobs here in the Valley. Palm Springs airport is tourist-oriented and Ontario is too far away. Development of Norton Air Force Base is a possibility

Public Transportation

- Get Metrolink extended to this area
- Bus transportation in individual communities is fairly satisfactory but regional connections are difficult
- People have to transfer between individual systems – some trips take a whole day
- There is no way to access the Palm Springs area by public transit

Safety and Maintenance

- Routes 60, 10 and 79 are hazardous
- Local road maintenance is poor – we need curbs, sidewalks and striping

Emergency Access

- We need to keep the area open for emergency transportation – all the way from access for fire crews to hazardous material cleanup (due to large number of trucks and freight trains coming through) to emergency medical services
- Because medical facilities are few and far between, air evac for medical access is key

Other Issues

- Air pollution is a problem for our area
- We don't want to be another Moreno Valley – Moreno Valley has poor access to jobs, no public transportation and "no escape" from Highway 60
- Bike lanes are nice but secondary

RESPONSE TO INTERACTIVE EXERCISE,

"If I could change one thing in Riverside County, it would be . . ."

- Bus service to and from Palm Springs
- Air Quality. It is getting worse. Should be more emphasis of electric cars and other sources to replace diesels
- Merge Banning, Beaumont, Cherry Valley, Calimesa into one city – with one city hall and one government
- Ecology! Ecology! Ecology! Trash disposal. Stripping the land of natural (illegible) that only increases humidity
- Wild life habitat
- My concern is the commercial and industrial development proposed for San Timoteo Canyon. It needs to be compatible with open space
- No sewer treatment plant on East San Timoteo Canyon Road
- Protect C.O.Is
- Stop city expansion and leave C.O.Is alone
- More input on water issues and land use
- Job to housing ratio
- Plot out permanent trails in San Timoteo Canyon
- Have you considered monorails?

WHAT RESIDENTS VALUE . . .

GROUP DISCUSSION COMMENTS & WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"

"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ." (Interactive exercises comments are noted with an asterisk *)

- Rural atmosphere (2)
- Low property costs
- Beautiful mountains, rolling hills (3)
- Diversity of natural terrain
- Clean air
- County and city work well together
- Open space, quiet (3) *

You really have to see:

- Orchards, scenery, mountains, wildlife (3) *

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:

Transportations "Winners" and "Losers"

Winners

- Lots of open area – please plan use well
- Air conditioned buses
- County road repair
- Less traffic in the Pass area

Losers

- Semi-truck traffic on freeways
- Semi-trucks on city streets
- Truck traffic, accidents and road debris
- Regional access for transit dependent individuals – needs to be more coordination between providers
- Interstate 10 needs repair where it meets up with the 60
- Street striping
- Banning and Beaumont should be cleaned up of all trash
- Too much competition for freeway access (i.e. railroad operations) and 24 hour load and unload operation

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:

"When I spend time outdoors, I enjoy doing..."

- Bicycle riding
- Looking at things which do not remind me of urbanization
- Walking the trail in Glen Avon

- Hiking, long walk with my dog, gardening, growing flowers, BBQ in backyard, bird watching

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- San Timoteo Canyon
- Bogart Park in Cherry Valley
- Edward Dean Museum

"What do you like about this special place?"

- Open space, rolling hills
- Great for outdoor hiking and horseback riding
- Great land and environment

"Why is this place important to you?"

- I live there
- Shade trees and wild animals roam, aesthetic atmosphere
- A great place for all activities

Riverside County Integrated Plan
Community Workshop Summary

LAKE ELSINORE
July 6, 1999

General Plan Discussion

Land Use

- Need curbs and gutters in our area.
- Development's continuing as General Plan is produced. We need a moratorium so that community can have a "say" in development.
- Potential and future growth can lead to loss of community character.
- City annexation has been piece meal and non-contiguous.
- Prevent urban sprawl through use of sunset clauses.
- Need more sensible boundaries.
- Need open space/wooded area --with parks, playgrounds --in new developments.
- We have inadequate services, infrastructures, water resources, and schools for the new development (that's taking place).
- Need stronger community input and implementation of EIRs.
- Need a greater variety of shopping areas.

Housing

- Developers don't respect General Plan.
- We need a cost-benefit analysis (reflecting externalities—true cost to society such as pollution) to calculate what developers should really be paying.

Open Space

- Need barrier (open space) between developments.
- Green belts would help.
- Important to examine what's habitat area and what can be built on.

Safety

- Need stronger restrictions (of where people can build) to protect again natural hazards.

Other Comments

Community Identify

- Need plans to reflect each community distinct interests.

Economic Development

- Need clean industries. Provide policies and incentives to attract them.

Transportation Discussion

Overall Issues and Observations

- The land use-transportation connection needs to be considered, especially in relation to job creation
  - Land use patterns and growth should be considered
  - The Temecula area is surrounded by County unincorporated areas – this makes it difficult for areas such as this to control their own destiny with regard to the land use-transportation connection
- The Meadowbrook area has been ignored and neglected:
  - There is no public transit
  - The community needs a community center

Transportation and Access Issues

- The area needs more alternative forms of transportation:
  - There is no dial-a-ride in some areas – there is a need to consider tradeoffs between dial-a-ride and fixed route
  - There may be a possibility of bus maturing to rail
  - The Moreno Valley area needs rail
  - The San Jacinto Branch is a possibility
  - For all public transit, funding resources are a concern
- Road conditions on many streets and highways are poor – specifically:
  - Residents are concerned that Bundy Canyon and Railroad Canyon cannot handle the projected growth
  - Macy in Meadowbrook needs improvement
  - Mission Trail and Olive are hazardous – especially given the overflow from Elsinore Storm games
  - The 91 freeway is crowded and needs resurfacing
- Highway 74 is a particular concern:
  - It is dangerous -- people question whether the safety figures – specifically number of fatalities – are accurate
  - There are no signs, speeding cars and unsafe passing on the highway
  - The corridor was number one on the Measure A list but there is confusion as to what is going to be done and when: widening the 2-lane road to 4 lanes and straightening curves. The curve straightening is to be done in the next 18 months but the widening will take 3-4 years
- Measure A is a resource but results are unclear to some -- and it will need to be re-voted soon
  - There are concerns whether the promises of Measure A have been kept
  - Officials need to communicate what has been done – specifically funding of the 60/215 connection, Highway 60 into the Moreno Valley and Rail

Multiple Species Habitat Conservation Plan Discussion

Special Places In Riverside County That Need To Be Maintained

All parks and open space (2)	Santa Rosa Plateau	Riding trails
San Timoteo Canyon	Temescal Canyon	Wasson Canyon
Wetlands	Lake Elsinore	

Development

- There is concern over the new Liberty Development, which is at the south end of the lake -- it proposes approximately 8,000 homes
- MWD plans could be at odds with private property rights
- MWD needs to plan mitigations with the city of Lake Elsinore

Water Quality and Environment

- There is concern about runoff into Lake Elsinore and nutrient buildup in lake. Nutrients build up and then the standing water evaporates, leaving all the damaging runoff byproducts. The county needs to mitigate this issue.
- There are concerns over shutting down Elsinore Valley treatment plant, due to noise and during special species habitation
- There are concerns over dumping in open areas -- we need better enforcement

Corridors and Equestrian Trails

- Riding trails plans submitted to county have in the past been ignored. Need better coordination to make sure these plans are included in planning processes
- Have riding trails that connect the Santa Ana River with Lake Elsinore
- Temescal Canyon Road needs to be preserved

Park Development

- Temescal Canyon needs active and passive parks
- There is concern over the low priority that the county gives its parks
- We need a policy for maintaining parks. An adaptive management plan will need funding.
- The money to maintain parks could come from user fees. "If you want to use it – you need to pay for it".
- There is concern over developers trading land for less desirable areas for park and open space designation
- Some donated parks have been designated not to have user fees.
- Temescal Canyon area needs parks and could be different types at different sites

Lake Elsinore and Wetlands

- Lake ownership issues include: the bottom, water and surface areas – these are all owned by different parties
- Land around lake is all privately owned. The launch ramp is the only revenue generator for the City
- We need to increase awareness of wetland areas and their benefits

Voter Involvement

- There could be $57 million dollars for parks in the Inland area is state bond passes
- Low local voter turnout has hurt local after school programs, especially those associated with the Ortega Trail

RESPONSE TO INTERACTIVE EXERCISE QUESTION,
"If I could change one thing in Riverside County, it would be . . ."

- Political representation. Meadowbrook is split between three County Supervisors that's why nothing is ever achieved.
- Speed limit enforcement on 74. And we see too much passing on double lines
- Do the 74 in Meadowbrook
- To build a community center and provide public transportation in Meadowbrook

WHAT RESIDENTS VALUE . . .

GROUP DISCUSSION COMMENTS & WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"
"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ." (Interactive exercise responses are indicated with an asterisk*)

- Open Space (6) "Preserve, carefully planned"
- Affordable housing
- Country life style

You really have to see:

- Donkey, pigs, sheep, ducks, chicken, dogs, cats, and k-rats *
- The outlet center *

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
Transportations "Winners" and "Losers"

Winners

- None Mentioned

Losers

- Lack of planning and permitting development without infrastructure
- Planned rerouting of Cajalco Road

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"When I spend time outdoors, I enjoy doing..."

- Reading and gardening

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- Citrus Park
- Mystic Lake (2)
- Temescal Wash

"What do you like about this special place?"

- Scenic landscapes
- Except for farming, it is pretty much left natural
- Natural area

"Why is this place important to you?"

- Historical value
- Natural habitats
- It is neat to see all the birds and wildlife

Riverside County Integrated Plan
Community Workshop Summary

PERRIS
July 8, 1999

General Plan Discussion

Land Use

- Loss of agricultural land should be addressed.
- Important to recognize that development standards and interests may differ between very rural area and urban areas. For example, rural areas with migrant workers need economic opportunities --jobs!
- We need soft transitions between urban areas and open space habitats. Important to establish urban limit lines.
- We want well-planned growth that makes development economically feasible
- Development is fine if we keep our small-town-feel

Circulation

- Transportation needs to be improved for all. East/west corridors especially.

Housing

- Adequate lot size is preferred over small lots with large homes
- A variety of housing styles is preferred, including a mix of lot sizes, to avoid boring developments. Design standards would help.

Open Space

- Higher density is fine if open space is allocated for public use (trails, parks) within developments.
- Ecosystem approach preferred over establishing large areas for habitat. Development shouldn't be disrupted. Clarity of purpose for habitat preservation is important.

Conservation

- Water resources need to be address

Other Comments
Economic Development

- Jobs and housing balance is a concern.

American Indians

- Tribal councils should be involved in this planning.

Transportation Discussion

Overall Issues and Observations

Transportation and Access Issues

- Interested in seeing Metrolink to Perris, especially the downtown area
- Why does LAFCO draw boundaries down the middle of the road? Meadow Brook has been paying for thirty-five years
- Ensure coordination of improvements
- Need public transportation to poorer areas in order to facilitate welfare-to-work programs (3)
- Need other transportation options like shuttles and T.R.I.P
- Especially need inter-city transportation
- Avoid impacting cities and communities trough transportation facilities that create sprawl
- Explore alternative modes of transportation
- Make cities more self contained to promote walking and biking
- Create landscaped, appealing freeways
- We need more freeways
- Need better communication between Caltrans and RCTC to speed economic development
- Need many modes of transportation plus good inter-modal connections, such as pedestrian facilities and shelters and equestrian trails
- Balance increasing alternative arterioles with open space

Issues Concerning Highway 74

- Concern regarding widening of Highway 74. People are frustrated about impacts. Need better communication with residents
- Concerned regarding large housing development project. Need better communication with residents
- County needs to be more involved in envisioning Highway 74 improvements. Caltrans and the county are not in sync. It is unclear what the right-of-way impacts will be
- Need to fast track the environmental review process and identified improvements

Comments from Transportation Map

- County work-welfare program representative is concerned about lack of transit service along Gavilan and Cajalco roads: people living in these areas need access to jobs in Perris and Temecula
- State parks representative expressed interest in working with the planning effort to enhance wildlife corridors between Perris Lake and San Jacinot Wildlife Preserve. Also concerned with the widening of the 71 freeway and that it not expand outside current right-of-way
- Need an east-west connection, especially to serve traffic from Eastside Reservoir
- Make highway 74 a direct connection
- Improve the 4th Street – Placentia ramps
- Need freeway to continue the alignment of 79 north to 74 to the 60
- Need access north from the 60 to San Bernardino County
- Need expressway along Cajalco Road

- Need Metrorail extension to Perris from Riverside

Multiple Species Habitat Conservation Plan Discussion

Special Places In Riverside County That Need To Be Maintained

San Jacinto Riverbed	Mystic Lake	Lake Perris	San Jacinto Wildlife Area

Waterways

- We need to preserve natural waterways
- We need to keep the San Jacinto riverbed natural
- People support the state conservation board buying areas surrounding Mystic Lake
- We need to keep Mystic Lake shallow -- Lake Perris is a deep water lake

Preservation and Open Space

- We need to preserve open space
- The plan needs to strike a balance between growth and preservation
- The cost of preserving open space is not "too much" -- it will be much more expensive later
- We want urban limit lines for cities to prevent further annexation
- Community members love the open space and rural character of area
- We need to make a connection between rural character and preservation of open space
- Perris and surrounding areas need more parks, both passive and active

Wildlife and Habitat Conservation

- Sycamore Canyon needs a habitat conservation area
- There is a lack of connectivity of areas
- There are economic issues in preservation, again the key is balancing preservation with growth
- New and existing freeways and arterials need to maintain or create habitat corridor crossings
- Improvement" is defined as returning area to whatever the historic habitat and natural dynamic was

Transportation Corridors

- There is a concern that people will want a north/south corridor that could cut through the San Jacinto Wildlife Area and Mystic Lake. We want alternative forms of transportation realized first
- Measure A has not been implemented. It included rail into Perris and improvements on Highway 74
- The Highway 74 extension will hurt downtown Perris and could pose safety issues for schoolchildren trying to cross
- There is a need for a Chino Hills and Prado Base connection

RESPONSES TO INTERACTIVE EXERCISE,
"If you could change one thing in Riverside County, it would be . . ."

- Transportation for the elderly in areas like Hemet. Better access to L.A.
- Metrolink connection to and from the communities to cut down traffic and emissions
- Upkeep on roads especially concentrating in Mead Valley. Develop Cajalco to be 4 lanes traveling to Corona
- Political mind set from conservative thinking to Democratic, Dialectic view

WHAT RESIDENTS VALUE . . .

GROUP DISCUSSION COMMENTS & WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"
"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ." (Interactive exercise comments are noted with an asterisk*)

- Parks
- Small town feel
- Rural areas (3)
- The people – genuine and caring
- Community involvement – ability to shape our community
- Green grass and flowing water
- Education facilities, colleges/universities *
- Career alternatives *
- Proximity to oceans, mountains, deserts *
- Orange groves *
- Orange Festival, Market street where I can play in misters and see waterfalls. I like hiking in Citrus Park (Van Buren). (comments from a five year old child) *

You really have to see:

- BMX (Perris Speedway) raceway* (comments from a nine year old child)

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"When I spend time outdoors, I enjoy doing..."

- Landscaping (at home), passive use of open space, picnics, fishing, and walking and observing
- Gardening, hiking (2), camping

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- Lake Perris
- SJ CDFG Reserve
- None in particular, but any place with groves of trees, water ways and hillsides

"What do you like about this special place?"

- It's bio-diversity
- These types of places allow us to unwind, to think. Kin of like having a window with a view at your office

"Why is this place important to you?"

- It is a SKR love reserve and I'd like to see it expanded and preserved

Riverside County Integrated Plan
Community Workshop Summary

BLYTHE
July 13, 1999

Note: At this workshop, there was a combined discussion of General Plan, Multiple Species Habitat Conservation Plan and Transportation issues.

Land Use

- Land use designations make it prohibitive for low-income populations to have an affordable home --(For example, mobile (affordable) homes aren't allowed in some areas by zoning code).

Housing

- Housing shortage exists, in general, because of large number of prison employees (have moved in)
- Lack of affordable homes in our area; too much sub-standard housing exists in low-income areas, such as Ripley, (near Blythe) with outdoor plumbing ("outhouses") in some cases.

Conservation (Preservation)

- Important to preserve ancient Native American sacred sites, such as Giant Intaglios Figures

Safety

- (The need for) Hydrocarbon mitigation --as petroleum products from previous gas stations mix with the high water table --affects development (prohibitively expensive) along Hobsonway

RESPONSE TO INTERACTIVE EXERCISE QUESTION,
"If I could change one thing in Riverside County, it would be . . ."

- This area is referred to as the stepchild of Riverside County. We are sometimes forgotten communities and left out of projects, plans, etc.

WHAT RESIDENTS VALUE . . .

GROUP DISCUSSION COMMENTS & WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"
"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ." (Interactive exercise comments are noted with an asterisk*)

- Generations of my family have lived here

You really have to see:

- Sacred sites and surrounding hills that are filled with petroglyphs and geoglyphs. *
- Richness of culture. You really have to see the Colorado River and Intaglios *

Riverside County Integrated Plan
Community Workshop Summary

HEMET
July 15, 1999

General Plan Discussion

Land Use

- Schools need physical improvements.
- School facilities should offer multi-uses.
- Concern for the policy of large parcel zoning (one dwelling unit per 10 acre) in Eastside Reservoir area. (May be too restrictive)
- Should use the expertise of agricultural landowners (regarding economic feasibility) to determine agricultural land policies. Consider the use of T.D.R. (as in northern California).
- Need more development within the city.
- Developers need to consider infrastructure demands, and water resources before building.
- Regarding vacant areas: land use projections and possible impacts should be considered.

Circulation

- Streets are too narrow. Can't ride bikes or walk safely. Weren't designed to support change in Hemet from retirement community to family community. Need to examine patterns of growth impacts --not just circulation --on families.
- There's inadequate public transportation.
- Alternative modes of transportation needed.

Open Space

- Need more green space in developments.

Other Comments

Coordination Between Agencies

- Need better planning between schools, states, and cities to correlate the needs/ways to meet those needs.
- Need streamlined permit process for development.

Social Issues

- Community youths need pre-job training and more activities.
- Important to provide senior services and intergenerational activities (such as mentoring of youth by seniors)
- Community needs more access to information about the services (mentoring, for example) that are available. We should tap into the local colleges as resources.

Transportation Discussion

Overall Issues and Observations

- People support the concept of having an integrated planning process:
- It is important to plan and put improvements in place before it's too late
- People need to thing "big picture" for Riverside County and not focus on the small things
- People need to consider wants vs. needs
- There is great value in getting to know County staff as people – and having them answer your questions and concerns. They are more responsive than people sometimes give them credit for!
- Residents need to support Measure A and get it re-voted
- But there are some who question what has been done with Measure A
- Volunteers are a key resource in the Hemet community – as people age the lack of public transit will be a hindrance to this resource

Transportation and Access Issues

Transportation and Development

- There is a need to consider land use and transportation connections:
- We anticipate an influx of visitors to the Reservoir – what will be the impact on corridors?
- Transit needs to be linked to job access, opportunities and development – For example, DPSS is relocating to the old Sears building – what will access be like?
- There needs to be transit linkage to the colleges

Rail and Guideways

- Rail is a need and an opportunity:
- Passenger rail needs to be extended and expanded
- Light rail should be considered
- The freeway corridors could be used to move buses
- Rail speed needs to be improved for freight
- People need to consider the rail-economic development connection

Public Transit Access

- Public transit in general is a problem in the area. There is lack of knowledge and confidence in the system:
- Some contend that no one believes in mass transit
- Some question whether people in the area will ever use transit
- The Southern California population in general is difficult to serve with transit
- Low demand causes less use and higher per-passenger costs
- The public should be re-educated about mass transit and its benefits
- More buses are needed but long delivery time is an issue

Special Transportation Issues

- There are serious gaps and needs in the transit system:
  - Dial-a-Ride is "the joke of the Valley" – the bumping system results in cancellation of trips at the last minute and people in the middle (specifically Seniors who aren't disabled) fall through the cracks
  - There is no transportation for kids after school – no one is responsible
  - A park-and-ride is needed – especially at Ramona and Sanderson – where car-poolers could meet up

Highway Issues

- The area needs better roads out of town:
- The area is sometimes "locked in" after rainstorms because of eroded or flooded roads – Drainage is especially a problem on 79, South State, Ramona and the bridge to Idyllwild
- Overall quality and capacity of the roadway system serving Hemet blocks emergency and other access
- Highway 79 needs improvement – some things are being done but more is needed
- Highway 74 between Perris and Elsinore is also dangerous
- Ramona Expressway needs to be expanded to 4 lanes and extended to Valle Vista
- Hemet needs to be connected to the airport

Multiple Species Habitat Conservation Plan Discussion

Overall Issues and Observations:

- Concerned about the assumptions of the doubling of population --self-defeating assumption
- Let's see projections and policy decisions
- Concern that the Kangaroo Rat process took eight years. That one species took so long, how long will a multiple species process take?
- Like animals --but how about private property rights? A balance is needed between preservation and property rights.
- Concern that Kangaroo Rat property has been removed from tax rolls
- Do not want the area to be like the San Fernando Valley
- Recognize that the Board of Supervisors has the final decision
- The state and federal government have to help with land acquisition.
- Endangered species study. How in depth is it?
- How do other species interact?

Community Involvement

- Need more input into policy decisions. Community needs to be actively involved.

Housing and Redevelopment Issues

- Low lands development is more accessible.
- Incentive should be provided for farmers to preserve agricultural land

Area Asset

- Eastside Reservoir --New recreation areas attract water contact, boating, camping, golf

Transportation

- Transportation issues surround Eastside Reservoir. Shouldn't impact surrounding communities.

Requirements for the Plan

- The Plan should include funding mechanisms--One area should not have to pay for all of it.
- Green belt areas
- Reforest where fire damage
- More open space/with reason
- Want to make sure plan looks at integrated corridors
- The MSHCP should rely on existing information, data generated at University of California at Riverside, while gathering new data
- Study resources collaboratively with University of California at Riverside
- It was suggested that there be a computer keyword search –MSHCP

Development and Open Space

- Concern about preserving snakes, gophers, rodent population
- Need healthy natural areas
- Islands --for the most part self-managing but as developing encroaches, they need more outside managing

RESPONSE TO INTERACTIVE EXERCISE QUESTION,
"If I could change one thing in Riverside County, it would be . . ."

- Transportation within our community and to nearby communities (3) *

WHAT RESIDENTS VALUE . . .

GROUP DISCUSSION COMMENTS & WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"
"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ." (Interactive exercise comments are noted with an asterisk*)

- County services are good
- Building department was very helpful, easy to work with.
- Friendly, small town feeling (3) *
- Community involvement thrives *
- Preservation of the natural environment *
- Natural beauty *

You really have to see:

- The Ramona Bowl and the mountains *
- The Natural History Museum *
- Idyllwild and our hills *
- The new reservoir (3) *

- Sight from driving from Lamb's canyon

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
Transportations "Winners" and "Losers"

Winners

- Retirement areas provide own transportation
- Road to Idyllwild is o.k.
- Traffic lights on Florida provide almost non-stop flow of traffic
- There are a lot of routes to travel in lots of directions

Losers

- Need improved bus service between Hemet and Riverside or extension of Light Rail Service
- Stetson at Soboba needs repaving
- Seniors who shouldn't be driving are still driving!
- Efforts should be increased to encourage commuters to carpool!
- The damage that cars and trucks do to air quality
- Road condition – repave 79
- Divide and widen Ramona Expressway

RESPONSE TO THE INTERACTIVE EXERCISE QUESTION:
"When I spend time outdoors, I enjoy doing…"

- Fishing, deer hunting, water skiing, hiking, softball
- Gardening, picnic in mountains, hike a bit in forest with NO FEE!
- Hiking, swimming and driving through the county discovering new places
- Camping, fishing, bike riding, hiking and swimming

"Is there a special natural place in Western Riverside County that is important to you to maintain? (i.e. Lake Matthews, Santa Rosa Plateau)"

- Simpson Park
- Mount San Jacinto

"What do you like about this special place?"

- It's naturalness
- All of Mount San Jacinto range

"Why is this place important to you?"

- Beauty / quiet / space
- For my soul

Riverside County Integrated Plan
Community Workshop Summary

SUN CITY
July 16, 1999

General Plan Discussion

Land Use

- How will growth be accommodated and our rural beauty preserved?
- There's an inadequacy of school sites ---and parks --for our growing population.
- We're not anti-growth but we need a balance between progress and growth.
- Urban limit lines (as in Portland) would control growth.

Housing

- We need mix of housing styles (single family, apartments) to meet needs and lifestyles.

Circulation

- Roads in our area need to be improved (better maintenance).
- Transportation corridors will destroy rural qualities by inducing growth.

Open Space

- Natural wild life is better than more housing.

Conservation

- Water quality is a concern.

Other Comments

Quality of Life

- It's getting too crowded. Crowds are visiting the dam and causing littering and speeding on our streets.

Economic Development

- We need jobs for growing population ...Let's make them clean industries so we have no more air pollution.

Communication

- We need better communication with county. There's no contact when we have a problem.
- Need clarity of language so we know what's being proposed. (Recent rezoning made some people feel confused, frustrated).

Land Value

- The value of my property has been devalued so much I can't sell (Why I am still living here.)

Transportation Discussion

Overall Issues and Observations

- Sun City is an unincorporated area and has no "official" representation
- However, incorporation would be difficult because of the area's limited tax base
- In addition, people in the area couldn't afford the taxes
- One possibility is to get a Civic Association together that would represent the area for the County Supervisor – However, the question would be defining the boundaries: who is represented inside and outside of Sun City?
- The public needs to know the details of road plans – there are many uncertainties and questions:
- What are the dates of completion
- What types of improvements are planned
- How can the County best get the word out?

Transportation and Access Issues

Public Transportation

- The dial-a-ride service is outrageous:
- There is a long wait for people calling in to schedule rides
- The return trip scheduling is unreliable
- There is no driver assistance – drivers seem to use excuses not to access facilities (for example, overhanging trees damaging vehicles)
- For much of the service, people have to be ADA certified – however, the only certification is done in Riverside
- Fixed route service no longer meets the area's needs:
- Services have been cut – trips that used to take an hour now take 2 to 3 hours
- For policy reasons, welfare to work transportation has replaced Senior transportation

Highways and Roads

- Newport widening is necessary but controversial:
- Widening Newport will bring in more traffic
- But it brings better transportation – we need to realize that growth is going to happen
- There are left turn problems out of driveways
- Scott Road should be considered as an alternative
- Development has had an impact on roads – especially Newport but, in general, all east-west connections:
- There is much development on the books along Newport Boulevard from Goetz to Menifee
- We have fantastic freeways but development brings truck traffic – especially gravel trucks
- Other Access Issues:
- Road condition in Riverside County is poor
- There is confusion on Eastside Reservoir access plans – does the County have them?
- The area supports French Valley airport expansion plans

- The area isn't particularly interested in regional transportation – even if people had regional transportation they couldn't get to it

Multiple Species Habitat Conservation Plan Discussion

Special Places in Riverside County That Need To Be Maintained

Lake Matthews	Santa Rosa Plateau	Hills behind the west side of Sun City
Mystic Lake	North Peak	Warm Springs Creek
Ortega Highway	Cleveland National Forest	Kabian Park – Bureau of Land Management and County land

Issue Areas:

Overall Issues and Observations:

- Many people moved to Riverside County for open space and the rural feel of the County
- The Plan needs to have an adaptive management plan
- Less responsible people should not be able to sue due to negligence

Housing and Redevelopment Issues:

- Want to preserve landowners' rights
- Need to balance preservation with property rights

Open Space:

- Some areas should be reserved for observations – not all should be for active recreation
- Areas without access could be kept as "extras" to other preservation areas
- Need to have open space between cities
- We have trails in place – we need to build from existing resources
- There is plenty of recreation available
- People are concerned about litter in recreational areas

Habitat Preservation:

- Need to have information on rules and "common sense" in dealing with wildlife
- For botanical species, translocation can be unique – it is associated with soils
- Needs to be a native-exotic balance
- Larger animals require larger areas to roam but population growth can get in the way
- Animals need corridors and areas without intrusion from people
- Diversity is key to a healthy habitat
- The food chain can be disrupted by development

RESPONSE TO INTERACTIVE EXERCISE QUESTION, *"If I could change one thing in Riverside County, it would be . . ."*

- Their attitude towards the people who they are supposed to be trying to serve.

WHAT RESIDENTS VALUE . . .

GROUP DISCUSSION COMMENTS & WRITTEN COMMENTS FROM INTERACTIVE EXERCISE, "POSTCARD HOME,"

"I moved here/am still living here because . . ." & "When you come visit me you really have to see . . ." (Interactive exercise comments are noted with an asterisk*)

- Open space
- Rural life style
- Wild animals (No more cows, though!)
- Potential to accommodate growth by planning. (We can) take the best of Orange County and mix with our rural life style.
- I love the area and the quiet. You really have to see the mountains, blue skies, clean air, the stars at night (2) *
- I am living here because it is so clean, well-maintained, low crime rate and mainly the very nice senior areas. *

You really have to see:

- My trees and flowers, nice view of the hills. *
- The wineries in Temecula and the reservoir that's being built *
- The nice people who live here (2) *

Appendix E-1:
Socioeconomic Build-Out Assumptions and Methodology

Appendix E-*1*: Socioeconomic Build-Out ~~Projections~~ Assumptions and Methodology

The following *document* ~~paper~~ provides a description of the assumptions and methods used to determine population, housing, and employment projections for the Riverside County General Plan Land Uses. *Appendix E-1 factors, assumptions and methods were used in preparing the updated General Plan and associated analyses.*

Assumptions & Methodology

The projections developed represent a range of estimates for potential population, dwelling units, and employment for the unincorporated areas of Riverside County. The General Plan land uses serve as the basis for these projections. A key assumption in understanding the magnitude of these projections is that the projections reflect a theoretical build-out of all unincorporated areas, rather than what is likely to appear on the ground over the next 20 years.

Land use designations differ among jurisdictions for a variety of reasons including unique physical and geographic characteristics, market forces, and varying community desires. There are no industry standards for population density or building intensity that can be applied to the new land use designations created for the Riverside County General Plan. ULI Handbooks, SCAG data, General Plans of cities within Riverside County and contemporary planning experience have been used to define the factors below to estimate Riverside County's future socioeconomic environment.

I. Residential: Population, Dwelling Units & Potential Workers

Gross Acres: Land use designation acreages were derived from GIS-based calculations for each of the Area Plans and the remaining unincorporated areas.

DU/AC (dwelling units per acre): A range of dwelling units per acre are identified for residential land use designations as well as for other designations that allow for limited residential uses (i.e., Rural Mountainous). As indicated *in Table E-1,* below, the range includes a minimum and maximum density for each designation as well as a midpoint. These ranges have been established based on actual product types and account for roads, rights-of ways, easements and public facilities typically found in residential areas such as elementary schools, parks, etc.

Table E-1: Residential Housing Density Ranges

Land Use Designation	DU/AC		
	Minimum	Midpoint*	Maximum
Agriculture (AG)	0	0.05	0.1
Rural Residential (RR)	0.1	0.15	0.2
Rural Mountainous (RM)	0	0.05	0.1
Rural Desert (RD)	0	0.05	0.1
Open Space – Rural (OS-RUR)	0	0.025	0.05
Estate Density (EDR) (RC and CD)	*0.2*	*0.35*	*0.5*
Very Low Density (VLDR) *(RC and CD)*	~~0.4~~ *0.5*	~~1.2~~ *0.75*	~~2~~ *1.0*
Low Density (LDR) *(RC and CD)*	~~2~~ *1.0*	~~3.5~~ *1.5*	~~5~~ *2.0*
Medium Density (MDR)	~~5~~ *2.0*	~~6.5~~ *3.5*	~~8~~ *5.0*
Medium High Density (MHDR)	~~8~~ *5.0*	~~11~~ *6.5*	~~14~~ *8.0*
High Density (HDR)	~~14~~ *8.0*	~~17~~ *11.0*	~~20~~ *14.0*
Very High Density (VHDR)	~~20~~ *14.0*	~~30~~ *17.0*	~~40~~ *20.0*
Highest Density (HHDR)	*20.0*	*30.0*	*40.0*

**Factor used for theoretical build-out calculations.*

Dwelling Units (DU): Dwelling unit projections are estimated by multiplying the number of gross acres by the DU/AC factor ranges for each land use designation. For example, 400 acres of ~~Low~~ *Medium* Density Residential with a density range of 2, 3.5, and 5 DU/AC would result in a range of 800; 1,400; and 2,000 DUs respectively.

Average Household Size: To reflect the variations of household size between different regions of Riverside County, separate average household size figures were used to determine population *on an Area Plan level basis.* ~~Western Riverside County, with the exception of REMAP, uses a factor of 3.01 persons. A factor of 2.97[1] persons was used for REMAP, Western Coachella Valley, Eastern Coachella Valley, Desert Center and Palo Verde Valley~~. *Table E-2 outlines average person per household by area plans, which was derived from 2005 average household size in the unincorporated Riverside County.*

Table E-2: Average Household Size by Area Plan

Area Plan	Average Household Size
Desert Center	*3.61*
East County - Desert Area	*3.23*
Eastern Coachella Valley	*4.92*
Eastvale	*3.69*
Elsinore	*3.18*
Harvest Valley / Winchester	*2.91*
Highgrove	*3.21*
Jurupa	*3.68*
Lake Mathews / Woodcrest	*3.34*
Lakeview / Nuevo	*3.21*
March	*1.96*
Mead Valley	*3.79*
Palo Verde Valley	*3.00*
Reche Canyon / Badlands	*3.03*
REMAP	*2.74*
San Jacinto Valley	*2.82*
Southwest Area	*3.17*
Sun City / Menifee Valley	*2.51*
Temescal Canyon	*3.60*
The Pass	*2.88*
Western Coachella Valley	*2.56*

Population: Population is determined by multiplying the projected number of dwelling units by the average persons per household factor *of each Area Plans*. *The result was then multiplied by 0.95 to reflect a true and healthy community vacancy rate of 5%.* For example, 1,000 dwelling units ~~with~~ *in Desert Center Area Plan (DCAP) would have* an average persons per household size of ~~3.01~~ *3.61, with a healthy community vacancy rate of 5% applied, it* would yield ~~3,010~~ *3,460* residents.

~~Participation Rate: Participation rate, as defined in Riverside County Population and Employment Forecasts2, is the percent of the total population that is either employed or not employed but actively seeking employment. The report identifies a rate of 44.86% for Riverside County.~~

~~Potential Workers: Potential workers are determined by multiplying the total projected population for each residential land use designation by the labor force participation rate. For instance, a Medium Density Residential land use that yields a population of 15,000 would, in turn, yield 6,729 potential workers (15,000 x 0.4486 = 6,729).~~

II. Non-Residential: Building Square Footage & Employment

Employment generation for Commercial, Industrial and Business Park land uses were calculated using the following method:

Net Parcel Acres: To determine the actual amount of land available for development, gross acres must be converted to net acres*, as shown in Table E-3.* For Commercial, Heavy Industrial and Business Park land uses, 25% of the gross area is assumed to be reserved for roads, right-of-ways, easements, etc. Since the Light Industrial designation allows uses that

~~[1] Source: SCAG, 1998 RTP Adopted Forecast, April 1998~~
~~[2] Source: Riverside County Population and Employment Forecasts, Stanley R. Hoffman Associates, January 2000~~

typically require less land for roads, right-of-ways, easements, etc. (i.e., warehouses), a separate gross to net acre factor of 20% is assumed. The remaining 75% (80% for light industrial) of the area is the net acreage. For example, 200 gross acres of Commercial Retail is equal to 150 net acres. 200 gross acres of Light Industrial is equal to 160 net acres.

Table E-3: Net Parcel Acre Factors

Land Use Designation	*Net Parcel Area*
Commercial Retail (CR)	*0.75*
Commercial Tourist (CT)	*0.75*
Commercial Office (CO)	*0.75*
Light Industrial (LI)	*0.80*
Heavy Industrial (HI)	*0.75*
Business Park (BP)	*0.75*

Net Parcel Square Feet: To convert net acres to net square feet, net acres are multiplied by 43,560 *feet per acre*. For example, 50 net acres of Commercial Office (66.66 gross acres) equals 2,178,000 net square feet.

Floor Area Ratio (FAR)*:* Floor Area Ratio, or FAR, indicates the ratio of gross building square footage permitted on a parcel to net square footage of the parcel. FAR's for Commercial, Industrial and Business Park land uses are *identified, in Table E-4*, below. *See General Plan Glossary for full definition of FAR.*

Table E-4: Development FAR Factors

Land Use Designation	FAR		
	Minimum	Probable*	Maximum
Commercial Retail (CR)	0.20	0.23	0.35
Commercial Tourist (CT)	0.20	0.25	0.35
Commercial Office (CO)	0.25	0.35	1.00
Light Industrial (LI)	0.25	0.38	0.60
Heavy Industrial (HI)	0.15	0.40	0.50
Business Park (BP)	0.25	0.30	0.60

**Factor used for theoretical planning estimates.*

Building Square Footage: Building square footage for the land use designations listed in the table above are calculated by multiplying the Net Square Feet of each land use designation by the corresponding FAR. For instance, 20,000 square feet of Commercial Retail with an FAR of *0*.23 would yield 4,600 square feet of building space.

Square Feet (SF)/Employee Factor: This factor indicates the number of *employees typically associated with a given amount of* square feet of building space per employee. ~~and~~ *It* is used to estimate the number of jobs *resulting* for a given land use designation. These factors for the commercial land use designations are listed in ~~the t~~*Table E-5* below.

Table E-5: Commercial Employment Factors

Land Use Designation	SF/Employee
Commercial Retail (CR)*	500
Commercial Tourist (CT)	500
Commercial Office (CO)	300
Light Industrial (LI)	1,030
Heavy Industrial (HI)	1,500
Business Park (BP)	600

**It is assumed that CR designated lands will build out at 40% CR and 60% MDR.*

Employment: Employment for commercial, industrial, and business park land uses is calculated by dividing the total number of building square feet by the SF/Employee factor. For example, 300,000 square feet of commercial office building space would yield 1,000 employees.

Employment generation for Agriculture, Open Space Mineral Resources, and Open Space Recreation land uses were calculated by multiplying gross acreages by assumed employee per acre factors. Employee per acre factors for these designations were determined using the following methods:

Agriculture: The employee per acre figure, 0.05, was calculated by dividing the total number of farm workers in Riverside County in 1998[13] by the total number of agriculture acres in 1998[24].

Open Space - Mineral Resources: The employee per acre figure, 0.03, was calculated by dividing the total number of mining workers in Riverside County in 2000[35] by the total number of Mineral Extraction acres in 2000[46].

Open Space - Recreation: The employee per acre figure, 0.15, accounts for a variety of recreational uses such as golf courses, greenways, and parks and is based on employment figures for existing facilities.

Public Facilities: ~~Due to the variety of land uses within the Public Facilities category (i.e. airports, schools, landfills), one single factor can not be used to calculate employment. A variety of methods were used to arrive at a projection for each public facility such as site visits, telephone conversations with facilities and referencing applicable Specific Plans to reflect their actual number of employees.~~ *The employee per acre factor, 1.0, accounts for a variety of public facilities such as airports, schools, landfills, hospitals, etc. This factor is based on employment figures for existing facilities in the unincorporated portion of the county.*

Jobs-to-Workers Ratio

The jobs-to-workers ratio is an indicator of the potential employment opportunities for the local labor supply. The ratio is calculated simply by dividing the number of jobs yielded by the employment-generating land use designations by the number of potential workers generated by the residential land use designations.

Jobs-to-Housing Ratio

The jobs-to-housing ratio identifies potential imbalances between housing and employment opportunities. The ratio of jobs to housing is estimated by dividing the ~~number of~~ total number of projected jobs by the total number of projected dwelling units.

III. Special Land Use Assumptions Community Centers, Community Center Overlay, and Rural Village Overlay

Unlike the land use designations discussed thus far, the Community Center, Community Center Overlay, Rural Village Overlay designations, *and other overlays and policy areas* allow and encourage multiple uses. As such, these designations require unique methodologies for determining population, dwelling unit and employment projections.

A. Community Centers

Community Center Types: Every Community Center identified *in the General Plan* ~~on the land use plans~~ is one of four types: Village, Town, Job or Entertainment. Each type has a unique mix of residential and employment uses. ~~The t~~*T*able *E-6,* below, provides a typical land use breakdown for each type. The actual proportions of land uses per Community Center type may vary. The following are general guidelines intended to indicate the anticipated mix of uses and to provide a means for calculating estimated build-out projections. The actual land use breakdown will be determined on a case by case basis and may differ from the guidelines below.

[13] Source: Stanley R. Hoffman Associates
[24] Source: County of Riverside, Office of the Agricultural Commissioner
[35] Source: Stanley R. Hoffman Associates
[46] Source: The Numbers Document, RCIP GIS Team, May 2, 2000

Table E-6: Community Center Planning Assumptions

Land Use		Community Center Type			
		Village (VC)	**Town (TC)**	**Job (JC)**	**~~Entertainment (EC)~~ Job Center with No Residential (JCNR)**
Residential	*Highest Density*		*5%*	*5%*	
	Very High Density	*10%*	~~5%~~ *10%*	5%	
	High Density	~~10%~~ *20%*	~~10%~~	~~5%~~	~~10%~~
	Medium High Density	20%			~~5%~~
	Residential Subtotal	***50%***	***15%***	***10%***	~~***15%***~~ ***0%***
Employment	Commercial Retail	30%	40%	15%	~~20%~~ *15%*
	Commercial Office	10%	40%	10%	10%
	Commercial Tourist				~~35%~~
	Light Industrial			30%	*30%*
	Business Park			30%	*30%*
	Employment Subtotal	***40%***	***80%***	***85%***	~~***65%***~~ ***85%***
Other	Public Facility (Civic)and/or Open Space	10%	5%	5%	~~20%~~ *15%*
	Acreage Total	***100%***	***100%***	***100%***	***100%***

Table E-7: Community Centers Identified in the General Plan

Community Center Land Use Designation	
Area Plan - Community	***Community Center Type for Land Use Assumption***
Eastern Coachella Valley- Mecca	*Village Center (VC)*
Lakeview/Nuevo- Nuevo (Ramona Expressway)	*Village Center (VC)*
Lakeview/Nuevo- Nuevo (Nuevo Road)	*Village Center (VC)*
~~Mead Valley- Mead Valley~~	~~Job Center (No Residential)(JCNR)~~
Temescal Canyon- Glen Ivy Hot Springs	*Job Center (No Residential)(JCNR)**

~~*Job Center – No Residential: 10% of the residential density designation is transferred to "other".~~

Acreages: Once the Community Center type is established, the number of acres of each land use can be calculated by multiplying the percentage of each land use designation by the total number of acres for the Community Center. For example, a 50-acre Village Center would assume 10% (5 acres) *Very* High Density Residential, 20% (10 acres) ~~Medium~~ High Density Residential, 20% (10 acres) Medium *High* Density Residential, 30% (15 acres) Commercial Retail, 10% (5 acres) Commercial Office, and 10% (5 acres) other. *Once calculated, these values are incorporated into the applicable General Plan land use planning tables, such as Table 4 for each area plan.*

Community Center: Residential

After acreages are determined, dwelling unit (DU) and population figures are calculated using the previous methodology for each residential designation. A 100-acre Town Center, for instance, would include 10% (10 acres) of *Very* High Density Residential and 5% (5 acres) ~~Very~~ High*est* Density Residential. Using the previous methodology, the 100-acre Town Center would yield 170 *Very* High Density DUs (10 ac x 17 DU/AC = ~~85~~ *170* DUs) and 150 ~~Very~~ High*est* Density *(5 ac x 30 DU/AC = 150 DUs)* DUs, for a total of 320 DUs. Using an average persons per household factor of 3.01, the Village Center would yield 963 residents (320 DUs x 3.01 persons per household = 963).

Community Center: Employment

For employment generating land uses in community centers, the number of jobs is calculated using the same method as described before: (Net Acres x 43,560 x FAR)/(SF per employee). Due to the concentrated nature of Community Centers and due to the varying mix of employment generating land uses within each Community Center type, the building intensity, or FAR, for each land use is typically greater in Community Centers than in areas designated for single uses and varies among the types. The square footage per employee factor remains the same as the single use land use designations. These factors are described as follows:

Table E-8: Community Center Land Use Factors

Community Center Type	FAR			SF/Emp.
	Minimum	Probable*	Maximum	
Village Center (VC)				
Commercial Retail	0.20	0.30	0.50	500
Commercial Office	0.25	0.50	1.00	300
Town Center (TC)				
Commercial Retail	0.20	1.00	1.50	500
Commercial Office	0.25	1.50	3.00	300
Job Center (JC)/*Job Center No Residential (JCNR)*				
Commercial Retail	0.20	0.40	0.50	500
Commercial Office	0.25	1.00	2.00	300
Light Industrial	0.25	0.38	0.60	1,030
Business Park	0.25	0.30	0.60	600
~~Entertainment Center (EC)~~				
~~Commercial Retail~~	~~0.20~~	~~0.40~~	~~0.50~~	~~500~~
~~Commercial Office~~	~~0.25~~	~~0.75~~	~~1.50~~	~~300~~
~~Commercial Tourist~~	~~0.20~~	~~0.30~~	~~0.50~~	~~500~~

**Factors used for planning estimates.*

For example, in a 100-acre Village Center, 30 acres (30%) would be designated as Commercial Retail and 10 acres (10%) as Commercial Office. Gross acres would be converted to net acres (30 x .75 = 22.5 net acres and 10 X 0.75 = 7.5 net acres). Next, to calculate net square footage, FARs would be applied to the net square feet (22.5 net acres x 43,560 sf X .30 = 294,030 net sf and 7.5 net acres x 43,560 sf X .50 = 163,350 net sf, or a total of 457,380 net sf). To calculate estimated employment, net square footage is divided by the SF per employee factor for each land use (294,030 net sf ÷ 500 = 588 employees and 163,350 net sf ÷ 300 = 546 employees, for a total estimated employment of 1,134).

Mixed Use Planning Areas

The Mixed-Use Planning Area land use designation is intended to reflect a mixture of higher intensity land uses generally appropriate for core urban or other specialized areas. The intent of the designation is not to identify a particular mixture of intensity of land uses, but to designate areas where a mixture of residential, commercial, office, entertainment, educational, and/or recreational uses, or other uses is planned. Many of the Mixed-Use Planning Areas are located in specific plans. The following are general guidelines intended to indicate the anticipated mix of uses and to provide a means for calculating estimated build-out projections. The actual land use breakdown will be determined on a case by case basis and may differ from the guidelines below.

Table E-9: Mixed Use Planning Area Assumptions

Area Plan	*MHDR*	*HDR*	*VHDR*	*HHDR*	*CR*	*CT*	*CO*	*PF*	*MDR*
San Jacinto Valley			*10%*	*5%*	*40%*		*40%*	*5%*	
Southwest			*10%*	*5%*	*40%*		*40%*	*5%*	
Harvest Valley/ Winchester	*20%*	*20%*	*10%*		*30%*		*10%*	*10%*	
Western Coachella Valley					*20%*	*80%*			
Lakeview / Nuevo	*11%*	*22%*	*32%*		*14%*			*21%*	

B. Land Use Overlays

Community Center Overlay*s*

The Community Center overlay provides an option for development at the densities and intensities permitted by the underlying land use or at the densities and intensities permitted by the Community Center designation. While these areas may ultimately build out at the underlying land use densities, projections for these areas reflect the more intense uses allowed within Community Center to avoid underestimating the numbers of residents and employees that could occur. Build-out estimates for Community Center Overlays will be calculated using the same method as Community Centers.

Table E-10: Community Center Overlays in the General Plan

Community Center Overlay	
Area Plan - Community	**Community Center Type for Land Use Assumption**
Eastvale- Mira Loma	Job Center (JC)
Eastvale- Eastvale (Archibald Avenue)	Village Center(VC)
Eastern Coachella Valley	Village Center (VC)
Harvest Valley/Winchester- Winchester	Town Center (TC)
Harvest Valley/Winchester- French Valley	Village Center (VC)
Jurupa- Mira Loma	Village Center (VC)
Jurupa- Rubidoux	Village Center (VC)
Southwest- French Valley	Village Center (VC)
Mead Valley – I215	Job Center (JC)
The Pass- Cabazon	Underlying Land Use

Rural Village *Land Use* Overlay*s (RVLUO) and Rural Village Overlays (RVO)*

The Rural Village *Land Use* Overlay and *Rural Village Overlays* allows a concentration of residential and commercial uses over and above what is permitted by the underlying land use designation, ~~typically Rural Residential or Very Low Density Residential.~~ While these areas may ultimately build out at the underlying land use densities, *socio-economic build out* ~~projections~~ for these areas reflect the more intense uses allowed within Rural Villages to avoid underestimating the numbers of residents and employees that could occur within the Rural Village. ~~For projection purposes, the following range of density and intensity standards were applied. It is assumed that 50% of the land area will be Low and Medium Density Residential and the remaining 50% will be Commercial Retail.~~

Table E-11: Rural Village Factors and Planning Assumptions

~~Land Use Designation~~	~~FAR or DU/Acre~~		
	~~Minimum~~	~~Probable*~~	~~Maximum~~
~~Rural Village – Commercial Retail~~	~~0.20~~	~~0.23~~	~~0.35~~
~~Rural Village – Residential~~	~~2.0~~	~~5.0~~	~~8.0~~
RURAL VILLAGE OVERLAY			
Area Plan - Community	*Land Use Assumption*		
Western Coachella Valley – Sky Valley	*EDR-RC*[+] and CR (5 acres only)*		
RURAL VILLAGE LAND USE OVERLAY			
Area Plans - Community	*Land Use Assumption*		
Elsinore – Meadowbrook	*Alternate Land Use (See Figure ELAP-5)*		
Mead Valley – Good Hope	*Alternate Land Use (See Figure MVAP-5)*		

~~*Factor used for theoretical build-out calculations.~~
**EDR-RC*[+]: 2.5 AC Minimum (0.3 DU/AC = Midpoint)*

For example, a 50-acre Rural Residential parcel with a Rural Village Overlay would be comprised of 25 acres of ~~Low~~ *Medium* and Medium *High* Density Residential and 25 acres of Commercial Retail. For residential uses, the 50-acre parcel would yield a range of 50, 125, and 200 DUs (25 ac x 2 du/ac, 25 ac x 5 du/ac, and 25 ac x 8 du/ac) and a population range of 150, 376, and 602 (50 du x 3.01, 125 du x 3.01, 200 du x 3.01). Employment would be calculated by multiplying the number of acres by the gross to net factor (25 x .75 = 18.75 net acres) then converted to net square feet (18.75 x 43,560 = 816,750), then multiplied by the FAR range (0.20, 0.23, and 0.35) then divided by the Square Footage per Employee factor (500) for a range of 327, 376, and 572 employees.

Community Development Overlay

The Community Development Overlay is a tool that allows Community Development land use designations to be applied through General Plan Amendments in the future within specified areas lying within Rural, Rural Community, Agriculture, or Open Space Foundation Component areas, while maintaining the underlying land use designations of these other foundation components until such time as the Community Development land uses are approved. The following are general guidelines intended to indicate the anticipated mix of uses in each one of the community development overlay and to provide a means for calculating estimated build-out projections. The actual land use breakdown will be determined on a case by case basis and may differ from the guidelines below.

Table E-12: Community Development Overlay Assumptions														
AREA PLAN/ Community	VLDR	LDR	MDR	MHDR	HDR	VHDR	HHDR	CR	CT	LI	HI	BP	MDR ‡*	OS-R
Jurupa														
Sunny slope	15%	15%	16%					4%	1%	45%	1%	3%		
Belltown								100%						
Southwest														
Winchester				15%	25%	20%	15%	25%						
Lakeview/Nuevo														
Lakeview	15%	15%	16%					4%	1%	45%	1%	3%		
The Pass														
Banning	15%	15%	16%	30%	5%	1%	1%	4%	3%	6%	1%	3%		
Eastern Coachella Valley														
East Jackson				100%										
Lemon					100%									
Middleton				100%										
Blossom	5%	5%	5%	32%	9%	3%	1%	6%	7%	24%	1%	2%		
70th	5%	5%	5%	32%	9%	3%	1%	6%	7%	24%	1%	2%		
64th				92%			4%							4%
W. Monroe				100%										
66th					25%		25%	25%		25%				
Mecca	5%	5%	5%	32%	9%	3%	1%	6%	7%	24%	1%	2%		
Vista Santa Rosa(VSR)	5%	5%	5%	45%				6%	7%	24%	1%	2%		
55th - VSR													50%	50%
66th - VSR				100%										
Desert Center														
Desert Center	5%	5%	5%	32%	9%	3%	1%	6%	7%	24%	1%	2%		

* MDR‡: DU: Min. 1.0, Max. 3.0, Mid. 2.0

Specific Community Development Designation Overlays

To provide for local flexibility, the County of Riverside may choose to designate properties within any foundation component with a specific community development designation overlay. The application of a Specific Community Development Designation Overlay to properties within any foundation component other than the Community Development foundation component may only occur in conjunction with the initial adoption of the General Plan and with the eight year cycles. In situations where the underlying designation is within a different foundation component, the specific community development designation overlay provides an exemption from the 85-year limit placed on Foundation Component General Plan Amendments, but only for the General Plan Amendment to the specific designation of the overlay. Otherwise, in situations where a Specific Community Development Designation Overlay (other than a Community Center Overlay) is applied over a different Community Development designation, a review of the applicable Area Plan text is required. The following are general guidelines intended to provide a means for calculating estimated build-out projections.

Table E-13: Specific Planning Assumptions

BUSINESS PARK OVERLAY	
Area Plan- Community	Land Use Assumption
Jurupa - Mira Loma	Business Park
Jurupa - Glen Avon	Business Park
Lakeview/Nuevo	Business Park
COMMERCIAL RETAIL OVERLAY	
Area Plan- Community	Land Use Assumption
Jurupa - Mira Loma	Commercial Retail

Policy Areas

Not all areas within an area plan are the same. Distinctiveness is a primary means of avoiding the uniformity that so often plagues conventional suburban development. A Policy Area is a portion of an Area Plan that contains special or unique characteristics that merit detailed attention and focused policies. The location and boundaries of the Policy Areas designated in each area plan are shown ~~as~~ in the respective Area Plan figure denoting ~~Figure 4~~, Overlays and Policy Areas~~, or as in the case of~~ The Airport Influence Areas are captured in~~, Figure 5~~ the respective Area Plan figure denoting the~~,~~ Airport Influence Policy Area~~, and~~ Each Policy Area is ~~are~~ described in detail within the corresponding ~~each individual~~ Area Plan text. For Policy Areas, the underlying land use designations are intended to be used for calculating estimated build-out projections, unless otherwise specified in the following guidelines. The actual land use breakdown will be determined on a case by case basis and may differ from the guidelines below. In certain cases, when there is an overlap between an overlay and policy area, overlay takes precedence over policy area.

Table E-14: Policy Area Planning Assumptions

Policy Name	Area Plan	Land Use Assumption
Glen Eden	Elsinore	LDR[1]
Highway 79	Southwest; Sun City/ Menifee Valley; Harvest Valley/ Winchester; San Jacinto Valley	Use underlying Land Use ~~and See~~ plus modifications as per General Plan ~~and Policy Area Text~~
Section 25 & 36	Southwest	EDR
Juniper Flats	Lakeview/ Nuevo	EDR-RC
El Sobrante	~~Lakeview/Nuevo~~ Lake Mathews/Woodcrest	MDR[2]
2-4 DU/AC	Lakeview/Nuevo	MDR[3]
Banning Bench	The Pass	VLDR[4]
Cherry Valley	The Pass	VLDR[1], except the overlapping part of Cherry Valley Gateway and 0.5 mile buffer from the San Bernardino County line.
Desert Center	Desert Center	BP
Walker Canyon	Elsinore	1/3 OS-RUR and 2/3 OS-CH
Keller Road South Side	Southwest	LDR
Vista Santa Rosa	Eastern Coachella Valley	25% MDR, 25% MHDR and 50% CR
Wiley's Well Road	Palo Verde Valley	Use Underlying Land Use and spare 5 acres for CR
Chiriaco Summit Planned Community	Eastern Coachella Valley	25% MDR, 25% MHDR and 50% CR

Footnotes:
1. ~~A.~~ LDR assumptions for this policy area: Minimum DU = 2.0, Midpoint DU = 2.5, Maximum DU = 3.0.
2. ~~B.~~ MDR assumptions for this policy area: Minimum DU = 2.0, Midpoint DU = 2.5, Maximum DU = 3.0.
3. ~~C.~~ MDR assumptions for this policy area: Minimum DU = 2.0, Midpoint DU = 3.0, Maximum DU = 4.0.
4. ~~D.~~ VLDR assumptions for this policy area: Midpoint DU = 1.0.

Appendix F-1:

Population and Employment Forecasts

Appendix F-*1*: Population and Employment Forecasts

PURPOSE AND SUMMARY OF RESULTS

This appendix presents historical trends and projections of population and employment along with other demographic and socioeconomic information for Riverside County. The first section provides a historical overview of past and current population and employment trends. The purpose is to provide a foundation of dynamics and patterns influencing growth in Riverside County. The next section looks at the two major population and employment forecasts used in the Southern California Association of Governments (SCAG) region, of which Riverside County is a part, for transportation, air quality, and other infrastructure planning. These two alternative forecasts are then broken down by Area Plan in the next section. The Area Plans are 22 geographic planning subdivisions that make up the Riverside County General Plan. The analysis presented in this appendix primarily considers population and employment in Riverside County, but also provides summary of the most current Southern California Association of Government (SCAG) projections for San Bernardino County, the Inland Empire and for the SCAG region as a whole.

HISTORIC POPULATION AND EMPLOYMENT TRENDS

Population - Population growth in Riverside County has been quite rapid over the past two decades as can be seen in Chart 1 below. According to the California Department of Finance, the population grew from approximately 1.2 million 1990 to nearly 2.14 million as of January 1, 2010. Growth since the 2000 Census has been the most rapid. During this period, the county's population increased by over one-half million people, making it the fastest growing county in California.

Growth in Riverside County has been largely driven by migration. There are three major types of migration: inter-state migration, intra-state migration, and immigration. Inter-state migration is the movement of population from other states to Riverside County; intra-state migration is the movement of population from other California Counties to Riverside County; and, immigration is the movement of population from other countries to Riverside County. During World War II and through the 1970s, millions of people flocked to California from other states. Some of these inter-sate migrants settled in Riverside as did some intrastate migrants. However, more recently the majority of the county's migration has been intra-state migration, primarily persons relocating outward from Orange, San Diego and Los Angeles Counties. In addition, immigration has played has played a noticeable and growing role. Affordable housing and life-style factors are major factors influencing this migration.

Chart 1

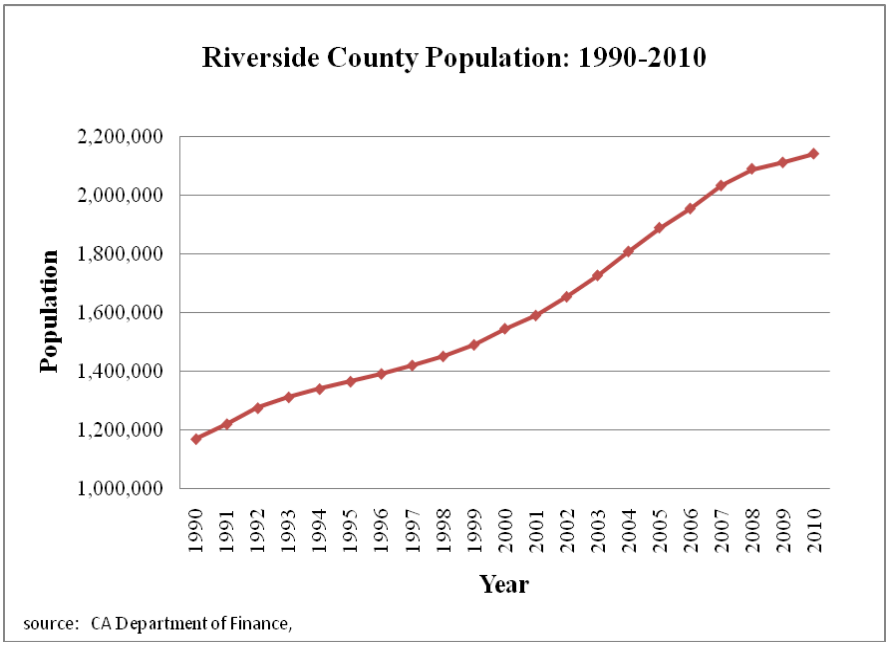


Table 1 below displays Riverside County's population change and the components of this population change from 1971 through 2010. As discussed above, net migration (in-migration minus out-migration) has accounted for the majority of the of the population growth for Riverside County for the past 4 decades. This trend is expected to continue for another two decades according to DOF projections that assume growth from natural increase (births minus deaths) will not exceed net migration until around 2030.

Table 1
Average Annual Components of Population Change
Year 1971 - 2010

Years	Change	Births	Deaths	Natural Increase	Net Migration	Net Migration as a % of Change
1971-75	14,580	7,602	4,960	2,642	11,938	82%
1976-80	27,060	9,657	5,844	3,812	23,248	86%
1981-85	33,320	13,436	7,001	6,435	26,885	81%
1986-90	70,380	19,310	8,691	10,619	59,761	85%
1991-95	38,108	25,154	10,205	14,949	23,159	61%
1996-00	36,055	23,597	11,538	12,060	23,995	67%
2001-05	72,862	27,475	13,088	14,387	58,475	80%
2006-10	47,529	32,969	14,145	18,824	28,705	60%

source: CA Department of Finance

Housing - Housing has been the major driver of growth in Riverside County between 2000 and 2010. Table 2 shows that the county's housing stock grew by nearly 200,000 units. Household (occupied housing units) growth during this same period generally paralleled the housing growth at

approximately 176,000 new households. It is interesting to note that the vacancy rate declined, indicating that some of the household growth was absorbed by existing vacant housing stock, and the newer housing has higher occupancy rates than in the past. Finally, the average size of a household has increased steadily peaking in 2004 – 05, and 2010.

Table 2
Housing Units, Households, Vacancy Rates, Persons per Household
Riverside County 1990 - 2010

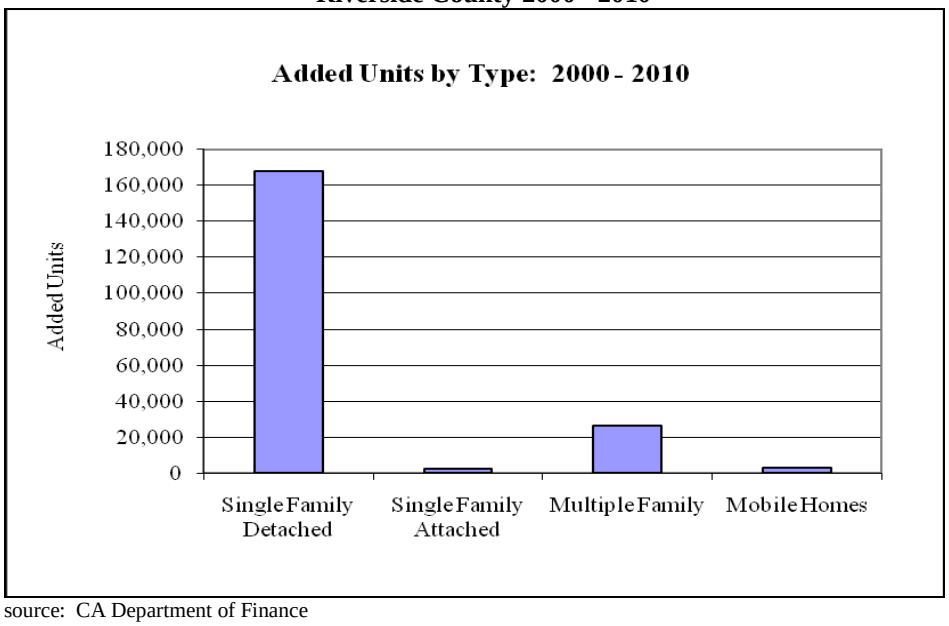
Year	Total Housing Units	Single Family Units	Multiple Family Units	Mobile Home	Households	Vacancy Rate	Persons Per Household
2000	584,674	398,752	103,034	82,888	506,218	13.42%	2.99
2001	595,682	408,045	104,701	82,936	515,958	13.38%	3.01
2002	613,667	423,777	106,928	82,962	531,908	13.32%	3.04
2003	634,197	442,037	109,118	83,042	549,979	13.28%	3.07
2004	659,966	466,033	110,749	83,184	572,582	13.24%	3.09
2005	690,037	491,462	115,046	83,529	598,689	13.24%	3.09
2006	722,532	518,789	118,796	84,947	627,352	13.17%	3.07
2007	753,968	544,824	123,117	86,027	653,826	13.28%	3.06
2008	773,331	559,165	127,740	86,426	671,036	13.23%	3.06
2009	780,112	564,836	128,592	86,684	677,582	13.14%	3.06
2010	784,357	569,016	129,620	85,721	682,283	13.01%	3.08

source: CA Department of Finance

The demand for housing in Riverside County is not simply the demand for affordable housing, but it is rather the demand for single-family housing. Chart 2 shows that 85% of the housing units added between 2000 and 2010 were single family detached units. Very few of the new units were single family attached (Condominiums and Town Homes) or multiple family and mobile homes.

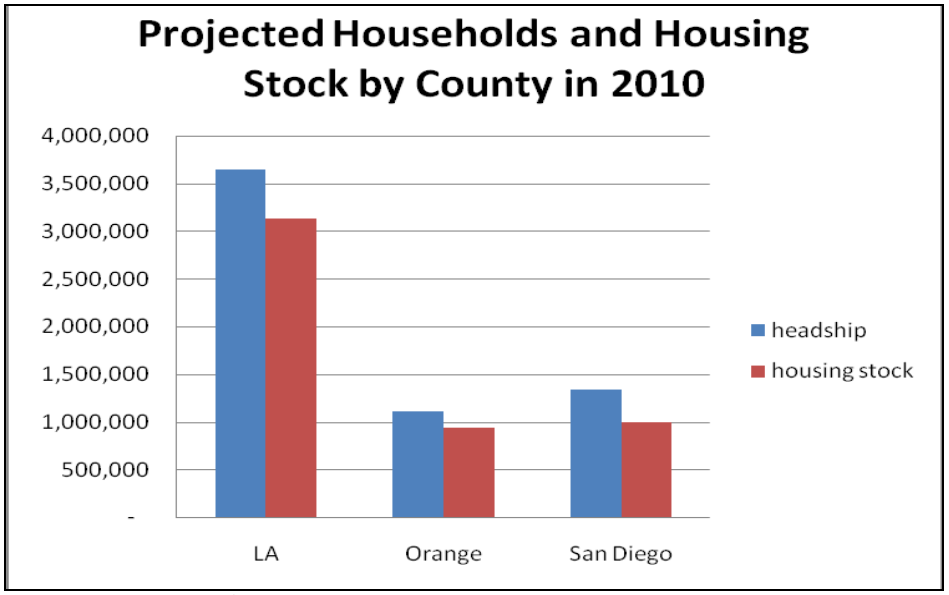
Part of the demand is due to the relative affordability of housing in Riverside County compared to that in Los Angeles, Orange, and San Diego Counties. However, a larger factor is the unavailability of developable land in these three coastal counties which constrains residential development in these counties. As shown in the graph below, headship rates were projected using Census 2000 headship rates normalized to DOF 2010 population projections exceed projected housing stock. The projected households are a measure of demand for housing. The graph shows the shortage of housing since the family headship numbers (the demand) exceeds the available housing stock (the supply). It is no surprise that many families turn to Riverside County in search of housing.

Chart 2
Added Units by Type
Riverside County 2000 - 2010



source: CA Department of Finance

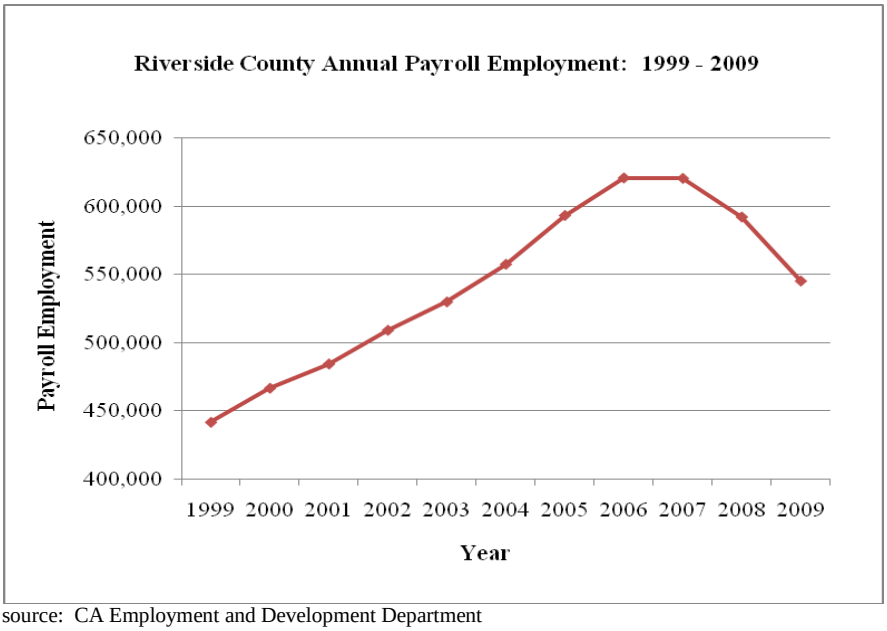
Chart 3



source: CA Department of Finance

Employment - Chart 4 and Table 3 present average annual payroll employment by industry for Riverside County for the period 1999 through 2009. According to the California Employment Development Department, the number of employment was at peak in the year of 2006, tapered in 2007, then dropped in 2008 and 2009, as the level between 2003 and 2004. These figures represent their estimates of wage and salary employment, or jobs in Riverside County for which workers are receiving a wage or salary. These figures do not include self-employed persons or military personnel. In a small number of cases, more than one job is held by a single person. According to the 2000 Census, there were approximately 53,000 self-employed persons who worked in Riverside County and 2,400 persons 18 years of age and over were in the military service. The number of multiple job holders is assumed to be minimal. During this period, employment rose by 103,600 in Riverside County from 1999 through 2009.

Chart 4



source: CA Employment and Development Department

For purposes of the analysis, the industry groupings have been sorted into two broad categories: Basic and Population serving. Basic industries are those that are driven primarily by factors broader than local consumption demand. Population-serving industries are those that are driven primarily by the demands of local population or consumers. Basic industries create new income for an area and typically support spin off industries. A common example of a basic industry is a manufacturing firm that provides goods outside of a region. In contract, population serving industries provide goods and services needed by the population in the region it serves. A retail store and a dentist office are examples of population serving business. The strength of a local economy is often measured by the size of its basic industries.

Both Basic and Population-Serving employment increased over the entire period; however Population-Serving employment increased at a faster rate. Hence, as a share of total employment, Basic employment in Riverside County has declined slightly from 38% in 1999 to 36% in 2009, whereas Population-Serving jobs increased from 62% to 64% over the same period.

Table 3
Annual Average Payroll Employment by Industry
Riverside County 1999-2009

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total Payroll Employment	**441,500**	**466,500**	**484,300**	**509,000**	**529,800**	**557,400**	**593,200**	**620,700**	**620,400**	**592,100**	**545,100**
Basic	**167,500**	**177,200**	**178,500**	**184,400**	**193,700**	**199,200**	**210,500**	**224,200**	**225,700**	**213,900**	**196,000**
Farm	17,300	17,600	16,700	16,200	16,200	15,100	15,000	14,200	13,000	13,100	13,200
Natural Resources & Mining	500	500	500	500	500	500	600	700	700	500	500
Manufacturing	49,400	51,800	50,600	49,800	50,000	50,900	53,400	57,000	54,400	48,400	39,200
Transportation & Public Utilities	10,200	10,200	10,500	10,800	12,300	13,600	15,700	17,000	20,900	21,200	19,700
Wholesale Trade	12,400	13,500	15,000	16,300	16,300	16,800	18,400	20,500	21,100	20,400	18,400
Information	5,500	5,800	6,300	6,600	6,600	7,000	7,400	7,700	7,800	7,700	7,300
Finance, Insurance & Real Estate	15,700	16,000	16,800	17,600	19,500	20,800	22,200	23,600	23,000	22,300	20,800
Business Related Services	37,900	42,200	42,500	46,500	52,000	54,000	57,100	62,600	63,000	58,000	54,300
Federal Government	6,400	6,800	6,300	6,300	6,400	6,600	6,600	6,600	6,400	6,600	6,900
State Government	12,200	12,800	13,300	13,800	13,900	13,900	14,100	14,300	15,400	15,700	15,700
Population-Serving	**274,000**	**289,300**	**305,800**	**324,600**	**336,100**	**358,200**	**382,700**	**396,500**	**394,700**	**378,200**	**349,100**
Construction	43,700	48,400	53,400	55,000	60,800	70,400	78,400	80,700	68,900	54,700	40,200
Retail Trade	57,300	60,000	62,400	66,200	70,000	76,300	82,100	85,900	88,000	84,900	78,500
Personal, Medical & Other Services*	113,400	116,400	120,300	127,000	129,300	134,300	140,100	145,900	150,700	150,300	143,800
Local Government	59,600	64,500	69,700	76,400	76,000	77,200	82,100	84,000	87,100	88,300	86,600
Share of Total											
Total Employment	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Basic	37.9%	38.0%	36.9%	36.2%	36.6%	35.7%	35.5%	36.1%	36.4%	36.1%	36.0%
Population-Serving	62.1%	62.0%	63.1%	63.8%	63.4%	64.3%	64.5%	63.9%	63.6%	63.9%	64.0%

* includes: "health care and social assistance", "accommodation and food services" and "other services"
sources: CA Employment and Development Department

As was discussed earlier, industries were classified either as Population-serving or Basic depending upon whether they sold primarily to local consumers or to external and other non-consumer markets. Table 4 shows 1999 and 2009 employment for each industry along with the average annual growth rate between 1999 and 2009. In the Basic industry grouping, Transportation and Public Utilities was the fastest growing sector at 9% per year; in the Population-serving grouping, Local Government grew the fastest at 5% per year. The sectors that had negative annual growth were Farm, Manufacturing, and Construction.

Table 4
Annualized Growth Rates by Industry
Riverside County 1999-2009

	1999	2009	% Growth	Annual Average Growth Rate
Total Payroll Employment	**441,500**	**545,100**	**23%**	**2%**
Basic	**167,500**	**196,000**	**17%**	**2%**
Farm	17,300	13,200	-24%	-2%
Natural Resources & Mining	500	500	0%	0%
Manufacturing	49,400	39,200	-21%	-2%
Transportation & Public Utilities	10,200	19,700	93%	9%
Wholesale Trade	12,400	18,400	48%	5%
Information	5,500	7,300	33%	3%
Finance, Insurance & Real Estate	15,700	20,800	32%	3%
Business Related Services	37,900	54,300	43%	4%
Federal Government	6,400	6,900	8%	1%
State Government	12,200	15,700	29%	3%
Population-Serving	**274,000**	**349,100**	**27%**	**3%**
Construction	43,700	40,200	-8%	-1%
Retail Trade	57,300	78,500	37%	4%
Personal, Medical & Other Services*	113,400	143,800	27%	3%
Local Government	59,600	86,600	45%	5%
Population	**1,490,500**	**2,107,653**	**41%**	**4%**

source: CA Employment and Development Department
*includes: "health care and social assistance," "accommodation and food services" and "other services"

RELATIONSHIP BETWEEN POPULATION, HOUSING AND EMPLOYMENT

This section describes the relationship between population and employment in Riverside County. A demographic perspective is presented in this section; that is, the discussion begins with population and then to the relationship with labor force and employment and finally to the question of jobs-housing balance. The implication is that there is a greater level of out-commuting with lower jobs-housing ratios.

Table 5
Population, Labor Force and Employment
Riverside County 2000 – 2009

	2000	2005	2007	2009
Population	1,545,387	1,882,812	2,034,840	2,107,653
Labor Force Participation Rate	44.0%	45.4%	44.6%	43.4%
Civilian Labor Force	680,700	854,300	907,400	913,900
Unemployment Rate	5.4%	5.4%	6.0%	13.6%
Civilian Unemployment	36,500	46,100	54,500	123,900
Civilian Employment (Employed Residents)	644,200	808,100	852,900	790,000
Total Payroll Jobs	466,500	593,200	620,400	545,100
Self-Employed Working in Riverside County	53,000	64,300	68,800	73,594
Total Jobs	514,333	653,919	682,249	618,694
Percent Self-Employed	10.3%	9.8%	10.1%	11.9%
Estimated Net Out-Commuting	129,867	154,181	170,651	171,306
Households	506,218	598,476	653,977	677,582
Jobs/Households Ratio	1.02	1.09	1.04	0.91

sources: US Census Bureau, CA Employment and Development Department and CA Department of Finance

Table 5 presents estimates of several key variables and relationships for the years 2000, 2005, 2007 and 2009. The population data are from the California Department of Finance (DOF), unemployment and payroll jobs are from the California Employment Development Department (EDD), and self-employed is from the US Census Bureau. Other data was then calculated from the population and employment data.

The Labor Force Participation Rate was calculated by dividing the civilian labor force by the total population. The Labor Force Participation Rate is simply the percent of the total population that is either employed or not employed but actively seeking employment. Labor force participation rates do vary by age and sex (often called cohorts), as well as race and ethnicity. The total labor force will change over time as a result of changing age structure of the population and as a result of changes in the racial and ethnic composition of the population.

The unemployment rate is calculated-based upon EDD's estimate of civilian unemployment divided by the civilian labor force. The annual average unemployment rate was 5.4% in 2000 and 2005, and then rose to 13.6% in 2009 as a result of the economic downturn. Subtracting civilian unemployment from civilian labor force derives the number of employed residents. Employed residents are simply those who live in Riverside County and are employed anywhere. (All labor force and employment data used in this analysis are Civilian data, i.e. military personnel are excluded.)

The difference between Employed Residents and Total Jobs is accounted for through workers commuting into and out of Riverside County. If there are more jobs than employed residents, we can conclude that there is net in-commuting; and conversely if there are more employed residents than jobs, we can conclude that there is net out-commuting. The difference between employed residents and total jobs in 2009 was 171,306 which reflects net out-commuting. The jobs to household ratios further reflect the net out-commuting.

SOCIOECONOMIC AND EMPLOYMENT FORECASTS BY AREA PLAN

The population, housing units, and employment data presented here is by Area Plan, then further broken down by incorporated (cities) and unincorporated areas. The data is originated from Riverside County Projections 2010 (RCP10), which is a set of population, housing units, and employment growth forecast for Riverside County. The RCP10 forecasts were adopted by the Riverside County Board of Supervisors, and the Executive Committees of the Coachella Association of Governments (CVAG) and the Western Riverside Council of Governments (WRCOG). There are considered to be the most probable forecasts for Riverside County given current and anticipated demographic and economic trends, along with current land use policies.

Map 1
Riverside County Area Plans and Cities

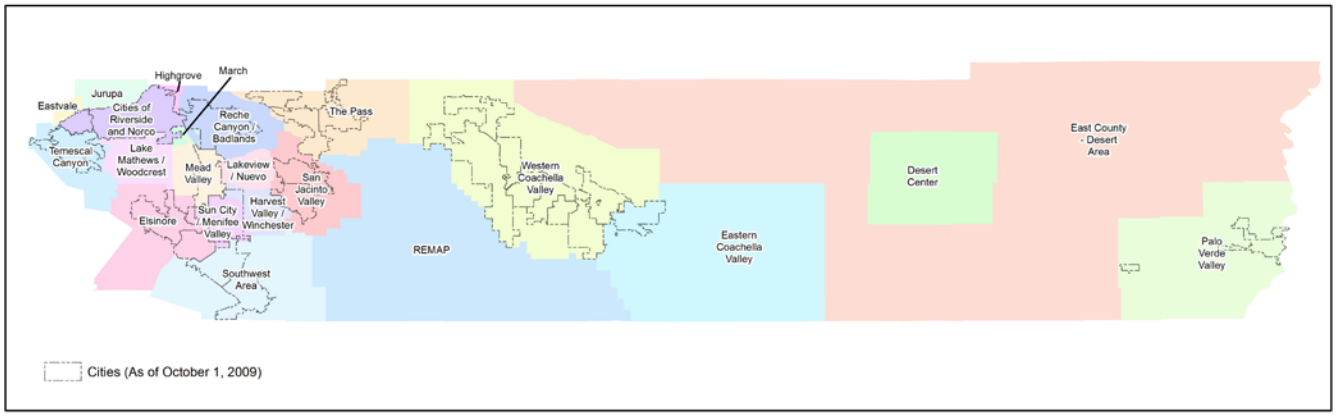


Table 6
Riverside County Projections 2010

RIVERSIDE COUNTY AREA PLAN	POPULATION			HOUSING UNITS			EMPLOYMENT		
	2010	2020	2035	2010	2020	2035	2010	2020	2035
Cities of Riverside and Norco									
Incorporated	330,132	369,741	415,791	107,875	121,362	136,051	163,889	212,198	240,545
Desert Center									
Unincorporated	725	780	922	734	877	1,159	72	139	425
East County - Desert Area									
Unincorporated	1,604	2,856	5,641	248	419	723	12	58	110
Eastern Coachella Valley									
Incorporated	42,500	76,500	135,000	9,300	19,010	36,542	6,351	12,700	30,400
Unincorporated	32,454	89,606	206,313	7,363	22,971	55,286	6,878	15,849	35,577
Total	74,954	166,106	341,313	16,663	41,981	91,828	13,229	28,549	65,977
Eastvale									
Unincorporated	44,375	50,162	61,465	14,061	15,849	19,282	3,102	4,717	7,988
Elsinore									
Incorporated	97,343	125,839	161,373	33,024	43,319	56,153	14,974	21,953	32,003
Unincorporated	24,357	26,827	32,258	9,023	10,033	12,148	2,804	4,488	8,121
Total	121,700	152,666	193,631	42,047	53,352	68,301	17,778	26,441	40,124
Harvest Valley/Winchester									
Incorporated	4,988	8,412	12,462	1,713	2,873	4,243	1,369	1,650	2,061
Unincorporated	11,129	18,427	34,488	4,108	6,769	13,245	2,167	4,706	12,992
Total	16,117	26,839	46,950	5,821	9,642	17,488	3,536	6,356	15,053
Highgrove									
Unincorporated	5,796	8,112	11,714	1,924	2,809	4,338	2,165	3,056	5,080
Jurupa									
Unincorporated	86,018	95,973	118,679	25,230	28,381	35,065	28,738	35,086	55,626
Lake Mathews / Woodcrest									
Unincorporated	36,227	40,534	49,614	11,687	13,369	16,766	5,938	7,773	10,989
Lakeview / Nuevo									
Unincorporated	10,729	25,294	52,798	4,133	9,291	19,336	2,099	3,661	6,784
March									
Joint Power Authority	914	923	971	551	552	553	2,578	10,803	17,518
Mead Valley									
Incorporated	57,843	82,029	114,046	16,750	24,468	34,747	14,438	21,508	27,338
Unincorporated	21,288	23,626	28,904	6,221	7,111	9,063	2,663	5,390	13,433
Total	79,131	105,655	142,950	22,971	31,579	43,810	17,101	26,898	40,771
Palo Verde Valley									
Incorporated	21,698	23,729	25,392	5,561	6,537	7,301	5,461	7,704	10,785
Unincorporated	2,954	5,096	9,625	2,608	3,587	5,664	1,244	2,205	4,095
Total	24,652	28,825	35,017	8,169	10,124	12,965	6,705	9,909	14,880
Reche Canyon / Badlands									
Incorporated	188,636	213,738	255,234	55,031	64,427	78,065	32,292	47,380	66,642
Unincorporated	2,177	2,941	4,522	925	1,301	2,087	1,608	3,468	6,138
Total	190,813	216,679	259,756	55,956	65,728	80,152	33,900	50,848	72,780
REMAP									
Unincorporated	16,305	19,257	26,633	10,597	12,628	16,858	2,601	4,683	10,224
San Jacinto Valley									
Incorporated	115,732	174,479	235,112	52,942	76,929	101,252	31,846	47,369	65,528
Unincorporated	34,356	39,126	49,539	13,781	15,915	20,607	3,796	7,076	12,978
Total	150,088	213,605	284,651	66,723	92,844	121,859	35,642	54,445	78,506
Southwest Area									
Incorporated	204,407	221,585	242,398	68,006	73,833	80,960	64,072	108,775	166,847
Unincorporated	44,707	48,801	58,456	15,945	17,666	21,274	7,860	13,489	21,358
Total	249,114	270,386	300,854	83,951	91,499	102,234	71,932	122,264	188,205

Table 6
Riverside County Projections 2010

RIVERSIDE COUNTY AREA PLAN	POPULATION			HOUSING UNITS			EMPLOYMENT		
	2010	2020	2035	2010	2020	2035	2010	2020	2035
Sun City / Menifee Valley									
Incorporated	66,024	84,676	106,893	29,074	37,386	47,218	7,435	8,648	10,711
Unincorporated	1,371	1,793	2,656	783	1,042	1,590	132	232	346
Total	67,395	86,469	109,549	29,857	38,428	48,808	7,567	8,880	11,057
Temescal Canyon									
Incorporated	149,622	155,819	164,558	46,179	48,162	50,891	71,187	86,924	106,529
Unincorporated	35,183	37,753	44,298	10,087	10,837	12,381	5,673	8,385	14,054
Total	184,805	193,572	208,856	56,266	58,999	63,272	76,860	95,309	120,583
The Pass									
Incorporated	72,212	113,583	167,133	28,733	44,851	66,018	14,842	22,540	35,182
Unincorporated	12,370	16,282	24,121	5,081	6,862	10,386	5,427	7,048	10,698
Total	84,582	129,865	191,254	33,814	51,713	76,404	20,269	29,588	45,880
Western Coachella Valley									
Incorporated	334,033	389,871	451,824	172,228	196,794	226,534	136,011	166,114	207,507
Unincorporated	42,980	55,611	85,454	26,841	33,077	46,763	12,231	19,525	28,672
Total	377,013	445,482	537,278	199,069	229,871	273,297	148,242	185,639	236,179
RIVERSIDE COUNTY TOTAL	**2,153,189**	**2,649,781**	**3,396,287**	**798,347**	**981,297**	**1,250,549**	**663,955**	**927,300**	**1,285,284**

Socioeconomic Projections. Table 7 presents two key socio-economic characteristics: persons per housing unit and jobs per housing unit. These numbers were calculated using the data from Table 6 - RCP10. Riverside County is projected the persons per housing unit to increase from 2.70 in 2010 to 2.72 in 2035. The jobs per housing unit are projected to increase from 0.94 in 2010 to 1.03 in 2035. This means that employment is projected to grow faster than population.

Table 6
Population and Employment per Housing Unit

RIVERSIDE COUNTY AREA PLAN	POPULATION PER HOUSING UNIT			EMPLOYMENT PER HOUSING UNIT		
	2010	2020	2035	2010	2020	2035
Cities of Riverside and Norco						
Incorporated	3.06	3.05	3.06	1.52	1.75	1.77
Desert Center						
Unincorporated	0.99	0.89	0.80	0.10	0.16	0.37
East County - Desert Area						
Unincorporated	6.47	6.82	7.80	0.05	0.14	0.15
Eastern Coachella Valley						
Incorporated	4.57	4.02	3.69	0.68	0.67	0.83
Unincorporated	4.41	3.90	3.73	0.93	0.69	0.64
Total	4.50	3.96	3.72	0.79	0.68	0.72
Eastvale						
Unincorporated	3.16	3.16	3.19	0.22	0.30	0.41
Elsinore						
Incorporated	2.95	2.90	2.87	0.45	0.51	0.57
Unincorporated	2.70	2.67	2.66	0.31	0.45	0.67
Total	2.89	2.86	2.83	0.42	0.50	0.59
Harvest Valley/Winchester						
Incorporated	2.91	2.93	2.94	0.80	0.57	0.49
Unincorporated	2.71	2.72	2.60	0.53	0.70	0.98
Total	2.77	2.78	2.68	0.61	0.66	0.86
Highgrove						

Table 6
Population and Employment per Housing Unit

RIVERSIDE COUNTY AREA PLAN	POPULATION PER HOUSING UNIT			EMPLOYMENT PER HOUSING UNIT		
	2010	2020	2035	2010	2020	2035
Unincorporated	3.01	2.89	2.70	1.13	1.09	1.17
Jurupa						
Unincorporated	3.41	3.38	3.38	1.14	1.24	1.59
Lake Mathews/ Woodcrest						
Unincorporated	3.10	3.03	2.96	0.51	0.58	0.66
Lakeview/Nuevo						
Unincorporated	2.60	2.72	2.73	0.51	0.39	0.35
March						
Unincorporated	1.66	1.67	1.76	4.68	19.57	31.68
Mead Valley						
Incorporated	3.45	3.35	3.28	0.86	0.88	0.79
Unincorporated	3.42	3.32	3.19	0.43	0.76	1.48
Total	3.44	3.35	3.26	0.74	0.85	0.93
Palo Verde Valley						
Incorporated	3.90	3.63	3.48	0.98	1.18	1.48
Unincorporated	1.13	1.42	1.70	0.48	0.61	0.72
Total	3.02	2.85	2.70	0.82	0.98	1.15
Reche Canyon/Badlands						
Incorporated	3.43	3.32	3.27	0.59	0.74	0.85
Unincorporated	2.35	2.26	2.17	1.74	2.67	2.94
Total	3.41	3.30	3.24	0.61	0.77	0.91
REMAP						
Unincorporated	1.54	1.52	1.58	0.25	0.37	0.61
San Jacinto Valley						
Incorporated	2.19	2.27	2.32	0.60	0.62	0.65
Unincorporated	2.49	2.46	2.40	0.28	0.44	0.63
Total	2.25	2.30	2.34	0.53	0.59	0.64
Southwest Area						
Incorporated	3.01	3.00	2.99	0.94	1.47	2.06
Unincorporated	2.80	2.76	2.75	0.49	0.76	1.00
Total	2.97	2.96	2.94	0.86	1.34	1.84
Sun City/Menifee Valley						
Incorporated	2.27	2.26	2.26	0.26	0.23	0.23
Unincorporated	1.75	1.72	1.67	0.17	0.22	0.22
Total	2.26	2.25	2.24	0.25	0.23	0.23
Temescal Canyon						
Incorporated	3.24	3.24	3.23	1.54	1.80	2.09
Unincorporated	3.49	3.48	3.58	0.56	0.77	1.14
Total	3.28	3.28	3.30	1.37	1.62	1.91
The Pass						
Incorporated	2.51	2.53	2.53	0.52	0.50	0.53
Unincorporated	2.43	2.37	2.32	1.07	1.03	1.03
Total	2.50	2.51	2.50	0.60	0.57	0.60
Western Coachella Valley						
Incorporated	1.94	1.98	1.99	0.79	0.84	0.92
Unincorporated	1.60	1.68	1.83	0.46	0.59	0.61
Total	1.89	1.94	1.97	0.74	0.81	0.86

Appendix G:
Fiscal Analysis

Fiscal Analysis
Riverside County General Plan Update

Prepared for:

Transportation and Land Management Agency
The County of Riverside
4080 Lemon St.
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Chapter 1
INTRODUCTION

1.1 Overview

This study has prepared a series of fiscal impact analyses of Riverside County's comprehensive General Plan update for the Preferred Plan land uses and selected scenarios. The analyses were provided for the County's General Fund at hypothetical build-out at four unincorporated geographic levels: 1) the entire Riverside County; 2) Western Riverside County; 3) Eastern Riverside County; and 4) Fiscal Analysis Areas.

This study employed the use of a Fiscal Model developed exclusively for the County of Riverside and implemented on the County's computer system. The modeling system connects with the County's Geographic Information System (GIS) and parcel level assessor's data from the County's Auditor-Controller. When combined with the digitized General Plan land use designations, parcel level files with acreage, planned land use and assessment information were created.

For the fiscal analysis, a predefined set of Preferred Plan parcel level databases were developed and organized into the four geographic levels mentioned above. Each of these Preferred Plan databases provided the starting point for the General Plan fiscal analysis and the following scenarios: 1) Preferred Plan; 2) Sphere of Influence areas; 3) Alternative Retail Development levels; and 4) comparison with SCAG 2025 forecasts.

1.2 Fiscal Model Methodology

The General Fund is the main operating fund of the County. It is used to account for expenditures and revenues for Countywide and selected locally delivered services. General Fund programs administered by the Board of Supervisors include: Administrative and Fiscal; General Services; Environmental and Development Services; Justice and Law Enforcement; Fire Protection; Health Services; Community and Social Services; Education, Recreation and Culture; and Capital Lease, Construction and Contingency.

The methodology has been to calibrate a set of General Fund revenue and cost factors based on the County's *Fiscal Year 2000-21 Final Budget.* The factors have been prepared to evaluate the fiscal impacts of development in the unincorporated portions of

Riverside County assuming a continuation of current public service levels and in constant 2001 dollars, i.e., not accounting for inflation.

Additionally, a set of market factors were estimated to account for residential and non-residential valuation, retail and non-retail taxable sales generation, average property turnover rates, average densities and square feet per employees by land use types. An important estimate was the average retail sales per household by incorporated cities versus unincorporated areas. These estimates formed the basis for retail scenarios at varying levels of development.

1.3 Organization of the Report

Chapter 2 presents a summary of the fiscal analyses for the various geographic areas and scenarios tested. Chapter 3 describes the Fiscal Model process and the key data sources. This is followed by Chapter 4 that includes a comparison of the General Plan build-out projections with SCAG 2025 forecasts for population, households, employment and jobs to household ratios.

Chapter 5 presents the fiscal impact analyses at the unincorporated Riverside County level for the Preferred Plan compared with the Sphere of Influence area, selected retail development scenarios and SCAG 2025. Chapters 6 and 7 present similar fiscal impact analyses for the unincorporated Western Riverside County and Eastern Riverside County areas.

Chapter 8 then finishes the fiscal impact analyses for the seven Fiscal Analysis Areas. The final Chapter 9 presents the General Fund fiscal methodology and the model calibration using existing budget and market information. The report concludes with six appendices. Appendices A through D include the detailed fiscal and development summary tables for all of the fiscal impact analyses. Appendices E and F then present the detailed tables that estimate net County General Fund costs and the calibration runs using existing County budget and development information.

Chapter 2
SUMMARY

2.1 Approach

This summary presents the key findings based on the fiscal analyses of the Preferred Plan at several geographic levels in the unincorporated areas, including: 1) Riverside County; 2) Western Riverside County; 3) Eastern Riverside County; and 4) seven Fiscal Analysis Areas. Additionally, scenarios were tested to cover development for the Sphere of Influence areas, selected levels of retail development and comparison with SCAG 2025 forecasts. The fiscal projections and development summaries are presented for General Fund recurring revenues and operating and maintenance costs at hypothetical build-out in 2001 constant dollars.

2.2 Socio-Economic Projections

The socio-economic projections provide the context for the fiscal analysis. The General Plan's projected population at build-out for unincorporated Riverside County is 1,366,265 and exceeds SCAG's 2025 projection of 985,945 by about 39 percent. Households at build-out for the same area are projected at 529,560 and exceed SCAG's 2025 household projections of 334,472 by about 58 percent.

Employment projections reveal a significant difference between the General Plan projections at build-out and SCAG 2025 projections. SCAG's General Plan employment projection of 763,212 for unincorporated Riverside County at build-out exceeds SCAG's 2025 projection of 215,919 by about 3.5 times. This reflects SCAG's forecast to concentrate relatively more employment in existing cities.

The jobs to households ratio is a general indicator used to measure the growth in jobs relative to households of each scenario used in the General Plan process. In theory, if households have job opportunities closer to where they live, this can potentially reduce overall commuting. For unincorporated Riverside County, the projected General Plan ratio of 1.44 jobs to households at build-out is about 2.2 times higher than SCAG's 2025 projections of 0.65. In 1997, for the combined incorporated and unincorporated areas of the county, the ratio for Riverside County was 0.93, not only less than one job per

household but significantly less than the regional ratio of 1.34. Also, Riverside County is shown to have the lowest ratio of all the counties in 1997.

2.3 Average Retail Sales Per Household, 2000

Retail sales are an important revenue generator for most jurisdictions and tend to be concentrated within incorporated cities. The average retail sales per household for incorporated cities within Riverside County was estimated at $33,162. This compares with an average per household of only $11,200 for the unincorporated areas. The combined average for the entire County was estimated at $27,182.

The Preferred Plan land uses contain a sizable shift in the proportion of future retail development in unincorporated Riverside County. This analysis forms the basis for projecting several retail scenarios where lesser levels of retail development are tested.

2.4 General Plan Build-out Database

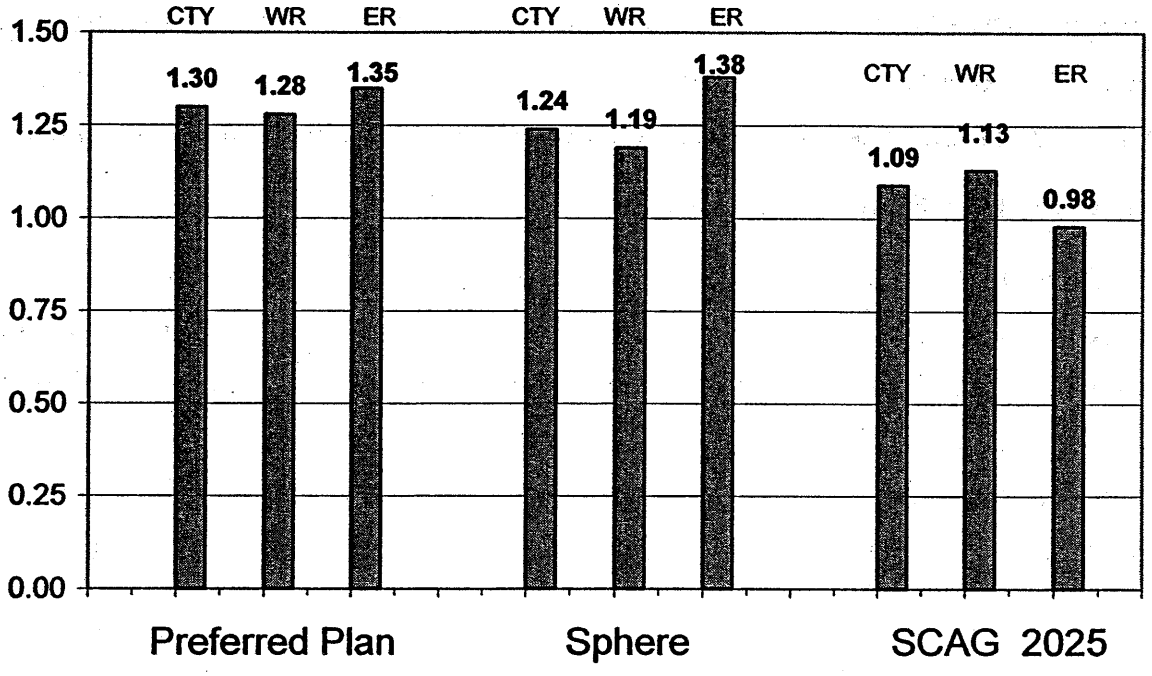
For the General Plan fiscal analysis, a predefined set of parcel level databases was developed. Initially, a countywide file of digitized Preferred Plan General Plan land uses were provided and then organized into the following databases: Riverside County, Western and Eastern Riverside County and seven Fiscal Analysis Areas. Each of these Preferred Plan databases provided the starting point for the General Plan fiscal analysis and subsequent scenarios. The General Plan database used in this fiscal analysis was current as of July 2001. While some technical changes in the database have since been made, they are not considered large enough to change the basic findings.

2.5 General Plan Fiscal Analysis

The overall fiscal results for the Preferred Plan have a positive General Fund revenue/cost ratio, i.e., where projected revenues exceed projected costs. However, while they are also generally positive for the selected scenarios, they can vary significantly by geographic area and level of retail development as discussed below.

Preferred Plan. The fiscal results for the Preferred Plan are summarized in Figure 2-1 at a positive fiscal impact ratio of 1.30. That is, General Fund revenues are projected to exceed costs at build-out by about 30 percent. The three major revenue sources are property taxes, sales taxes and motor vehicle license fees accounting for about 78 percent of the total revenues. The General Fund costs for the following five categories

Figure 2-1
Summary of Revenue/Cost Ratios
Riverside County General Plan Update



Note: CTY:County, WR:Western Riverside, ER:Eastern Riverside

Source: Stanley R. Hoffman Associates, Inc.

account for about 84 percent of total projected costs: 1) local Justice and Law Enforcement for sheriff patrol; 2) Justice and Law Enforcement for countywide functions, such as the court system; 3) General Fund Fire Protection costs; 4) Administrative and Fiscal functions; and 5) Capital Lease/Construction/Contingency.

When the fiscal analysis for the Preferred Plan was prepared for the unincorporated areas in Western and Eastern Riverside County, the major finding was that the Eastern Riverside County area was more positive at 1.35 compared with Western Riverside County at 1.28 as shown in Figure 2-1, probably reflecting more tourist related retail activities relative to projected household growth.

Sphere of Influence Areas. When the fiscal analysis was prepared for development within the unincorporated Sphere of Influence areas as shown in Figure 2-1, the major finding was that the revenue/cost ratios for Riverside County and Western Riverside County were less at 1.24 and 1.19, respectively, than for the entire Preferred Plan area. This reflects the County's General Plan policy direction of concentrating future development in community centers and rural villages generally located outside these sphere areas.

SCAG 2025 Forecasts. The final set of fiscal impact ratios shown in Figure 2-1 reflect the fiscal analysis with development assumptions that approximate SCAG's 2025 forecasted level of growth. This yields a low fiscal ratio of 1.09 for the total unincorporated County areas that reflects SCAG's projections of more employment growth in existing incorporated cities and proportionally more housing growth in unincorporated areas.

Western Riverside County is slightly higher at 1.13, but Eastern Riverside County is actually projected to be fiscally negative at 0.98, slightly less than breakeven. While these projections contain a level of uncertainty, they tend to illustrate general differences between the County's job oriented focus and SCAG's less job intensive development in the unincorporated areas.

2.6 Retail Development Scenarios

Retail sales tax is the third largest General Fund revenue source to the County behind property taxes and motor vehicle license fees. Since this is such an important revenue source for the County in achieving a balanced General Fund budget, a series of retail square footage reduction scenarios have been analyzed and summarized in Figure 2-2.

The projected fiscal surplus decreases significantly as less retail square footage is assumed to be developed under the scenarios tested for each of the major geographic areas. For example, as shown in Figure 2-2 for the total unincorporated area of Riverside County, the revenue/cost ratio of 1.30 for the Preferred Plan decreases to 1.20 for the 56 percent scenario and down to 1.13 for the 23 percent scenario. Similarly, the same pattern of decrease is shown for unincorporated Western and Eastern Riverside County.

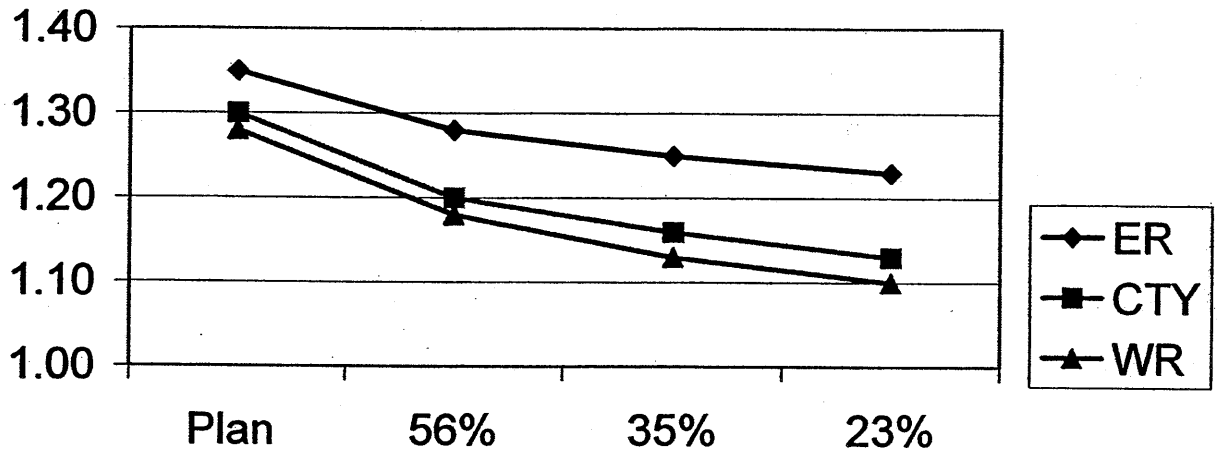
The 56 percent scenario represents an estimated capture of household taxable retail sales at 56 percent of the level of the retail development under the Preferred Plan projection. This approximates the average retail sales per household of all incorporated cities in the County as discussed earlier in Section 2.3; the 23 percent scenario approximates the County's existing average retail sales per household within the unincorporated area. The 35 percent scenario represents an intermediate point where the County is projected to increase above its existing average but not quite to the average of the cities.

2.7 Fiscal Analysis Areas

The Fiscal Analysis Areas (FAA's) were selected to represent economic subareas of the County as shown later in Figure 3-1. These seven FAA's provide a more manageable number to study sub-regional differences than the 20 Community Plan areas.

The fiscal comparisons for the Preferred Plan are shown for each FAA in Figure 2-3. The highest revenue/cost ratios of 1.39 and 1.36 are for the Coachella Valley and Northwest areas, respectively. The lowest ratios are for more undeveloped areas such as Eastern at 1.15 (including Desert Center and Palo Verde Valley) and the Centralwest at 1.16, including the San Jacinto Valley. The REMAP, or Riverside Extended Mountain Area Plan, is also lower at a ratio of 1.21.

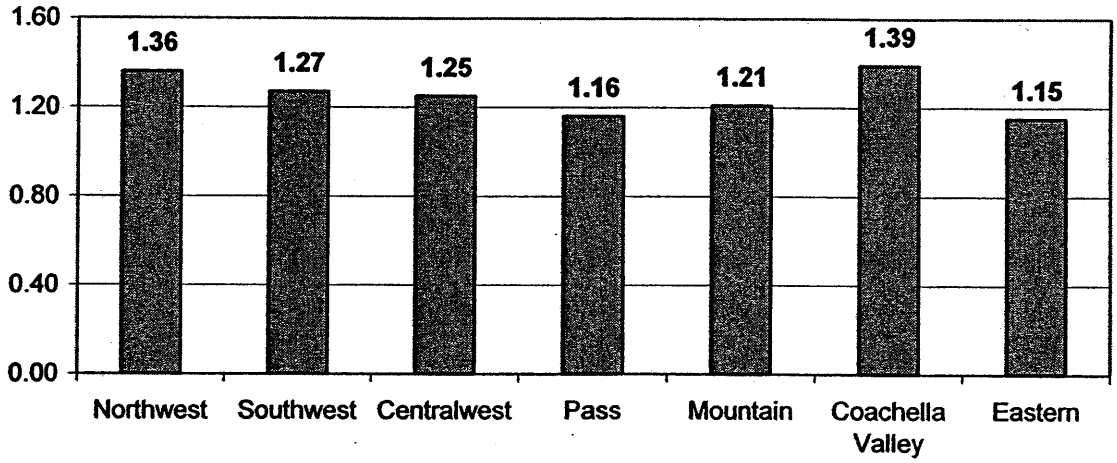
Figure 2-2
Retail Development Scenarios: Revenue/Cost Ratios
Riverside County General Plan Update



Note: ER: Eastern Riverside, WR: Western Riverside, CTY: County

Source: Stanley R. Hoffman Associates, Inc.

Figure 2-3
Fiscal Analysis Areas: Revenue/Cost Ratios
Riverside County General Plan Update



Source: Stanley R. Hoffman Associates, Inc.

Chapter 3
FISCAL MODEL PROCESS

3.1 Overview of Riverside County Fiscal Model

The fiscal modeling system consists of three major components: (1) the Geographic Information System (GIS) Interface Model; (2) the Parcel Level Databases; and (3) the Fiscal Impact Model. The system has been implemented on Riverside County's computer system and dynamically links with their GIS databases. This study has used the databases developed for the comprehensive General Plan update process to project General Fund fiscal impacts at build out for the Preferred Plan land uses and selected alternatives.

The GIS Interface Model allows for development and modification of land use scenarios in an ArchInfo environment using the County's existing GIS system. Scenarios can be created from predefined land use files for fiscal analysis or in real time "on-the-fly." The Fiscal Model then analyzes these scenarios and allows the user to quickly develop alternative land use, market and fiscal assumptions for "What-if" scenarios.

3.2 Overlay with Riverside County Assessor's Data

A key step in the fiscal analysis process is to overlay the County Assessor's information from the Auditor-Controller's database with the General Plan land use designations for residential and non-residential land uses. This generates a set of Assessor's parcels for the entire County or any subarea being tested with allowable General Plan land uses, acreages, residential densities, non-residential floor area ratios (FARs), and existing land and building assessment information. This file is updated at least annually.

This parcel level database provides the flexibility to study areas of Riverside County including: the entire County, major subareas, such as Western and Eastern Riverside County, Fiscal Analysis Areas, Community Plan areas and all the way down to individual parcels. In addition to studying General Plan designated areas, the Fiscal Model can also be used to analyze unincorporated Spheres of Influence, specific project areas and proposed annexations and incorporations.

3.3 Preparation of General Plan Parcel Level Databases

For the General Plan fiscal analysis, a predefined set of parcel level databases was developed. Initially, a countywide file of digitized Preferred Plan General Plan land uses were provided and then organized into the following databases: Riverside County, Western and Eastern Riverside County and seven Fiscal Analysis Areas. Each of these Preferred Plan databases provided the starting point for the General Plan fiscal analysis and subsequent scenarios.

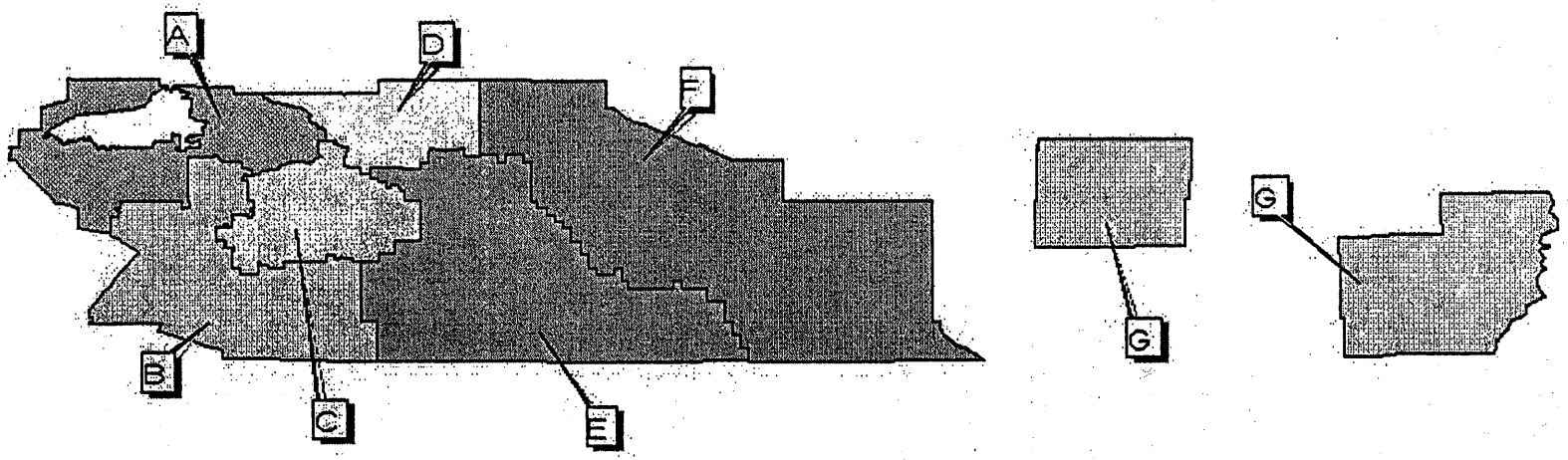
The scenarios modified the land uses in various ways to simulate different geographies or market conditions. For example, different levels of retail development were tested to show the sensitivity of the General Fund balance to taxable sales generation. Also, fiscal conditions were tested for development projected within the Spheres of Influence areas and for development assumptions comparable to SCAG's 2025 forecasts.

3.4 Fiscal Analysis of General Plan Study Areas

A separate analysis unit, entitled the Fiscal Analysis Area (FAA), was also developed to represent economic sub areas of the County as shown in Figure 3-1. These seven FAA's provide a more manageable number to study sub-regional differences than the 20 Community Plan areas. As shown in Figure 3-1, the Western Riverside County sub region consists of five FAA's, including: Northwest, Southwest, Centralwest, the Pass and Mountain. The Eastern Riverside County sub-region consists of two FAA's, including the Coachella Valley and the eastern Riverside County area with Desert Center and Palo Verde Valley.

The 20 Community Plan is wholly contained within one of the seven FAA's as presented in Table 3-1. In Western Riverside County, the Northwest FAA extends from Jurupa and Eastvale on the west to March AFB and Reche Canyon/Badlands on the east. The Southwest area extends from Lake Elsinore and Mead Valley southward to the unincorporated areas around the cities of Temecula and Murrieta. The Centralwest area covers the Sun City/Menifee area eastward to the San Jacinto Valley. The Pass extends through the San Gorgonio Pass between Mt. San Gorgonio on the north and Mt. San Jacinto on the south. Finally, the Mountain area covers the mountainous region extending from the San Jacinto Valley over the Mt. San Jacinto range to the Coachella Valley.

Figure 3-1
Fiscal Analysis Areas
Riverside County General Plan Update



Western Riverside
- A Northwest
- B Southwest
- C Centralwest
- D Pass
- E Mountain

Eastern Riverside
- F Coachella Valley
- G Eastern

Source: Stanley R. Hoffman Associates, Inc.
Mende Consulting

Table 3-1
Fiscal Analysis Areas (FAAs)
Riverside County General Plan Update

FAA Number	Code	Name	Area Plans
FAA01	A	Northwest	Jurupa, Eastvale, Temescal Canyon, Lake Mathews, Highgrove/Northside, March, Reche Canyon/Badlands
FAA02	B	Southwest	Lake Elsinore, Mead Valley, Southwest Area
FAA03	C	Centralwest	Sun City/ Menifee, Lakeview/ Nuevo, Highway 74/79 Corridor, San Jacinto Valley
FAA04	D	Pass	The Pass
FAA05	E	Mountain	REMAP
FAA06	F	Coachella Valley	Western Coachella Valley, Eastern Coachella Valley
FAA07	G	Eastern	Desert Center, Palo Verde Valley

Source: Stanley R. Hoffman Associates, Inc.
Transportation and Land Management Agency, County of Riverside

Chapter 4

OVERVIEW OF SOCIO-ECONOMIC PROJECTIONS

4.1 General Plan Build-Out Projections Versus SCAG 2025

An overview of socio-economic projections is presented for the Preferred Plan land uses for unincorporated Riverside County. These land uses have been prepared as part of the County's Comprehensive General Plan update. Figures 4-1 through 4-4 present projections at hypothetical build-out for population, households, employment, and jobs to household ratios for unincorporated Riverside County and Western and Eastern Riverside County sub-regions. The Southern California Association of Governments' (SCAG) projections for the year 2025 are also included for comparison with the County's build-out projections.

Population

The General Plan's projected population at build-out for unincorporated Riverside County is 1,366,265 and exceeds SCAG's 2025 projection of 985,945 by about 39 percent as shown in Figure 4-1. About 79 percent of this population, or 1,080,860, is projected for unincorporated Western Riverside County with the remaining 285,411, or 21 percent, projected for unincorporated Eastern Riverside County.

Households

Households at build-out for unincorporated Riverside County are projected at 529,560 and exceed SCAG's 2025 household projections of 334,472 by about 58 percent as shown in Figure 4-2. Similar to population, about 79 percent of these households, or 418,938, are projected for unincorporated Western Riverside County with the remaining 110,624, or 21 percent, projected for unincorporated Eastern Riverside County. Household projections represented occupied housing units and do not account for vacant units or second homes that are not occupied full time.

Employment

In contrast, employment projections reveal a significant difference between the General Plan projections at build-out and SCAG 2025 projections. Figure 4-3 shows a General Plan employment projection of 763,212 for unincorporated Riverside County at build-out

Figure 4-1
Population Projections
Riverside County General Plan at Buildout vs. SCAG 2025

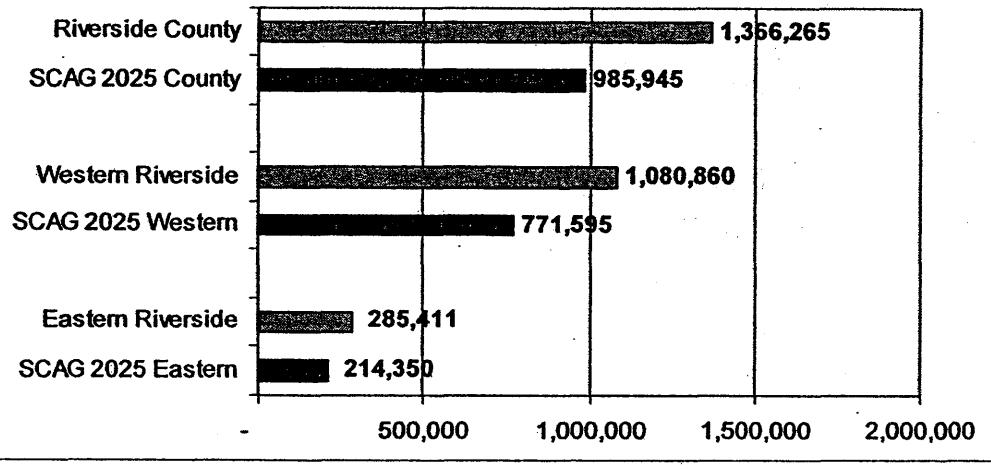


Figure 4-2
Household Projections
Riverside County General Plan at Buildout vs. SCAG 2025

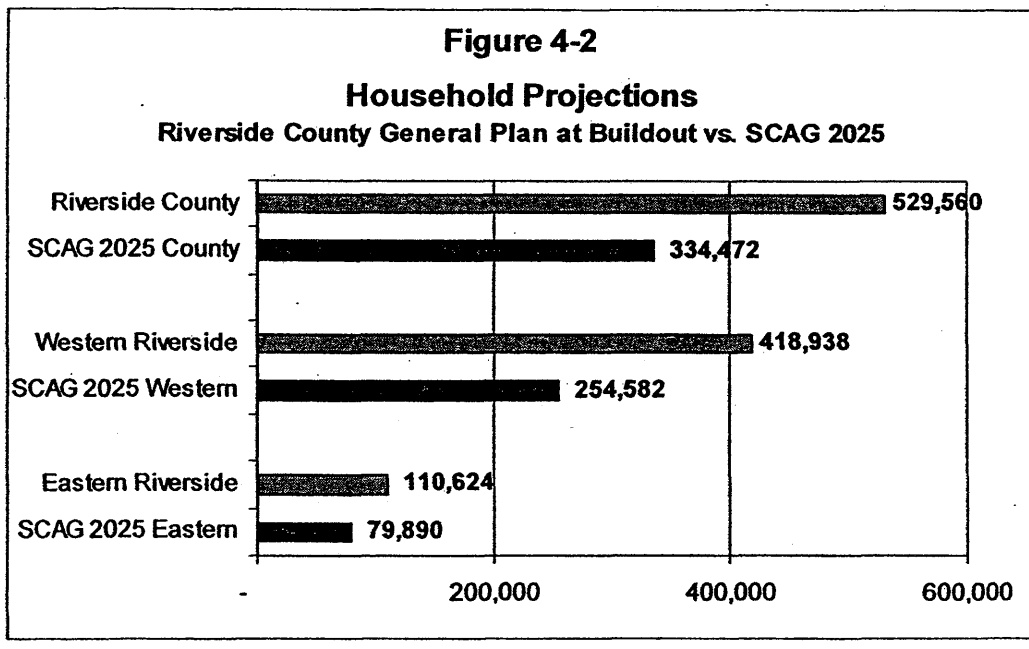


Figure 4-3

Employment Projections

Riverside County General Plan Buildout vs. SCAG 2025

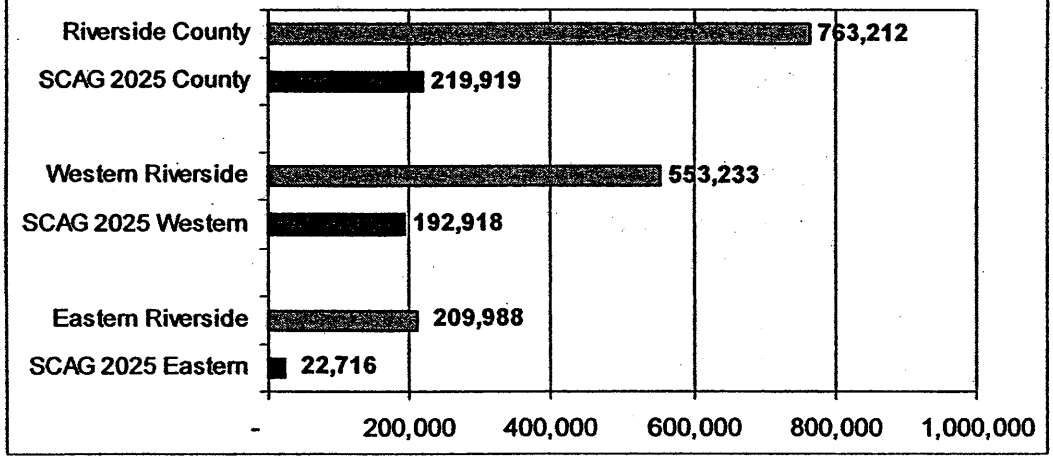
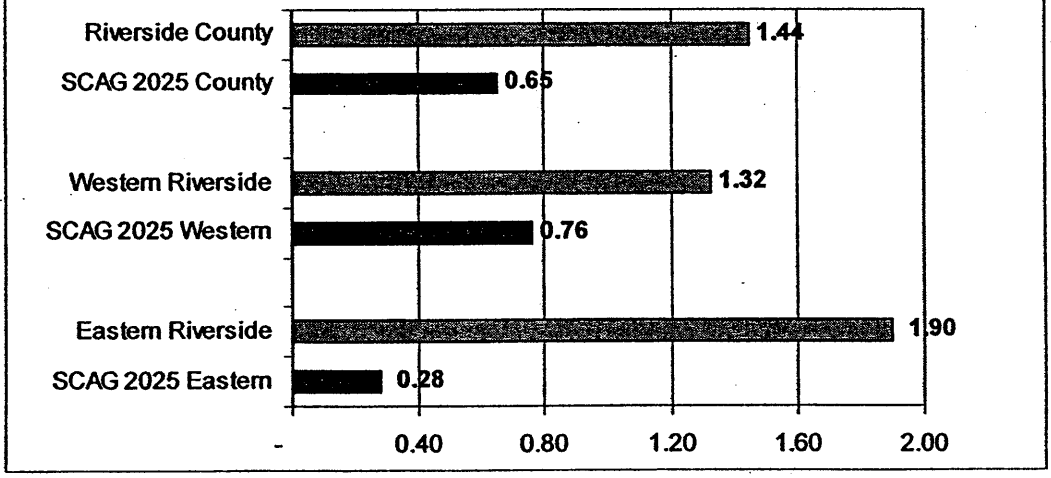


Figure 4-4

Jobs to Households Ratio

Riverside County General Plan Buildout vs. SCAG 2025



that exceeds SCAG's 2025 projection of 215,919 by about 3.5 times. This reflects SCAG's projection to concentrate more employment in existing cities. The General Plan employment projection of 553,233 for Western Riverside County accounts for about 72 percent of total unincorporated Riverside County employment at build-out with the remaining 209,988 employment, or 28 percent, in Eastern Riverside County.

Jobs to Households Ratio

The jobs to households ratio is a general indicator used to measure the growth in jobs relative to households of each scenario used in the General Plan process. In theory, if households have job opportunities closer to where they live, this can potentially reduce overall commuting. Figure 4-4 shows there is a higher jobs to households ratio in the General Plan build-out projections than there is for SCAG 2025.

For unincorporated Riverside County, the projected General Plan ratio of 1.44 jobs to households at build-out is about 2.2 higher than SCAG's 2025 projections of 0.65. For Western Riverside County, the ratio of 1.32 jobs per household is closer to the SCAG 2025 ratio of 0.76, but still 1.7 times higher. For Eastern Riverside County, the jobs to households ratio of 1.90 is radically higher than the SCAG 2025 ratio of 0.28 – almost 7 times higher.

Regional Comparison of Jobs to Households Ratios: 1997 to 2025

For comparison, Table 4-1 presents the jobs to household ratios for each of the six counties within the SCAG region for their forecasts from 1997 to 2025. These ratios are for the combined incorporated and unincorporated areas of each county. In 1997, the ratio for Riverside County was 0.93, not only less than one job per household but significantly less than the regional ratio of 1.34. Also, Riverside County is shown to have the lowest ratio of all the counties.

By 2025, SCAG forecasts that Riverside County will increase to 1.08, a gain of about 16 percent. While Riverside County continues to show more job growth relative to households, it still lags its neighboring counties with San Bernardino County at 1.22 and Orange County at 1.91 by 2025. Los Angeles County while showing a decline in its jobs to household ratio to 1.28 is still forecasted to exceed Riverside County by 2025.

Table 4-1
Regional Job to Households Trends: 1997 to 2025
Riverside County General Plan Update

County	1997			2025			
	Jobs	Households	Ratio	Jobs	Households	Ratio	Change
Imperial	55,573	38,384	1.45	94,061	97,883	0.96	-0.49
Los Angeles	4,303,192	3,071,597	1.40	5,290,938	4,118,809	1.28	-0.12
Orange	1,345,626	887,887	1.52	2,043,660	1,068,051	1.91	0.39
Riverside	432,400	462,830	0.93	1,006,419	933,887	1.08	0.15
San Bernardino	540,141	508,551	1.06	1,085,709	889,875	1.22	0.16
Ventura	293,948	232,831	1.26	431,506	309,210	1.40	0.14
Regional Total	6,970,880	5,202,080	1.34	9,952,293	7,417,715	1.34	0.00

Source: Stanley R. Hoffman Associates, Inc.
SCAG 2025 Regional Forecasts

4.2 Average Retail Sales Per Household, 2000

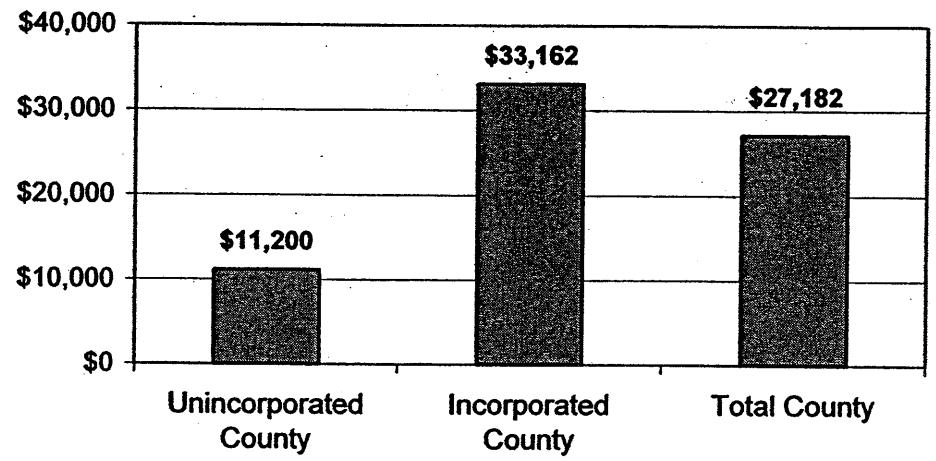
Retail sales are an important revenue generator for most jurisdictions and tend to be concentrated within incorporated cities. As shown in Figure 4-5, the average retail sales per household for incorporated cities within Riverside County was estimated at $33,162. This compares with an average per household of only $11,200 for the unincorporated areas. The combined average for the entire County was estimated at $27,182.

This estimate was based on the California Board of Equalization's 1999 taxable sales data inflated by 3.3 percent to year 2000 dollars. The non-taxable food and drug store sales were estimated to yield a total retail sales estimate. While the Preferred Plan contains a sizable shift in the proportion of future retail development in unincorporated Riverside County, this analysis forms the basis for projecting several retail scenarios where lesser levels of retail development are later tested.

4.3 Market Assumptions

A number of residential and non-residential market assumptions are also included in the Fiscal Model projections as shown in Table 4-2. The average floor area ratios (FARs) by land use for non-residential development provide an estimate of the average amount of gross building square footage when applied against developable acres. These are

Figure 4-5
Average Retail Sales Per Household, 1999
Riverside County General Plan Update



Source: Stanley R. Hoffman Associates, Inc.

Table 4-2
Market Assumptions
Riverside County General Plan Update

Land Use Categories	Floor Area Ratio	Annual Turnover	Average Value/SF [1]	Average SF/Emp.	Taxable Sales/SF
Non-Residential					
Business Park	0.30	5%	$90	600	$10.50
Commercial Office	0.35	5%	$110	300	$0.00
Commercial Retail	0.23	5%	$100	500	$125.00
Commercial Tourist	0.25	5%	$100	500	$0.00
Heavy Industrial	0.40	5%	$60	1,500	$0.00
Light Industrial	0.38	5%	$75	1,030	$21.00

	Units per Acre	Annual Turnover	Average Value/Unit [2]	Average Pop./Unit [3]
Residential				
Open Space-Rural	0.025	7%	$187,600	2.58
Agriculture	0.05	7%	$187,600	2.58
Desert	0.05	7%	$187,600	2.58
Rural Mountainous	0.05	7%	$187,600	2.58
Rural Residential	0.15	7%	$187,600	2.58
Very Low	1.20	7%	$187,600	2.58
Low	3.50	7%	$187,600	2.58
Medium	6.50	7%	$187,600	2.58
Medium High	11.00	7%	$187,600	2.58
High	17.00	7%	$187,600	2.58
Very High	30.00	7%	$187,600	2.58

Note:
1. The average value per square foot includes construction costs and land value.
2. The average value per unit is based on the April 2001 average annual home price from the Real Estate Research Council of Southern California.
3. The average population per housing unit of 2.58 for unincorporated Riverside County is based on the January 1, 2000 Department of Finance estimate which accounts for vacant units. The estimated average population per occupied housing unit is 3.01 in the unincorporated area.

Source: Stanley R. Hoffman Associates, Inc.
The Planning Center.
California Department of Finance Population and Housing Estimates, January 1, 2000.

mid-point averages developed by The Planning Center and can increase somewhat for more intensified development within community center or rural village overlay zones.

Additionally, an average ownership turnover rate was estimated once every 20 years, or 5 percent. The average valuation per square foot is also shown in Table 4-2 as ranging from a low of $60 per square foot for heavy industrial to $110 per square foot for commercial office, including construction and land cost. Conversely, average square feet per employee ranges from a low of 300 square feet per employee for commercial office to 1,500 square foot per employee for heavy industrial.

Taxable sales per square foot also vary by type of land use as discussed in detail in Chapter 9, Section 5. Taxable retail sales per square foot are currently estimated to average about $125 per square foot for existing retail development in unincorporated Riverside County. Additionally, light industrial and business park uses are estimated to generate $21 per square foot and $10.50 per square foot of non-retail taxable sales, respectively.

Also, as shown in Table 4-2, residential densities vary by land use from lows of 0.025 units per acre (40 acre minimum) and 0.05 units per acre (20 acre minimum) for Agriculture, Desert and Rural Mountainous zones to 17 units per acre for High density and 30 units per acre for Very High density. As indicated above, these are mid-point averages developed by The Planning Center and can increase somewhat for more intensified development within community center or rural village overlay zones. An average ownership turnover rate of 7 percent, or once every 14 years, is estimated for all units.

The average value for new homes of $187,600 is based on the April 2001 average annual home price survey from the Real Estate Research Council of Southern California. Based on a calibration analysis discussed in Chapter 9, Section 5, the estimated valuation of existing units was $146,330. Also, the average population per housing unit of 2.58 for unincorporated Riverside County is based on the January 1, 2000 Department of Finance estimate that accounts for vacant units. The estimated average population per occupied housing unit is 3.01 in the unincorporated area.

Chapter 5
FISCAL ANALYSIS OF UNINCORPORATED RIVERSIDE COUNTY

The General Fund fiscal analysis at hypothetical build-out is presented for six land use scenarios as shown in Table 5-1. These projections are for the unincorporated portion of Riverside County. The Preferred Plan fiscal analysis is the base case against which the other scenarios are compared and represents a projected population of 1,366,265 and households of 529,560. The employment is projected to reach 763,212 for office, retail, tourist commercial and light and heavy industrial land uses. Retail square footage is estimated to total 91,357,850.

Table 5-1
Socio-Economic Summary, Unincorporated Riverside County
Riverside County General Plan Update

Scenario	Population	Housing Units	Employment	Retail Sq. Ft.
Plan	1,366,265	529,560	763,212	91,357,850
Sphere	464,031	179,856	224,476	21,537,959
Retail 56%	1,366,265	529,560	683,365	51,434,470
Retail 35%	1,366,265	529,560	644,081	31,792,532
Retail 23%	1,366,265	1,366,265	622,886	21,195,021
SCAG 2025	856,651	332,035	219,919	25,580,198

Source: Stanley R. Hoffman Associates, Inc.

The socio-economic projections for the Sphere area represent about one-third of the total development and about 24 percent of the retail square footage. A series of retail sensitivity analyses are then presented that test varying levels ranging from 56 percent down to 23 percent of the Preferred Plan retail square footage. The SCAG 2025 projections are also presented for comparison. SCAG 2025 projections of population and employment are about two-thirds the level of the build-out totals. The SCAG 2025 employment projections are only about 29 percent of the build-out totals. The retail square footage under the SCAG 2025 scenario is estimated by reducing the Preferred Plan retail square footage in proportion to employment. The detailed fiscal and land use tables for each of the scenarios are presented in Appendix A.

5.1 Preferred Plan

The General Fund fiscal impact analysis for the Preferred Plan yields a revenue/cost ratio at build-out of 1.30 as summarized in Figure 5-1. This means that the projected revenues of about $600.8 million exceed projected costs of about $460.7 million by 30 percent, or $140.1 million, as presented in the detailed Appendix Table A-1.1, page A-1. As shown in the appendix table, the three major revenue sources of property taxes ($217.7 million), sales taxes ($177.7 million) and motor vehicle license fees ($73.8 million) represent about 78 percent of the total revenues.

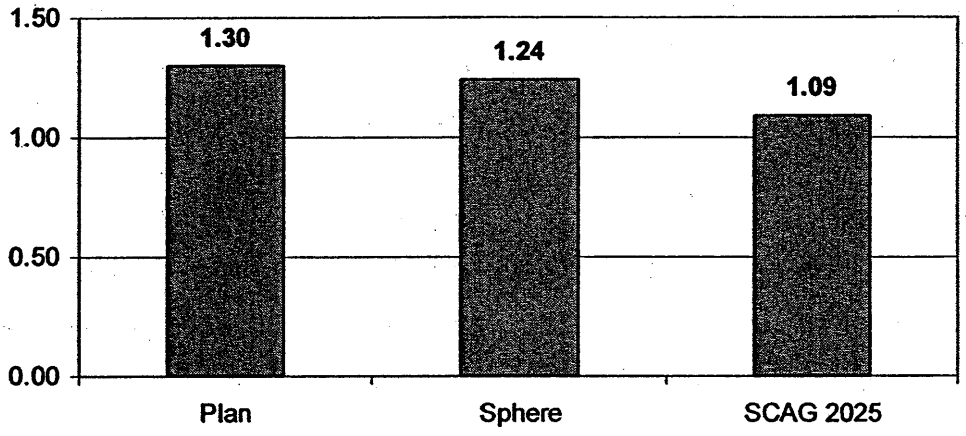
The General Fund costs total about $460.7 million. In addition to local Justice and Law Enforcement costs estimated at $139.5 million for sheriff patrol, Justice and Law Enforcement for countywide functions, such as the court system, are projected at about $136.2 million. Also, General Fund Fire Protection costs of $36.3 million are projected to supplement the County Fire Department's property tax and fee revenue sources. Two other significant cost areas include Administrative and Fiscal functions ($34.6 million) and Capital Lease/Construction/Contingency categories ($40.4 million). Together, these five categories represent about 84 percent of the total projected costs.

5.2 Sphere

The fiscal projections for the unincorporated Sphere of Influence areas adjacent to existing incorporated cities are summarized in Figure 5-1 at a revenue/cost ratio of 1.24 and presented in detail in Appendix Table A-2.1, page A-3. This ratio of 1.24 is less than the Preferred Plan ratio of 1.30 and suggests that the Preferred Plan retail and employment development is more concentrated outside the existing Sphere of Influence areas, particularly in the proposed community center and rural village overlays.

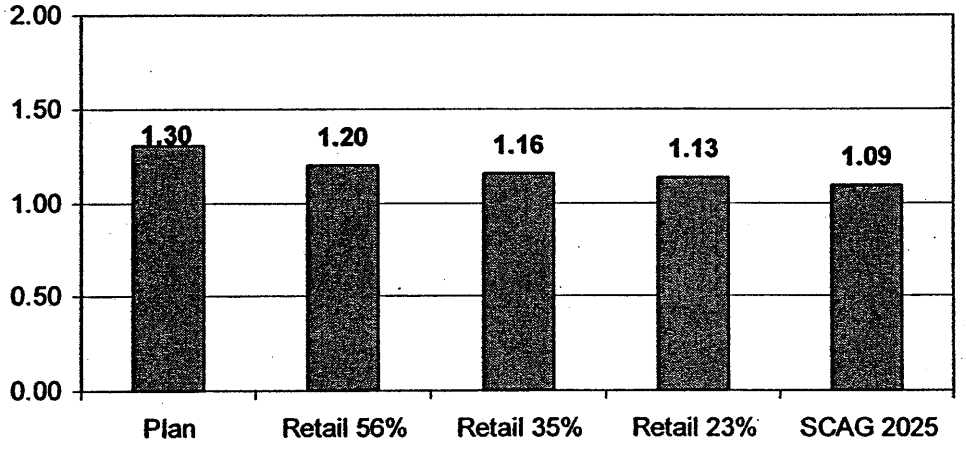
The total projected revenues of $186.6 million represent about 31 percent of the Preferred Plan revenues. However, the sales tax revenues are proportionally less for the Sphere area at about 26 percent of total General Fund revenues compared to 30 percent for the larger Preferred Plan area. The total projected costs of $149.7 million represent about 32 percent of the Preferred Plan costs and have a similar cost distribution.

Figure 5-1
Revenue/Cost Ratios
Unincorporated Riverside County



Source: Stanley R. Hoffman Associates, Inc.

Figure 5-2
Retail Scenario Revenue/Cost Ratios
Unincorporated Riverside County



Source: Stanley R. Hoffman Associates, Inc.

5.3 Retail Scenarios

A series of retail square footage reduction scenarios are summarized in Figure 5-2 as decreasing the projected fiscal surplus under the Preferred Plan land uses. Compared with the revenue/cost ratio of 1.30 for the Preferred Plan, the ratios decrease from 1.20 for the 56 percent scenario down to 1.13 for the 23 percent scenario. As discussed earlier, the 56 percent scenario represents an estimated capture of household taxable retail sales similar to the average of all incorporated cities in the County while the 23 percent scenario approximates the existing average of the total unincorporated area. The 35 percent scenario represents an intermediate point where the County is projected to increase above its existing average but not quite to the average of the cities.

Retail sales tax is the third most important revenue source to the County behind property taxes and motor vehicle license fees. This analysis demonstrates the importance of retail sales tax for the County in achieving a balanced budget. The General Fund fiscal projections and the development summaries for each scenario are presented in detail in Appendix Tables A-3.1 through A-5.2, pages A-5 through A-10.

5.4 SCAG 2025

Also shown in both Figures 5-1 and 5-2 is a comparison of the SCAG 2025 projections with the other scenarios. The SCAG 2025 projections yield the lowest revenue/cost ratio of 1.09. As presented earlier in Chapter 4, this is due to the lower projected employment gains in the unincorporated areas of the County as compared with the cities under SCAG 2025. The level of sales tax revenues under the SCAG 2025 projections represents about 18 percent of the total General Fund revenues. This is virtually the same as the current sales tax proportion under the County's 2000-2001 General Fund budget.

The SCAG 2025 projections are estimated by lowering the development land uses under the Preferred Plan in proportion to the lower residential population and employment projections. The detailed General Fund fiscal projections and the development summary for this scenario are presented in Appendix Tables A-6.1 and A-6.2, pages A-11 and A-12.

Chapter 6

FISCAL ANALYSIS OF UNINCORPORATED WESTERN RIVERSIDE COUNTY

The General Fund fiscal analysis at hypothetical build-out is also presented for six land use scenarios for the unincorporated portion of Western Riverside County as shown in Table 6-1. The Preferred Plan fiscal analysis is the base case against which the other scenarios are compared and represents a projected population of 1,080,860 and households of 418,938 -- 79 percent of the total projected unincorporated County. The employment is projected to reach 553,233 for office, retail, tourist commercial and light and heavy industrial land uses – about 73 percent of the total projected County employment. Retail square footage is estimated to total 76,034,251.

Table 6-1
Socio-economic Summary, Unincorporated Western Riverside County
Riverside County General Plan Update

Scenario	Population	Housing Units	Employment	Retail Sq. Ft.
Plan	1,080,860	418,938	553,233	76,034,251
Sphere	360,449	139,709	131,442	17,195,970
Retail 56%	1,080,860	418,938	486,779	42,807,283
Retail 35%	1,080,860	418,938	454,084	26,459,919
Retail 23%	1,080,860	418,938	436,444	17,639,946
SCAG 2025	665,062	257,776	195,121	26,535,954

Source: Stanley R. Hoffman Associates, Inc.

The socio-economic projections for the Sphere area represent about one-third of the total development and about 23 percent of the retail square footage. A series of retail sensitivity analyses are then presented that test varying levels ranging from 56 percent down to 23 percent of the Preferred Plan retail square footage. The SCAG 2025 projections are also presented for comparison. SCAG 2025 projections of population and employment are about 63 percent of the level of the build-out totals. The SCAG 2025 employment projections are only about 29 percent of the build-out totals. The retail square footage under the SCAG 2025 scenario is estimated by reducing the

Preferred Plan retail square footage in proportion to employment. The detailed fiscal and land use tables for each of the scenarios are presented in Appendix B.

6.1 Preferred Plan

The General Fund fiscal impact analysis for the Preferred Plan yields a revenue/cost ratio at build-out of 1.28 as summarized in Figure 6-1. This means that the projected revenues of about $457.0 million exceed projected costs of about $354.6 million by about 28 percent, or $102.4 million, as presented in the detailed Appendix Table B-1.1, page B-1. As shown in the appendix table, the three major revenue sources of property taxes ($163.9 million), sales taxes ($133.8 million) and motor vehicle license fees ($58.4 million) represent about 78 percent of the total revenues.

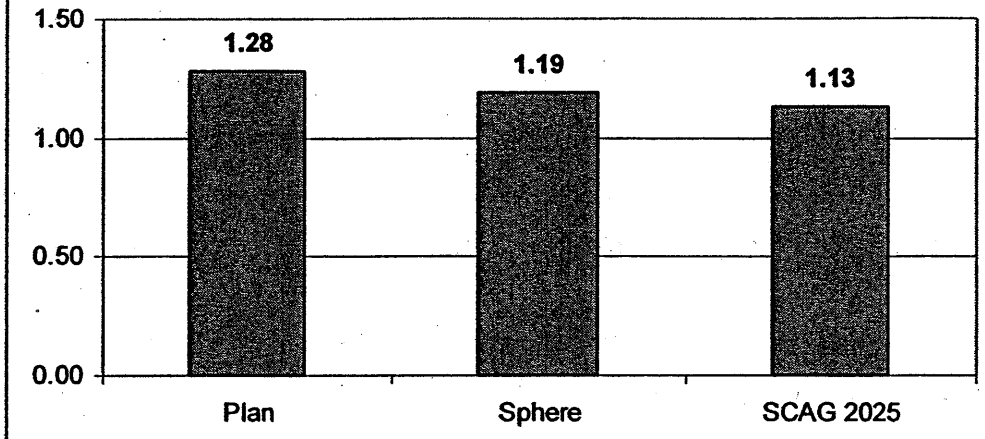
The General Fund costs total about $354.6 million. In addition to local Justice and Law Enforcement costs estimated at $107.1 million for sheriff patrol, Justice and Law Enforcement for countywide functions, such as the court system, are projected at about $104.5 million. Also, General Fund Fire Protection costs of $27.9 million are projected to supplement the County Fire Department's property tax and fee revenue sources. Two other significant cost areas include Administrative and Fiscal functions ($26.6 million) and Capital Lease/Construction/Contingency categories ($31.0 million). Together, these five categories represent about 84 percent of the total projected costs.

6.2 Sphere

The fiscal projections for the unincorporated Sphere of Influence areas adjacent to existing incorporated cities are summarized in Figure 6-1 at a revenue/cost ratio of 1.19 and presented in detail in Appendix Table B-2.1, page B-3. This ratio of 1.19 is less than the Preferred Plan ratio of 1.28 and suggests that the Preferred Plan retail and employment development is more concentrated outside the existing Sphere of Influence areas, particularly in the proposed community center and rural village overlays.

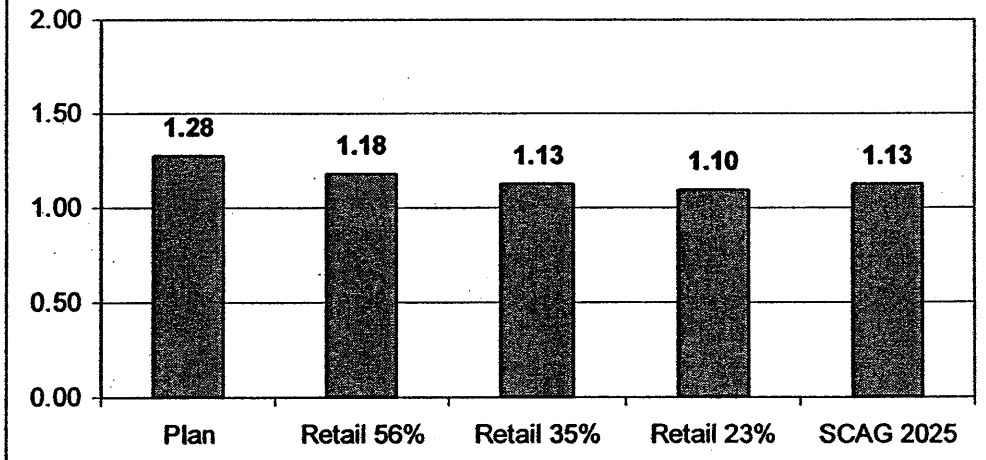
The total projected revenues of $129.0 million represent about 28 percent of the Preferred Plan revenues. However, the sales tax revenues are proportionally less for the Sphere area at about 24 percent of total revenues compared to 29 percent for the larger Preferred Plan area. The total projected costs of $108.0 million represent about 30 percent of the Preferred Plan costs and have a similar cost distribution.

Figure 6-1
Revenue/Cost Ratios
Unincorporated Western Riverside County



Source: Stanley R. Hoffman Associates, Inc.

Figure 6-2
Retail Scenario Revenue/Cost Ratios
Unincorporated Western Riverside County



Source: Stanley R. Hoffman Associates, Inc.

6.3 Retail Scenarios

A series of retail square footage reduction scenarios are summarized in Figure 6-2 as decreasing the projected fiscal surplus under the Preferred Plan land uses. Compared with the revenue/cost ratio of 1.30 for the Preferred Plan, the ratios decrease from 1.18 for the 56 percent scenario down to 1.10 for the 23 percent scenario. As discussed earlier, the 56 percent scenario represents an estimated capture of household taxable retail sales similar to the average of all incorporated cities in the County while the 23 percent scenario approximates the existing average of the total unincorporated area. The 35 percent scenario represents an intermediate point where the County is projected to increase above its existing average but not quite to the average of the cities.

Retail sales tax is the third most important revenue source to the County behind property taxes and motor vehicle license fees. Again, this analysis demonstrates the importance of retail sales tax for the County in achieving a balanced budget. The General Fund fiscal projections and the development summaries for each scenario are presented in detail in Appendix Tables B-3.1 through B-5.2, pages B-5 through B-10.

6.4 SCAG 2025

Also shown in both Figures 6-1 and 6-2 is a comparison of the SCAG 2025 projections with the other scenarios. The SCAG 2025 projections yield a revenue/cost ratio of 1.13. As presented earlier in Chapter 4, this is due to the lower projected employment gains in the unincorporated areas of the County as compared with the cities under SCAG 2025. The level of sales tax revenues under the SCAG 2025 projections represents about 22 percent of the total General Fund revenues. This is only about 3 percentage points higher than the current sales tax proportion under the County's 2000-2001 General Fund budget.

As stated previously, the SCAG 2025 projections are estimated by lowering the development land uses under the Preferred Plan in proportion to the lower residential population and employment projections. The detailed General Fund fiscal projections and the development summary for this scenario are presented in Appendix Tables B-6.1 and B-6.2, pages B-11 and B-12.

Chapter 7

FISCAL ANALYSIS OF UNINCORPORATED EASTERN RIVERSIDE COUNTY

The General Fund fiscal analysis at hypothetical build-out is presented for six land use scenarios for the unincorporated portion of Eastern Riverside County as shown in Table 7-1. Again, the Preferred Plan fiscal analysis is the base case against which the other scenarios are compared and represents a projected population of 285,411 and households of 110,624 -- 21 percent of the total unincorporated County. The employment is projected to reach 209,988 for office, retail, tourist commercial and light and heavy industrial land uses. Retail square footage is estimated to total 15,323,600.

Table 7-1
Socio-Economic Summary, Unincorporated Eastern Riverside County
Riverside County General Plan Update

Scenario	Population	Housing Units	Employment	Retail Sq. Ft.
Plan	285,411	110,624	209,988	15,323,600
Sphere	103,587	40,150	93,182	4,341,689
Retail 56%	285,411	110,624	193,937	8,627,187
Retail 35%	285,411	110,624	190,061	5,332,613
Retail 23%	285,411	110,624	186,506	3,555,075
SCAG 2025	207,187	80,305	29,525	1,654,949

Source: Stanley R. Hoffman Associates, Inc.

The socio-economic projections for the Sphere area represent about 36 percent of the total development and about 28 percent of the retail square footage. A series of retail sensitivity analyses are then presented that test varying levels ranging from 56 percent down to 23 percent of the Preferred Plan retail square footage. The SCAG 2025 projections are also presented for comparison. SCAG 2025 projections of population and employment are about 72 percent of the build-out totals for Eastern Riverside. The SCAG 2025 employment projections are only about 14 percent of the build-out totals. The retail square footage under the SCAG 2025 scenario is estimated by reducing the Preferred Plan retail square footage in proportion to employment. The detailed fiscal and land use tables for each of the scenarios are presented in Appendix C.

7.1 Preferred Plan

The General Fund fiscal impact analysis for the Preferred Plan yields a revenue/cost ratio at build-out of 1.35 as summarized in Figure 7-1. This means that the projected revenues of about $143.8 million exceed projected costs of about $106.1 million by about 35 percent, or $37.7 million, as presented in the detailed Appendix Table C-1.1, page C-1. As shown in the appendix table, the three major revenue sources of property taxes ($53.8 million), sales taxes ($43.9 million) and motor vehicle license fees ($15.4 million) represent about 79 percent of the total revenues.

The General Fund costs total about $106.1 million. In addition to local Justice and Law Enforcement costs estimated at $32.4 million for sheriff patrol, Justice and Law Enforcement for countywide functions, such as the court system, are projected at about $31.6 million. Also, General Fund Fire Protection costs of $8.4 million are projected to supplement the County Fire Department's property tax and fee revenue sources. Two other significant cost areas include Administrative and Fiscal functions ($8.1 million) and Capital Lease/Construction/Contingency categories ($9.4 million). Together, these five categories represent about 85 percent of the total projected costs.

7.2 Sphere

The fiscal projections for the unincorporated Sphere of Influence areas adjacent to existing incorporated cities are summarized in Figure 7-1 at a revenue/cost ratio of 1.38 and presented in detail in Appendix Table C-2.1, page C-3. This ratio of 1.38 is more than the Preferred Plan ratio of 1.35 and suggests that the Preferred Plan retail and employment development in Eastern Riverside is slightly more concentrated inside the existing Sphere of Influence areas in contrast to Western Riverside County.

The total projected revenues of $57.9 million represent about 40 percent of the Preferred Plan revenues. The sales tax revenues are proportionally similar for the Sphere area at about 29 percent compared to 31 percent for the larger Preferred Plan area. The total projected costs of $41.8 million represent about 39 percent of the Preferred Plan costs with a similar cost distribution.

Figure 7-1
Revenue/Cost Ratios
Unincorporated Eastern Riverside County

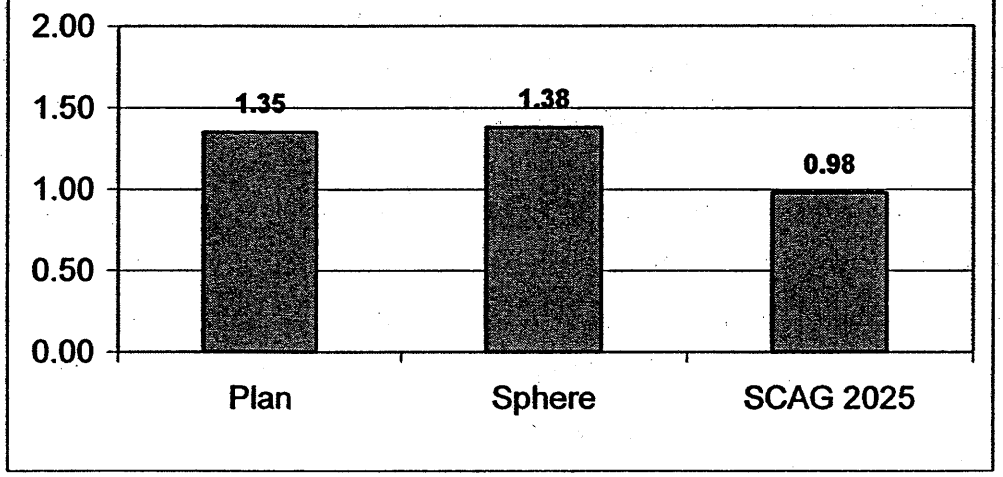
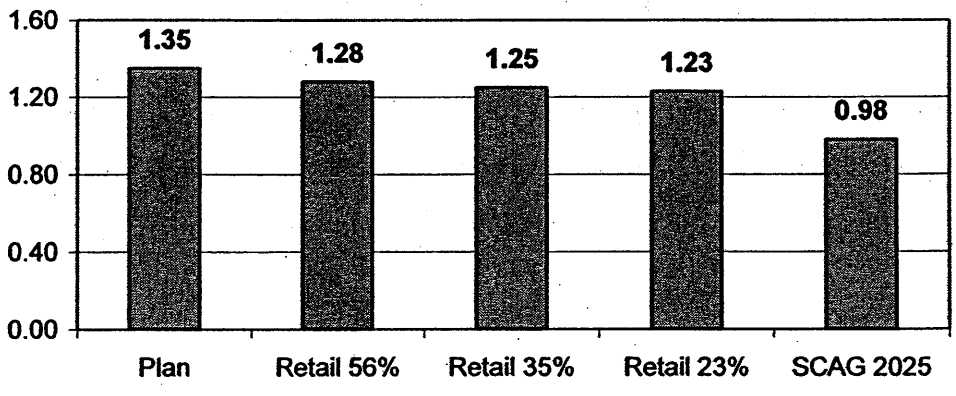


Figure 7-2
Retail Scenario Revenue/Cost Ratios
Unincorporated Eastern Riverside County



Source: Stanley R. Hoffman Associates, Inc.

7.3 Retail Scenarios

As before, a series of retail square footage reduction scenarios are summarized in Figure 7-2 as decreasing the projected fiscal surplus under the Preferred Plan land uses. Compared with the revenue/cost ratio of 1.35 for the Preferred Plan, the ratios decrease from 1.28 for the 56 percent scenario down to 1.23 for the 23 percent scenario. As discussed earlier, the 56 percent scenario represents an estimated capture of household taxable retail sales similar to the average of all incorporated cities in the County while the 23 percent scenario approximates the existing average of the total unincorporated area. The 35 percent scenario represents an intermediate point where the County is projected to increase above its existing average but not quite to the average of the cities.

Retail sales tax is the third most important revenue source to the County behind property taxes and motor vehicle license fees. As before, this analysis demonstrates the importance of retail sales tax for the County in achieving a balanced budget. The General Fund fiscal projections and the development summaries for each scenario are presented in detail in Appendix Tables C-3.1 through C-5.2, pages C-5 through C-10.

7.4 SCAG 2025

Also shown in both Figures 7-1 and 7-2 is a comparison of the SCAG 2025 projections with the other scenarios. The SCAG 2025 projections yield the lowest revenue/cost ratio of 0.98. This is the only scenario that shows a small fiscal deficit and is due to the low projected employment gains in the unincorporated areas of the County as compared with the cities under SCAG 2025. The level of sales tax revenues under the SCAG 2025 projections represents only about 9 percent of the total General Fund revenues. This is much lower than the current sales tax proportion of 19 percent under the County's 2000-2001 General Fund budget. The detailed General Fund fiscal projections and the development summary for this scenario are presented in Appendix Tables C-6.1 and C-6.2, pages C-11 and C-12.

Chapter 8
FISCAL ANALYSIS AREAS

This chapter presents the revenue/cost projections by seven Fiscal Analysis Areas as shown in Figure 8.1. As discussed earlier, the FAA's were selected to represent economic subareas of the County. The Western Riverside County sub region consists of five FAA's, including the mountainous REMAP area. The Eastern Riverside County sub-region consists of two FAA's, including the Coachella Valley and the eastern Riverside County area with Desert Center and Palo Verde Valley. These seven FAA's provide a more manageable number to study sub-regional differences than the 20 General Plan Area Plans. The fiscal comparisons are made only for the Preferred Plan at this time and are summarized in Figure 8-2. The socioeconomic projections are summarized in Table 8-1 for each Fiscal Analysis Area.

Table 8-1
Socio-Economic Summary, Fiscal Analysis Areas
Riverside County General Plan Update

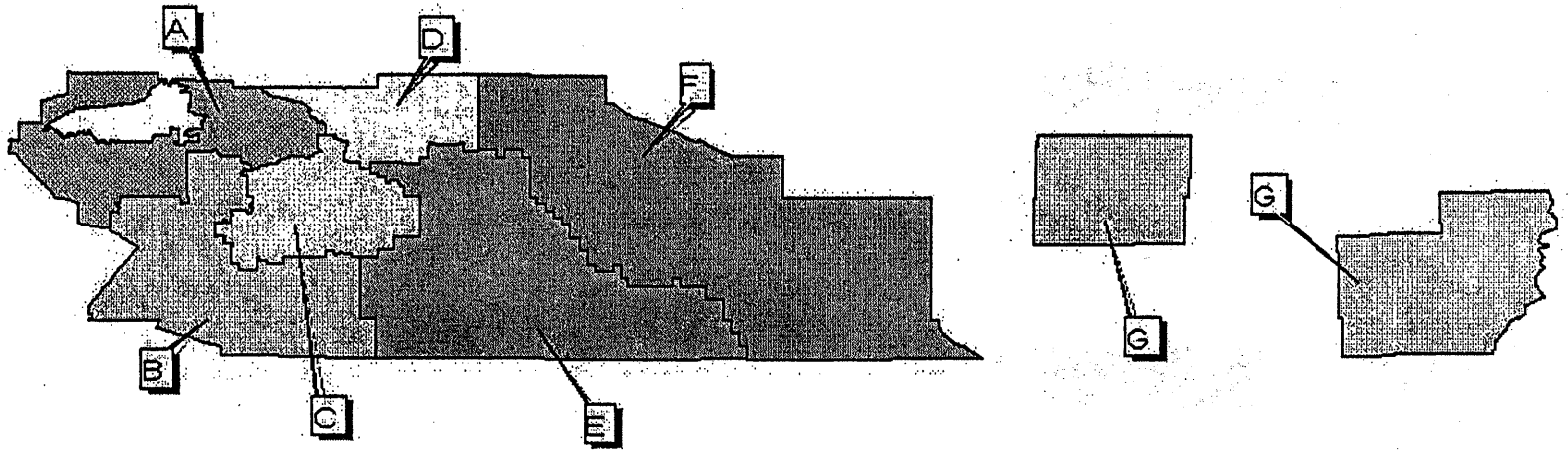
Scenario	Population	Housing Units	Employment	Retail Sq. Ft.
Northwest	265,709	102,988	235,258	20,206,674
Southwest	240,270	93,128	124,394	20,341,066
Centralwest	423,120	164,000	163,501	28,106,941
Pass	51,717	20,045	12,584	2,562,610
Mountain	100,046	38,777	17,734	4,816,960
Coachella Valley	235,078	91,116	181,509	13,586,800
Eastern	50,326	19,506	28,564	1,736,800
Total	**1,366,266**	**529,560**	**763,544**	**91,357,851**

Source: Stanley R. Hoffman Associates, Inc.

8.1 Northwest

This FAA consists of the following Area Plans: Jurupa, Eastvale, Temescal Canyon, Lake Mathews, Highgrove/Northside, March and Reche Canyon/Badlands. It is the closest subarea to Orange and Los Angeles Counties and represents about 19 percent of the total projected population and about 31 percent of the total projected

Figure 8-1
Fiscal Analysis Areas
Riverside County General Plan Update



Western Riverside
- A Northwest
- B Southwest
- C Centralwest
- D Pass
- E Mountain

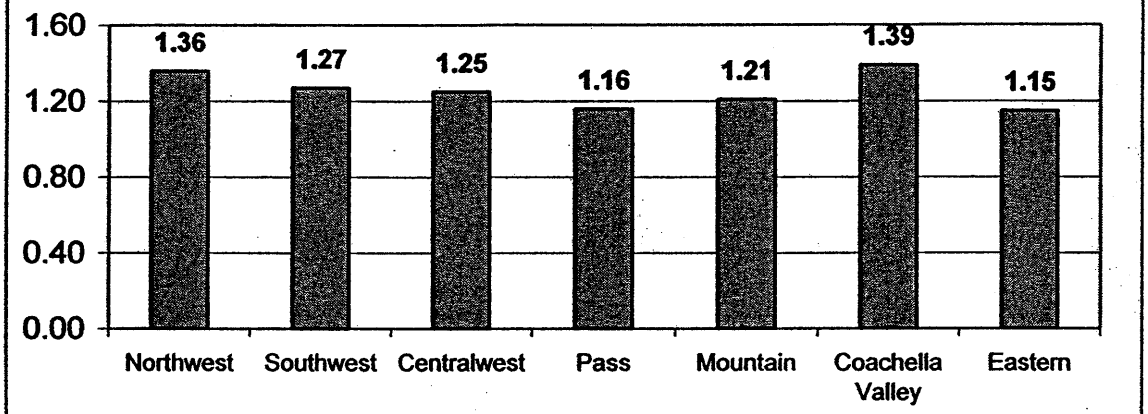
Eastern Riverside
- F Coachella Valley
- G Eastern

Source: Stanley R. Hoffman Associates, Inc.

Mende Consulting

employment. The revenue/cost ratio is the second highest at 1.36, as shown in Figure 8-2 and detailed in Tables D-1.1 and D-1.2, pages D-1 and D-2.

Figure 8-2
Fiscal Analysis Areas: Revenue/Cost Ratios
Riverside County General Plan Update



Source: Stanley R. Hoffman Associates, Inc.

8.2 Southwest

This FAA consists of the following Area Plans: Lake Elsinore, Mead Valley and the Southwest area. This FAA occupies the southwestern corner of Riverside County and includes the rapidly growing cities of Temecula and Murrieta. This FAA is traversed in a north-south direction by Interstate 15. It has a similar proportion of the County's projected population at 18 percent, but significantly less employment, at 16 percent, than the Northwest FAA. The revenue/cost ratio is 1.27 with about 22 percent of the total Preferred Plan retail square footage allocated in this area. The detailed projections are shown in Tables D-2.1 and D-2.2, pages D-2 and D-3.

8.3 Centralwest

This FAA consists of the unincorporated developments of Sun City/Memifee, Lakeview/Nuevo, Highway 74/79 Corridor and the San Jacinto Valley. It occupies a central geographic position in Western Riverside County extending from the Sun City/Menifee community to the base of San Jacinto Mountain. It is traversed in the north/south direction by the Highway 74/79 corridor that is slated for upgrade to a multiple lane thoroughfare in the near future. At 423,120, it has the largest proportion

(31 percent) of the total projected County population and 21 of the total projected employment. As shown on Figure 8-2, it has a revenue/cost ratio of 1.25. It also has the highest proportion of the total Preferred Plan retail square footage at 31 percent. The detailed projections are shown in Tables D-3.1 and D-3.2, pages D-5 and D-6.

8.4 Pass

The Pass FAA is located in the northeastern section of Western Riverside County and encompasses the area that leads through the San Gorgonio Pass into the Coachella Valley. It represents only about 4 percent of the total projected County population and about 2 percent of the projected employment. As shown in Figure 8-2, it has one of the lowest projected revenue/cost ratios of 1.16 with only about 3 percent of the projected retail square footage in the unincorporated County. The detailed projections are shown in Tables D-4.1 and D-4.2, pages D-7 and D-8.

8.5 Mountain (REMAP)

The Mountain FAA, or REMAP (Riverside Extended Mountain Area Plan), consists of the unincorporated communities in the foothills of San Jacinto Mountain. It represents about 7 percent of the total projected County population and only 2 percent of the projected employment, as shown in Table 8-1. The revenue/cost ratio of 1.21 is summarized in Figure 8-2 and detailed in Table D-5.1, page D-9. The development summary is presented in Table D-5.2, page D-10.

8.6 Coachella Valley

The Coachella Valley FAA consists of the western Coachella Valley from the San Gorgonio Pass to the eastern Coachella Valley ending at the Salton Sea. It is largely a desert region with a high proportion of second homes and seasonal tourist activities. Its projected population of 235,078 represents 17 percent of the projected total population in the unincorporated area; its build-out employment of 181,509 represents 24 percent of the projected employment. The revenue/cost ratio of 1.39 summarized in Table 8-2 is the highest projected ratio. This area is characterized by a high proportion of tourist destination locations and is allocated about 15 percent of the retail square footage in the unincorporated County under the Preferred Plan. The detailed fiscal projections and development summary are presented in Tables D-6.1 and D-6.2, pages D-11 and D-12.

8.7 Eastern

The Eastern FAA is the most undeveloped portion of the County and extends eastward from the Coachella Valley to the eastern border of Riverside County along the Colorado River. The Desert Center and the Palo Verde Valley area plans are included in this geographic region. The projected population of 50,326 represents about 4 percent of the unincorporated County and the projected employment of 28,564 also represents about 4 percent of the total, as shown in Table 8-1. The projected revenue/cost ratio of 1.15 is the lowest of the seven FAA's. Only about 2 percent of the retail square footage is allocated in this Fiscal Analysis Area. The detailed fiscal projections and development summary are presented in Tables D-7.1 and D-7.2, pages D-13 and D-14.

Chapter 9

GENERAL FUND FISCAL METHODOLOGY

The General Fund is the main operating fund of the County. It is used to account for expenditures and revenues for Countywide and selected locally delivered services. General Fund programs administered by the Board of Supervisors include: Administrative and Fiscal; General Services; Environmental and Development Services; Justice and Law Enforcement; Fire Protection; Health Services; Community and Social Services; Education, Recreation and Culture; and Capital Lease, Construction and Contingency.

This chapter presents the methodology used to derive the 2000-2001 fiscal factors for the County of Riverside General Fund. The fiscal factors have been developed to evaluate the fiscal impacts of new development in the unincorporated portions of Riverside County and for other fiscal analyses. Derivations of the fiscal factors have been prepared based on review and analysis of the current Riverside County *Fiscal Year 2000-01 Final Budget* and discussions with County staff.

9.1 Fiscal Analysis Approach

Several approaches are used in this methodology including the multiplier approach or average cost approach; the marginal cost approach; and case study analysis.

Multiplier Approach. Costs and revenues are estimated on net cost or net revenue per unit basis using the multiplier approach. Unit measures include per capita, per dwelling unit, per employee, per lane mile, per acre or other per unit approach. This approach is also referred to as the average cost method.

Case Study. This approach is used for a unique situation or service. Revenue and cost estimates are made by a consultant or management level personnel knowledgeable about the particular service and existing local conditions. Two examples of the case study approach include:

- The calculation of property tax revenue, which is determined by the allocations of the one percent basic property tax levy within a specific tax rate area (TRA) for estimated project valuations
- The estimation of local fire protection costs from the Fire Department based on unique station requirements

Marginal Cost Approach. The marginal cost approach assumes that certain fixed costs do not increase in direct proportion with new growth. Net costs are adjusted by a marginal rate. The marginal net costs are then allocated on a per capita and per employee basis.

Additionally, the concept of level of service standards that should be applied in the future is very important and is tied to the combination of policy decisions and budget constraints. The level of services is also related to the quality of life expected by residents and businesses. Generally, two approaches are taken with regards to level of service analysis:

- **Existing Levels of Service** - Estimated and used as guidelines to be held constant into the future.
- **Desired Level of Service** - Estimated and used for policy analysis as to the cost to achieve these levels in the future.

The General Fund fiscal analysis utilizes the existing level of service approach. In reality, jurisdictions are balancing both revenues and costs to provide an adequate level of service while striving for ways to either raise revenues or develop more efficient service delivery systems to achieve a desired level of service.

9.2 General Assumptions

The 2000-2001 fiscal factors are based on analysis of the County of Riverside *Fiscal Year 2000-2001 Final Budget* prepared by the County Executive Office, discussions with County staff and population and employment estimates. Population estimates are from the California Department of Finance and employment estimates are from the Southern California Association of Governments. Population and employment estimates for January, 2000 are:

Riverside County	Population	Employment
Total County	1,522,855	511,045
Unincorporated	401,362	78,568

Many of the General Fund recurring revenues and costs are allocated between population and employment based on the shares of population and employment to the combined population and employment for the appropriate jurisdiction. As shown in the following tables population and employment for the Total County is split at a ratio of 75 percent to 25 percent, while population and employment in the unincorporated areas of the County is split at a ratio of 84 percent to 16 percent.

Riverside County	Population and Employment	Share of Total	
		Population	Employment
Total County	2,033,900	75%	25%
Unincorporated	479,930	84%	16%

9.3 General Fund Recurring Revenues

Fiscal Year 2000-2001 recurring revenues to the General Fund are estimated at $340.37 million. As shown in Table 9-1, these recurring revenues include property tax, property transfer tax, sales and use tax and transient occupancy tax totaling $159.31 million and other General Fund revenues totaling $181.05 million.

Land Use and Market Based Revenue Factors

Property tax, property transfer tax, sales and use tax and transient occupancy tax are projected on a case study approach. These revenues are based on project specific land use and market assumptions as well as taxes and rates set by the County and State.

TABLE 9-1
RIVERSIDE COUNTY GENERAL FUND FISCAL ANALYSIS
SUMMARY OF GENERAL FUND REVENUE FACTORS
(In Constant 2001 Dollars)

Category	Fiscal Year 2000-2001 Budget Amount	Distribution/Divisor[1]	Revenue Allocation[2]		Revenue Factor[3]	
			Population	Employment	Per Capita	Per Employee
Taxes						
Property Tax	$132,171,000	Assessed Valuation	Case Study			
Property Transfer Tax	7,000,000	Assessed Valuation	Case Study			
Sales and Use Tax	19,394,000	Taxable Sales	Case Study			
Transient Lodging Tax	748,000	Room Receipts	Case Study			
Subtotal	$159,313,000					
Other General Fund Revenues						
Franchises	$3,065,000	Unincorporated Population and Employment	84.0%	16.0%	$6.41	$6.24
Vehicle Code Fines	2,035,000	Unincorporated Population and Employment	84.0%	16.0%	$4.26	$4.14
Other Court Fines	990,000	Countywide Population and Employment	75.0%	25.0%	$0.49	$0.48
Municipal Court Fines	17,886,739	Countywide Population and Employment	75.0%	25.0%	$8.81	$8.75
Forfeitures and Penalties	8,968,240	Countywide Population and Employment	75.0%	25.0%	$4.42	$4.39
Interest on Invested Funds	29,200,932	Countywide Population and Employment	75.0%	25.0%	$14.38	$14.28
Motor Vehicle In-lieu[4]	82,307,629	Countywide Population	100.0%	0.0%	$54.05	$0.00
Federal In-Lieu Taxes	993,000	Countywide Population	100.0%	0.0%	$0.65	$0.00
Property Tax Administration	8,881,836	Countywide Population and Employment	75.0%	25.0%	$4.37	$4.34
Rents and Concessions	478,129	Countywide Population and Employment	75.0%	25.0%	$0.24	$0.23
Miscellaneous Revenue	26,246,053	Countywide Population and Employment	75.0%	25.0%	$12.93	$12.84
Subtotal	$181,052,558				$111.00	$55.71
Total	$340,365,558					

Notes: 1. The particular category is either generated in unincorporated areas or countywide, as shown.
2. Revenues are allocated between population and employment based on the shares of population and employment to the combined population and and employment for the appropriate jurisdiction.
3. Per capita and per employee factors are derived by dividing the allocated costs by either population or employment for appropriate jurisdiction.
4. The motor vehicle in-lieu revenue is based on the estimated apportionment payable to Riverside County by the State Controller.

Source: Stanley R. Hoffman Associates, Inc.
County of Riverside, *FY 2000-01 Final Budget*
California State Controller, *State of California, Shared Revenue Estimates, Fiscal Year 2000-2001*
State of California, Department of Finance, *E-5 County/City Population and Housing Estimates, January 1,2000*
Southern California Association of Governments, *Projections 2000*, Riverside County Employment Estimates

Property Tax. Property tax is projected based on project level assessed valuation and the County's General Fund allocation of the 1.0 percent basic levy. The allocation of the 1.0 percent basic levy is derived from the Tax Rate Areas (TRAs) in which the property is located, obtained from the Riverside County Auditor-Controllers office.

Property Transfer Tax (Development Turnover). Riverside County receives property transfer tax equivalent to $1.10 per $1,000 of property value transferred for all real estate transactions in the unincorporated areas. The document transfer tax is projected based on property turnover rates and property valuation.

Site Specific Sales Tax. Sales tax can be projected based on taxable sales per square foot for specific retail or non-retail sales tax generating projects. Sales per square feet should be distinguished by retail type as neighborhood, community, regional or other. Business park/light industrial development projects may include sales tax revenues and should be analyzed on a case-by-case basis. Sales tax revenues from hotels are generated from on-site activities as restaurants, banquet facilities, meeting facilities and room service. For a typical hotel, taxable sales are estimated at about 50 percent of gross room receipts. Resort hotels could have a much higher rate and should be analyzed on a case study basis with the appropriate documentation.

Use Tax. Use tax is allocated to a local jurisdiction from the State. Use tax is projected based on a percentage of taxable sales to account for retail sales that are not directly tied to a situs based location. The current rate applied to taxable sales is estimated at 11 percent based on information from the State Board of Equalization.

Transient Occupancy Tax (TOT). A transient occupancy tax (TOT) of 10 percent is levied on the gross room receipts of motels, hotels and inns situated in the unincorporated area of the County. Revenue estimates from this source are based on room rates and occupancy rates of the proposed projects.

Population and Employment Based Revenue Factors

Many of the General Fund revenue factors are presented on a per capita or per employee basis, as shown in Table 9-1. The population and employment estimates and allocation percentages for both Countywide and unincorporated areas were presented earlier in Section 9.2 of this chapter.

Franchises. Franchise revenues are estimated at $3.07 million. Franchises are projected based on unincorporated population and unincorporated employment, with the split of revenues associated with franchises 84 percent to population and 16 percent to employment. Franchises are projected at $6.41 per capita and $6.24 per employee.

Vehicle Code Fines. This revenue source is projected using a factor of $4.26 per capita and $4.14 per employee. These factors are based on unincorporated population and employment and the budgeted revenues of $2.04 million and an 84/16 split among population and employment.

Other Court Fines. Other court fines are projected using a revenue factor of $0.49 per capita and $0.48 per employee. These factors are based on Countywide population and employment, with a split of 75/25 among population and employment, and budgeted revenues of $990.0 thousand.

Municipal Court Fines. Municipal court fines are estimated at $17.89 million. These fines are projected based on Countywide population and employment, with a split of 75/25 among population and employment. Municipal court fines are projected at $8.81 per capita and $8.75 per employee.

Forfeitures and Penalties. This revenue source is projected using a factor of $4.42 per capita and $4.39 per employee. These factors are based on budgeted revenues of $8.97 million and a 75/25 split among Countywide population and employment.

Interest on Invested Funds. As shown in Table 9-1, interest income revenues from invested funds are estimated at $29.20 million. Interest income is projected at $14.38 per capita and $14.28 per employee, based on the Countywide population and employment and a 75/25 split between population and employment.

Motor Vehicle In-Lieu. Motor vehicle in-lieu revenues are subvened to local jurisdictions by the State based on population. These revenues are projected on a per capita basis and are based on the Countywide population and estimated revenues of $82.31 million from the California State Controller. Motor vehicle in-lieu revenues are projected at $54.05 per capita.

Federal In-Lieu Taxes. These revenues are allocated to the County based on population. They are projected at $0.65 per capita based on budgeted revenues of $993.0 thousand and the total County population.

Property Tax Administration Revenues. Property tax administration revenues are projected using a revenue factor of $4.37 per capita and $4.34 per employee. These factors are based on Countywide population and employment, with a split of 75/25 among population and employment, and budgeted revenues of $8.88 million.

Rents and Concessions. These revenues are projected using a factor of $0.24 per capita and $0.23 per employee. These factors are based on budgeted revenues of $478.1 thousand and a 75/25 split among Countywide population and employment.

Miscellaneous Revenue. Miscellaneous revenues are projected based on budgeted revenues of $26.25 million and a 75/25 split among Countywide population and employment. These revenues are projected at $12.93 per capita and $12.84 per employee.

9.4 General Fund Recurring Net County Costs

As shown in Table 9-2, Fiscal Year 2000-2001 net recurring costs for the General Fund are projected at $230.44 per capita and $196.93 per employee. Net County costs shown are derived by subtracting 2000-2001 revenue from the appropriations for each budget function. Appendix Table E-1 presents the derivation of the net expenditures shown in Table 9-2.

A marginal rate is assumed for most Countywide services because certain fixed costs do not increase in direct proportion to new growth. The net County costs are assumed to increase at a marginal rate of 90 percent of new growth for all Countywide services except registrar of voters, clerk-recorder, housing authority, fire protection, museum and capital lease/construction/contingency costs. All unincorporated area services of environment and development, sheriff protection and fire protection are assumed to increase in direct proportion to new growth. The marginal net costs for each service category are then allocated to residential and non-residential development.

TABLE 9-2
RIVERSIDE COUNTY GENERAL FUND FISCAL ANALYSIS
SUMMARY OF GENERAL FUND NET COST FACTORS

(In Constant 2001 Dollars)

Category	Fiscal Year 2000-2001 Net Expenditures	Marginal Net Costs[1]	Net Cost Allocation[2]		Cost Factor[3]	
			Residential	Non-Residential	Per Capita	Per Employee
Administrative and Fiscal	$36,374,740	$33,118,291	$24,838,718	$8,279,573	$16.31	$16.20
General Services	13,414,753	12,073,278	9,054,958	3,018,319	$5.95	$5.91
Environment and Development	374,470	337,023	252,767	84,256	$0.17	$0.16
Environment and Development: Unincorporated	4,273,290	4,273,290	3,589,564	683,726	$8.94	$8.70
Justice and Law Enforcement	148,160,396	133,344,356	100,008,267	33,336,089	$65.67	$65.23
Justice and Law Enforcement: Unincorporated	30,851,053	30,851,053	25,914,885	4,936,168	$64.57	$62.83
Fire Protection: Unincorporated	9,229,844	9,229,844	7,753,069	1,476,775	$19.32	$18.80
Health Services	29,300,431	26,370,388	26,370,388	0	$17.32	$0.00
Community and Social Services	21,938,909	19,745,018	19,745,018	0	$12.97	$0.00
Education, Recreation and Culture	466,479	434,831	326,123	108,708	$0.21	$0.21
Capital Lease/Construction/Contingency	38,616,418	38,616,418	28,962,314	9,654,105	$19.02	$18.89
Total Recurring Costs	$333,000,783	$308,393,790	$246,816,071	$61,577,719	$230.44	$196.93

Note: 1. All Countywide costs, except capital/lease/construction/contingency costs, are projected to increase at a marginal rate with new growth. Costs for municipal-type services to unincorporated areas are projected to increase in direct proportion to new growth.
2. Net costs are allocated 75 percent to residential development and 25 percent to non-residential development for countywide costs, based on the shares of population and employment to the combined total County population and employment. Costs for unincorporated services are allocated 84 percent to residential development and 16 percent to non-residential development, based on the shares of population and employment to the combined unincorporated County population and employment.
3. Per capita and per employee factors are derived by dividing the allocated costs by either population or employment for appropriate jurisdiction.

Source: Stanley R. Hoffman Associates, Inc.
County of Riverside, *FY 2000-01 Final Budget*
State of California, Department of Finance, *E-5 County/City Population and Housing Estimates, January 1,2000*
Southern California Association of Governments, *Projections 2000*, Riverside County Employment Estimates

Administrative and Fiscal. These costs are projected based on a 75/25 split among Countywide population and employment and a marginal net County cost of $33.12 million. Administrative and fiscal costs are projected at $16.31 per capita and $16.20 per employee.

General Services. Costs for General Services are projected at $5.95 per capita and $5.91 per employee based on a 75/25 split among Countywide population and employment and a marginal net County cost of $12.07 million.

Environment and Development. The marginal net Countywide cost for Environment and Development services is $374.5 thousand. These costs are projected at $0.17 per capita and $0.16 per employee based on Countywide population and employment and a 75/25 split between population and employment.

Environment and Development: Unincorporated. The net County cost for Environment and Development services in the unincorporated area of the County is $4.27 million. These costs are projected at $8.94 per capita and $8.70 per employee based on unincorporated County population and employment and an 84/16 split between population and employment.

Justice and Law Enforcement. Countywide Justice and Law Enforcement, other than Sheriff's patrol, is based on a 75/25 split among Countywide population and employment and a marginal net County cost of $133.34 million. These costs are projected at $65.67 per capita and $65.23 per employee.

Justice and Law Enforcement: Unincorporated. These services include Sheriff patrol to unincorporated areas. Sheriff patrol services to contract cities are not included in this category. Sheriff's patrol services are projected at $64.57 per capita and $62.83 per employee, based on an 84/16 split among unincorporated area population and employment and a net County cost of $30.85 million.

Fire Protection: Unincorporated. Fire protection to unincorporated areas is provided by the Riverside County Fire Department. General Fund costs for fire protection to the unincorporated areas is projected at $19.32 per capita and $18.80 per employee based on net County costs of $9.23 million and an 84/16 split among unincorporated area population and employment. The $9.23 million net County cost includes an additional

$1,000,000 in costs above the Fiscal Year 2000-2001 Budget based on discussion with County Administrative staff to account for increasing fire protection needs.

Health Services. Health Services are projected using only Countywide population and are projected at $17.32 per capita, based on marginal net County costs of $26.37 million.

Community and Social Services. Community and Social Services are projected using only Countywide population and a marginal net County cost of $19.75 million. Community and social services costs are projected at $12.97 per capita.

Education, Recreation and Culture. Costs for these services are projected based on a 75/25 split among Countywide population and employment and the marginal net County costs of $434.83 thousand. Education, recreation and culture costs are projected at $0.21 per capita and $0.21 per employee.

Capital Lease/Construction/Contingency. These costs are projected at $19.02 per capita and $18.89 per employee based on Countywide population and employment. These factors are based on net County costs of $38.62 million and a 75/25 split between population and employment. Major capital facilities that are funded from a variety of impact fee sources or require special funding are not included in this category.

9.5 Fiscal Model Calibration

The Fiscal Model was calibrated against the County's Fiscal Year 2000-01 budget. The Final Budget for the County assumed an estimated $316.5 million in General Fund discretionary revenues. When this was combined with a carry over of $15.46 million, the total amount of discretionary funding sources available was estimated at $332.0 million. These revenues were used to provide for the discretionary General Fund net county costs – i.e., General Fund costs that are not specifically covered by earmarked program revenue sources from Federal, State or other non-discretionary sources.

To calibrate the Fiscal Model, the discretionary General Fund revenues and costs were estimated for the existing residential and non-residential development and adjusted to essentially breakeven, similar to the County budget, as shown in Appendix Table F-1.1, page F-1. The existing development was estimated by running the Fiscal Model for non-vacant parcels as presented in Appendix Table F-1.2, page F-2. As shown, for the

2000-01 fiscal year, the units were calibrated to 155,272 and the population was calibrated to 400,600 in the unincorporated area according to the January 1, 2000 estimates from the California Department of Finance. Total unincorporated area employment was calibrated to 78,566 based on estimates from SCAG data. Total non-residential square footage was estimated at about 53.3 million with about 10.3 million as retail square footage. Light industrial was estimated at about 28.1 million square feet and business park development at 6.1 million square feet.

After the net costs from the County budget were adjusted to per capita or per employee factors as discussed earlier, the revenue factors were calibrated to estimate property and sales tax consistent with the base year budget. In order to approximate existing property taxes from the unincorporated area, the average housing value was estimated at $146,330. When compared with the average home prices of $187,600 as presented in the Real Estate and Construction Report for First Quarter 2001, this reflected the effect of Proposition 13 that causes the assessed value of older properties to lag behind the current estimated market rate value.

The latest annual retail sales tax data available from the California State Board of Equalization was for year 1999. When the retail square footage of 10.3 million square feet was divided into the estimated taxable retail sales, it yielded an estimated taxable retail sales per square foot of $125 for *existing* retail development. This compares with an estimated taxable retail sales per square foot for *new* retail development of $185 based on the Urban Land Institute's *Dollars and Cents of Shopping Centers: 2000.*

In a similar manner, the taxable non-retail sales from the estimated existing 28.1 million light industrial development was estimated at $21 per square foot; the 6.1 million square feet of business park development was calibrated at $10.50 per square foot based on the assumption that 50 percent was industrial/research and development space and 50 percent was office space. When the retail and non-retail factors were applied against their estimated existing square feet, they yielded approximately $19.4 million in sales tax, similar to the County's Fiscal Year 2000-01 budgeted amount.

Appendix A
STUDY AREA: RIVERSIDE COUNTY

Appendix A presents the detailed results of the Fiscal Model for unincorporated Riverside County as identified in Chapter 5 of this report. The General Fund tables show recurring revenues and costs, the County's net fiscal impact and the revenue-to-expenditure ratio at build out for the preferred plan land uses and various alternatives. The Development Summary tables show land use, population, housing and employment information plus the estimated total assessed valuation for these same alternatives. The tables are listed as follows:

A-1.1 General Fund Summary, Riverside County, Plan A-1
A-1.2 Development Summary, Riverside County, Plan A-2

A-2.1 General Fund Summary, Riverside County, Sphere A-3
A-2.2 Development Summary, Riverside County, Sphere A-4

A-3.1 General Fund Summary, Riverside County, Retail 56% A-5
A-3.2 Development Summary, Riverside County, Retail 56% A-6

A-4.1 General Fund Summary, Riverside County, Retail 35% A-7
A-4.2 Development Summary, Riverside County, Retail 35% A-8

A-5.1 General Fund Summary, Riverside County, Retail 23% A-9
A-5.2 Development Summary, Riverside County, Retail 23% A-10

A-6.1 General Fund Summary, Riverside County, SCAG 2025 ..... A-11
A-6.2 Development Summary, Riverside County, SCAG 2025 ..... A-12

Table A-1.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Plan — Build Out

Revenues	
Property Tax	217,689,772
Property Transfer Tax	11,287,069
Sales Tax	177,693,954
Federal In-Lieu Taxes	888,072
Forfeitures and Penalties	9,389,392
Franchise Taxes	13,520,202
Interest on Invested Funds	30,545,558
Miscellaneous Revenue	27,465,449
Motor Vehicle License Fees	73,846,623
Municipal Court Fines	18,714,900
Other Court Fines	1,035,812
Property Tax Administration	9,282,918
Rents and Concessions	503,442
Vehicle Code Fines	8,979,987
Total Revenues	600,843,150
Expenses	
Administrative & Fiscal	34,649,628
Capital Lease/Const./Contingency	40,401,936
Community and Social Services	17,714,719
Education, Recreation and Culture	454,989
Environment & Development	352,654
Environment & Development - Unicorp.	18,860,967
Fire Protection - Unicorp.	36,323,753
General Services	12,631,494
Health Services	23,658,791
Justice & Law Enforcement	139,510,043
Justice & Law Enforcement - Unicorp.	136,166,270
Total Expenses	460,725,244
Net Fiscal Impact	140,117,906
Revenue / Expenditure Ratio	1.30

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-1.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	7679.07	75,262,542	0.23	0	125,438	10,494,943,360
Commercial Office	1179.77	31,528,375	0.61	0	105,095	4,139,668,905
Commercial Retail	10647.83	91,357,850	0.20	0	182,716	14,230,770,950
Commercial Tourist	3802.19	31,183,045	0.19	0	62,366	4,930,453,515
Heavy Industrial	1908.84	24,944,730	0.30	0	16,630	2,452,898,450
Light Industrial	19991.61	264,733,684	0.30	0	257,023	29,887,039,580
Totals	45,209.31	519,010,226	0.26	0	749,268	66,135,774,760

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	204802.32	10,240	0.05	26,419	10,240	1,921,024,000
High	1573.78	26,754	17.00	69,025	0	5,019,050,400
Low	61457.16	215,100	3.50	554,958	0	40,352,760,000
Medium	12589.06	81,829	6.50	211,119	0	15,351,120,400
Medium High	3664.45	40,309	11.00	103,997	0	7,561,968,400
Open Space Rural	644328.10	16,108	0.03	41,559	0	3,021,860,800
Desert	22213.40	1,111	0.05	2,866	0	208,423,600
Rural Mountainous	160907.82	8,045	0.05	20,756	0	1,509,242,000
Rural	167797.62	25,170	0.15	64,939	0	4,721,892,000
Very High	202.48	6,074	30.00	15,671	0	1,139,482,400
[illegible]ry Low	82350.21	98,820	1.20	254,956	0	18,538,632,000
Totals	1,361,886.40	529,560	0.39	1,366,265	10,240	99,345,456,000

Other	Acres	Units	Density	Population	Employment	Value
City	409022.93	0	0.00	0	0	0
Freeway	8086.74	0	0.00	0	0	0
Indian	89708.51	0	0.00	0	0	0
Open Space - C	54866.30	0	0.00	0	0	0
Open Space - CH	742846.70	0	0.00	0	0	0
Open Space Mineral	5980.27	0	0.00	0	179	0
Open Space Recreation	23298.08	0	0.00	0	3,495	0
Open Space Water	73121.53	0	0.00	0	0	0
Other - PF / OS	291.47	0	0.00	0	0	0
Public Facility	20722.71	0	0.00	0	30	0
Totals	1,427,945.24	0	0.00	0	3,704	0
Totals	2,835,040.95			1,366,265	763,212	165,481,230,760

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-2.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
X Sphere
All Parcels

Study Area: Riverside County

Scenario : Sphere

	Build Out
Revenues	
Property Tax	71,015,401
Property Transfer Tax	3,711,975
Sales Tax	48,095,498
Federal In-Lieu Taxes	301,620
Forfeitures and Penalties	3,036,467
Franchise Taxes	4,375,169
Interest on Invested Funds	9,878,283
Miscellaneous Revenue	8,882,193
Motor Vehicle License Fees	25,080,876
Municipal Court Fines	6,052,278
Other Court Fines	335,124
Property Tax Administration	3,002,041
Rents and Concessions	162,997
Vehicle Code Fines	2,906,103
Total Revenues	186,836,025
Expenses	
Administrative & Fiscal	11,205,427
Capital Lease/Const./Contingency	13,065,681
Community and Social Services	6,016,533
Education, Recreation and Culture	147,141
Environment & Development	114,045
Environment & Development - Unicorp.	6,103,541
Fire Protection - Unicorp.	11,754,620
General Services	4,084,928
Health Services	8,035,346
Justice & Law Enforcement	45,116,497
Justice & Law Enforcement - Unicorp.	44,064,361
Total Expenses	149,708,120
Net Fiscal Impact	37,127,905
Revenue / Expenditure Ratio	1.24

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-2.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
X Sphere
All Parcels

Study Area: Riverside County

Scenario : Sphere

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	2552.84	25,020,358	0.23	0	41,701	3,488,949,920
Commercial Office	164.36	5,369,334	0.75	0	17,898	689,067,950
Commercial Retail	2579.47	21,537,659	0.19	0	43,075	3,385,072,785
Commercial Tourist	2103.05	17,176,682	0.19	0	34,353	2,719,641,340
Light Industrial	6669.24	88,315,649	0.30	0	85,743	9,970,371,950
Totals	14,068.96	157,419,682	0.26	0	222,770	20,253,103,945

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	12888.53	644	0.05	1,662	644	120,814,400
High	440.73	7,492	17.00	19,329	0	1,405,499,200
Low	19876.33	69,567	3.50	179,483	0	13,050,769,200
Medium	5346.68	34,753	6.50	89,663	0	6,519,662,800
Medium High	1672.16	18,394	11.00	47,457	0	3,450,714,400
Open Space Rural	31850.82	796	0.03	2,054	0	149,329,600
Desert	7188.78	359	0.05	926	0	67,348,400
Rural Mountainous	30824.00	1,541	0.05	3,976	0	289,091,600
Rural	44513.17	6,677	0.15	17,227	0	1,252,605,200
Very High	38.37	1,151	30.00	2,970	0	215,927,600
Very Low	32067.95	38,482	1.20	99,284	0	7,219,223,200
Totals	186,707.52	179,856	0.96	464,031	644	33,740,985,600

Other	Acres	Units	Density	Population	Employment	Value
City	649.20	0	0.00	0	0	0
Freeway	2380.52	0	0.00	0	0	0
Indian	3581.33	0	0.00	0	0	0
Open Space - C	20436.74	0	0.00	0	0	0
Open Space - CH	50603.86	0	0.00	0	0	0
Open Space Mineral	4284.87	0	0.00	0	129	0
Open Space Recreation	5654.89	0	0.00	0	848	0
Open Space Water	10206.48	0	0.00	0	0	0
Other - PF / OS	39.11	0	0.00	0	0	0
Public Facility	3019.08	0	0.00	0	85	0
Totals	100,856.08	0	0.00	0	1,062	0
Totals	301,632.56			464,031	224,476	53,994,089,545

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-3.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Retail 56%

	Build Out
Revenues	
Property Tax	210,141,190
Property Transfer Tax	10,945,033
Sales Tax	127,789,729
Federal In-Lieu Taxes	888,072
Forfeitures and Penalties	9,038,864
Franchise Taxes	13,021,956
Interest on Invested Funds	29,405,343
Miscellaneous Revenue	26,440,213
Motor Vehicle License Fees	73,846,623
Municipal Court Fines	18,016,238
Other Court Fines	997,485
Property Tax Administration	8,936,382
Rents and Concessions	485,078
Vehicle Code Fines	8,649,420
Total Revenues	538,601,626
Expenses	
Administrative & Fiscal	33,356,003
Capital Lease/Const./Contingency	38,893,554
Community and Social Services	17,714,719
Education, Recreation and Culture	438,006
Environment & Development	339,487
Environment & Development - Unicorp.	18,166,107
Fire Protection - Unicorp.	34,985,541
General Services	12,159,902
Health Services	23,658,791
Justice & Law Enforcement	134,301,528
Justice & Law Enforcement - Unicorp.	131,149,747
Total Expenses	445,163,385
Net Fiscal Impact	93,438,241
Revenue / Expenditure Ratio	1.20

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-3.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Retail 56%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	7679.07	75,262,542	0.23	0	125,438	10,494,943,360
Commercial Office	1179.77	31,528,375	0.61	0	105,095	4,139,668,905
Commercial Retail	5994.73	51,434,470	0.20	0	102,869	8,011,924,092
Commercial Tourist	3802.19	31,183,045	0.19	0	62,366	4,930,453,515
Heavy Industrial	1908.84	24,944,730	0.30	0	16,630	2,452,898,450
Light Industrial	19991.61	264,733,684	0.30	0	257,023	29,887,039,580
Totals	40,556.21	479,086,846	0.27	0	669,421	59,916,927,902

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	204802.32	10,240	0.05	26,419	10,240	1,921,024,000
High	1573.78	26,754	17.00	69,025	0	5,019,050,400
Low	61457.16	215,100	3.50	554,958	0	40,352,760,000
Medium	12589.06	81,829	6.50	211,119	0	15,351,120,400
Medium High	3664.45	40,309	11.00	103,997	0	7,561,968,400
Open Space Rural	644328.10	16,108	0.03	41,559	0	3,021,860,800
Desert	22213.40	1,111	0.05	2,866	0	208,423,600
Rural Mountainous	160907.82	8,045	0.05	20,756	0	1,509,242,000
Rural	167797.62	25,170	0.15	64,939	0	4,721,892,000
Very High	202.48	6,074	30.00	15,671	0	1,139,482,400
y Low	82350.21	98,820	1.20	254,956	0	18,538,632,000
Totals	1,361,886.40	529,560	0.39	1,366,265	10,240	99,345,456,000

Other	Acres	Units	Density	Population	Employment	Value
City	409022.93	0	0.00	0	0	0
Freeway	8086.74	0	0.00	0	0	0
Indian	89708.51	0	0.00	0	0	0
Open Space - C	54866.30	0	0.00	0	0	0
Open Space - CH	742846.70	0	0.00	0	0	0
Open Space Mineral	5980.27	0	0.00	0	179	0
Open Space Recreation	23298.08	0	0.00	0	3,495	0
Open Space Water	73121.53	0	0.00	0	0	0
Other - PF / OS	291.47	0	0.00	0	0	0
Public Facility	20722.71	0	0.00	0	30	0
Totals	1,427,945.24	0	0.00	0	3,704	0
Totals	2,830,387.85			1,366,265	683,365	159,262,383,902

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-4.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Retail 35%

	Build Out
Revenues	
Property Tax	206,427,346
Property Transfer Tax	10,776,754
Sales Tax	103,237,306
Federal In-Lieu Taxes	888,072
Forfeitures and Penalties	8,866,407
Franchise Taxes	12,776,824
Interest on Invested Funds	28,844,367
Miscellaneous Revenue	25,935,806
Motor Vehicle License Fees	73,846,623
Municipal Court Fines	17,672,503
Other Court Fines	978,629
Property Tax Administration	8,765,890
Rents and Concessions	476,042
Vehicle Code Fines	8,486,784
Total Revenues	507,979,353
Expenses	
Administrative & Fiscal	32,719,551
Capital Lease/Const./Contingency	38,151,444
Community and Social Services	17,714,719
Education, Recreation and Culture	429,650
Environment & Development	333,009
Environment & Development - Unicorp.	17,824,242
Fire Protection - Unicorp.	34,327,153
General Services	11,927,883
Health Services	23,658,791
Justice & Law Enforcement	131,738,985
Justice & Law Enforcement - Unicorp.	128,681,663
Total Expenses	437,507,090
Net Fiscal Impact	70,472,263
Revenue / Expenditure Ratio	1.16

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-4.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Retail 35%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	7679.07	75,262,542	0.23	0	125,438	10,494,943,360
Commercial Office	1179.77	31,528,375	0.61	0	105,095	4,139,668,905
Commercial Retail	3705.45	31,792,532	0.20	0	63,585	4,952,308,312
Commercial Tourist	3802.19	31,183,045	0.19	0	62,366	4,930,453,515
Heavy Industrial	1908.84	24,944,730	0.30	0	16,630	2,452,898,450
Light Industrial	19991.61	264,733,684	0.30	0	257,023	29,887,039,580
Totals	38,266.93	459,444,908	0.28	0	630,137	56,857,312,122

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	204802.32	10,240	0.05	26,419	10,240	1,921,024,000
High	1573.78	26,754	17.00	69,025	0	5,019,050,400
Low	61457.16	215,100	3.50	554,958	0	40,352,760,000
Medium	12589.06	81,829	6.50	211,119	0	15,351,120,400
Medium High	3664.45	40,309	11.00	103,997	0	7,561,968,400
Open Space Rural	644328.10	16,108	0.03	41,559	0	3,021,860,800
Desert	22213.40	1,111	0.05	2,866	0	208,423,600
Rural Mountainous	160907.82	8,045	0.05	20,756	0	1,509,242,000
Rural	167797.62	25,170	0.15	64,939	0	4,721,892,000
Very High	202.48	6,074	30.00	15,671	0	1,139,482,400
Very Low	82350.21	98,820	1.20	254,956	0	18,538,632,000
Totals	1,361,886.40	529,560	0.39	1,366,265	10,240	99,345,456,000

Other	Acres	Units	Density	Population	Employment	Value
City	409022.93	0	0.00	0	0	0
Freeway	8086.74	0	0.00	0	0	0
Indian	89708.51	0	0.00	0	0	0
Open Space - C	54866.30	0	0.00	0	0	0
Open Space - CH	742846.70	0	0.00	0	0	0
Open Space Mineral	5980.27	0	0.00	0	179	0
Open Space Recreation	23298.08	0	0.00	0	3,495	0
Open Space Water	73121.53	0	0.00	0	0	0
Other - PF / OS	291.47	0	0.00	0	0	0
Public Facility	20722.71	0	0.00	0	30	0
Totals	1,427,945.24	0	0.00	0	3,704	0
Totals	2,828,098.57			1,366,265	644,081	156,202,768,122

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-5.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Retail 23%

	Build Out
Revenues	
Property Tax	204,423,606
Property Transfer Tax	10,685,962
Sales Tax	89,990,417
Federal In-Lieu Taxes	888,072
Forfeitures and Penalties	8,773,361
Franchise Taxes	12,644,567
Interest on Invested Funds	28,541,703
Miscellaneous Revenue	25,663,663
Motor Vehicle License Fees	73,846,623
Municipal Court Fines	17,487,047
Other Court Fines	968,455
Property Tax Administration	8,673,903
Rents and Concessions	471,167
Vehicle Code Fines	8,399,037
Total Revenues	491,457,583
Expenses	
Administrative & Fiscal	32,376,165
Capital Lease/Const./Contingency	37,751,051
Community and Social Services	17,714,719
Education, Recreation and Culture	425,142
Environment & Development	329,514
Environment & Development - Unicorp.	17,639,794
Fire Protection - Unicorp.	33,971,931
General Services	11,802,701
Health Services	23,658,791
Justice & Law Enforcement	130,356,410
Justice & Law Enforcement - Unicorp.	127,350,051
Total Expenses	433,376,269
Net Fiscal Impact	58,081,314
Revenue / Expenditure Ratio	1.13

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-5.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : Retail 23%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	7679.07	75,262,542	0.23	0	125,438	10,494,943,360
Commercial Office	1179.77	31,528,375	0.61	0	105,095	4,139,668,905
Commercial Retail	2470.30	21,195,021	0.20	0	42,390	3,301,538,839
Commercial Tourist	3802.19	31,183,045	0.19	0	62,366	4,930,453,515
Heavy Industrial	1908.84	24,944,730	0.30	0	16,630	2,452,898,450
Light Industrial	19991.61	264,733,684	0.30	0	257,023	29,887,039,580
Totals	37,031.78	448,847,397	0.28	0	608,942	55,206,542,649

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	204802.32	10,240	0.05	26,419	10,240	1,921,024,000
High	1573.78	26,754	17.00	69,025	0	5,019,050,400
Low	61457.16	215,100	3.50	554,958	0	40,352,760,000
Medium	12589.06	81,829	6.50	211,119	0	15,351,120,400
Medium High	3664.45	40,309	11.00	103,997	0	7,561,968,400
Open Space Rural	644328.10	16,108	0.03	41,559	0	3,021,860,800
Desert	22213.40	1,111	0.05	2,866	0	208,423,600
Rural Mountainous	160907.82	8,045	0.05	20,756	0	1,509,242,000
Rural	167797.62	25,170	0.15	64,939	0	4,721,892,000
Very High	202.48	6,074	30.00	15,671	0	1,139,482,400
[illegible]y Low	82350.21	98,820	1.20	254,956	0	18,538,632,000
Totals	1,361,886.40	529,560	0.39	1,366,265	10,240	99,345,456,000

Other	Acres	Units	Density	Population	Employment	Value
City	409022.93	0	0.00	0	0	0
Freeway	8086.74	0	0.00	0	0	0
Indian	89708.51	0	0.00	0	0	0
Open Space - C	54866.30	0	0.00	0	0	0
Open Space - CH	742846.70	0	0.00	0	0	0
Open Space Mineral	5980.27	0	0.00	0	179	0
Open Space Recreation	23298.08	0	0.00	0	3,495	0
Open Space Water	73121.53	0	0.00	0	0	0
Other - PF / OS	291.47	0	0.00	0	0	0
Public Facility	20722.71	0	0.00	0	30	0
Totals	1,427,945.24	0	0.00	0	3,704	0
Totals	2,826,863.42			1,366,265	622,886	154,551,998,649

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-6.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : SCAG 2025

	Build Out
Revenues	
Property Tax	99,093,896
Property Transfer Tax	5,814,805
Sales Tax	49,754,308
Federal In-Lieu Taxes	556,823
Forfeitures and Penalties	4,751,842
Franchise Taxes	6,863,427
Interest on Invested Funds	15,459,085
Miscellaneous Revenue	13,900,257
Motor Vehicle License Fees	46,301,987
Municipal Court Fines	9,471,387
Other Court Fines	525,320
Property Tax Administration	4,698,013
Rents and Concessions	256,178
Vehicle Code Fines	4,559,798
Total Revenues	262,007,126
Expenses	
Administrative & Fiscal	17,535,465
Capital Lease/Const./Contingency	20,446,599
Community and Social Services	11,107,166
Education, Recreation and Culture	230,271
Environment & Development	178,469
Environment & Development - Unicorp.	9,575,281
Fire Protection - Unicorp.	18,440,733
General Services	6,392,532
Health Services	14,834,111
Justice & Law Enforcement	70,603,222
Justice & Law Enforcement - Unicorp.	69,128,513
Total Expenses	238,472,362
Net Fiscal Impact	23,534,764
Revenue / Expenditure Ratio	1.09

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table A-6.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Riverside County

Scenario : SCAG 2025

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	2150.14	21,073,512	0.23	0	35,123	2,938,584,164
Commercial Office	330.33	8,827,945	0.61	0	29,426	1,159,107,293
Commercial Retail	2981.39	25,580,198	0.20	0	51,160	3,984,615,866
Commercial Tourist	1064.61	8,731,253	0.19	0	17,463	1,380,527,026
Heavy Industrial	534.48	6,984,524	0.30	0	4,656	686,811,540
Light Industrial	5597.65	74,125,431	0.30	0	71,966	8,368,371,041
Totals	12,658.60	145,322,863	0.26	0	209,794	18,518,016,930

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	128411.06	6,421	0.05	16,566	6,421	1,204,579,600
High	986.76	16,775	17.00	43,280	0	3,146,990,000
Low	38533.64	134,868	3.50	347,959	0	25,301,236,800
Medium	7893.34	51,307	6.50	132,372	0	9,625,193,200
Medium High	2297.61	25,274	11.00	65,207	0	4,741,402,400
Open Space Rural	403993.72	10,100	0.03	26,058	0	1,894,760,000
Desert	13927.80	696	0.05	1,796	0	130,569,600
Rural Mountainous	100889.20	5,044	0.05	13,014	0	946,254,400
Rural	105209.11	15,781	0.15	40,715	0	2,960,515,600
Very High	126.96	3,809	30.00	9,827	0	714,568,400
Very Low	51633.58	61,960	1.20	159,857	0	11,623,696,000
Totals	853,902.78	332,035	0.39	856,651	6,421	62,289,766,000

Other	Acres	Units	Density	Population	Employment	Value
City	409022.93	0	0.00	0	0	0
Freeway	8086.74	0	0.00	0	0	0
Indian	89708.51	0	0.00	0	0	0
Open Space - C	54866.30	0	0.00	0	0	0
Open Space - CH	742846.70	0	0.00	0	0	0
Open Space Mineral	5980.27	0	0.00	0	179	0
Open Space Recreation	23298.08	0	0.00	0	3,495	0
Open Space Water	73121.53	0	0.00	0	0	0
Other - PF / OS	291.47	0	0.00	0	0	0
Public Facility	20722.71	0	0.00	0	30	0
Totals	1,427,945.24	0	0.00	0	3,704	0
Totals	2,294,506.62			856,651	219,919	80,807,782,930

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Appendix B
STUDY AREA: WESTERN RIVERSIDE COUNTY

Appendix B presents the detailed Fiscal Model results for unincorporated Western Riverside County as identified in Chapter 6 of this report. The General Fund tables show recurring revenues and costs, the County's net fiscal impact and the revenue-to-expenditure ratio at build out for the preferred plan land uses and various alternatives. The Development Summary tables show land use, population, housing and employment information plus the estimated total assessed valuation for these same alternatives. The tables are listed as follows:

B-1.1 General Fund Summary, Western Riverside County, Plan B-1
B-1.2 Development Summary, Western Riverside County, Plan B-2

B-2.1 General Fund Summary, Western Riverside County, Sphere B-3
B-2.2 Development Summary, Western Riverside County, Sphere B-4

B-3.1 General Fund Summary, Western Riverside County, Retail 56% B-5
B-3.2 Development Summary, Western Riverside County, Retail 56% B-6

B-4.1 General Fund Summary, Western Riverside County, Retail 35% B-7
B-4.2 Development Summary, Western Riverside County, Retail 35% B-8

B-5.1 General Fund Summary, Western Riverside County, Retail 23% B-9
B-5.2 Development Summary, Western Riverside County, Retail 23% B-10

B-6.1 General Fund Summary, Western Riverside County, SCAG 2025 ..... B-11
B-6.2 Development Summary, Western Riverside County, SCAG 2025 ..... B-12

Table B-1.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Plan — Build Out

Revenues	
Property Tax	163,872,450
Property Transfer Tax	8,569,288
Sales Tax	133,803,927
Federal In-Lieu Taxes	702,559
Forfeitures and Penalties	7,206,094
Franchise Taxes	10,380,487
Interest on Invested Funds	23,442,934
Miscellaneous Revenue	21,079,032
Motor Vehicle License Fees	58,420,483
Municipal Court Fines	14,363,165
Other Court Fines	795,173
Property Tax Administration	7,124,389
Rents and Concessions	386,650
Vehicle Code Fines	6,894,848
Total Revenues	457,041,479
Expenses	
Administrative & Fiscal	26,592,569
Capital Lease/Const./Contingency	31,007,297
Community and Social Services	14,014,215
Education, Recreation and Culture	349,193
Environment & Development	270,651
Environment & Development - Unicorp.	14,481,126
Fire Protection - Unicorp.	27,888,752
General Services	9,694,298
Health Services	18,716,604
Justice & Law Enforcement	107,069,858
Justice & Law Enforcement - Unicorp.	104,546,124
Total Expenses	354,630,687
Net Fiscal Impact	102,410,792
Revenue / Expenditure Ratio	1.28

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table B-1.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	6899.67	67,623,631	0.23	0	112,706	9,429,739,635
Commercial Office	1175.69	31,461,744	0.61	0	104,872	4,130,229,500
Commercial Retail	8612.25	76,034,251	0.20	0	152,069	11,735,090,775
Commercial Tourist	1260.43	10,423,214	0.19	0	20,846	1,643,480,250
Heavy Industrial	1413.40	18,470,300	0.30	0	12,314	1,816,246,160
Light Industrial	11385.15	150,764,915	0.30	0	146,374	17,020,565,400
Totals	30,746.59	354,778,055	0.26	0	549,181	45,775,351,720

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	30565.71	1,528	0.05	3,942	1,528	286,652,800
High	1299.96	22,099	17.00	57,015	0	4,145,772,400
Low	50155.87	175,546	3.50	452,909	0	32,932,429,600
Medium	9248.04	60,112	6.50	155,089	0	11,277,011,200
Medium High	2522.66	27,749	11.00	71,592	0	5,205,712,400
Open Space Rural	142623.26	3,566	0.03	9,200	0	668,981,600
Desert	2969.22	148	0.05	382	0	27,764,800
Rural Mountainous	160024.49	8,001	0.05	20,643	0	1,500,987,600
Rural	143813.30	21,572	0.15	55,656	0	4,046,907,200
Very High	202.48	6,074	30.00	15,671	0	1,139,48[illegible]
Very Low	77118.95	92,543	1.20	238,761	0	17,361,06[illegible]
Totals	620,543.94	418,938	0.68	1,080,860	1,528	78,592,768,800

Other	Acres	Units	Density	Population	Employment	Value
City	213836.82	0	0.00	0	0	0
Freeway	3481.41	0	0.00	0	0	0
Indian	75651.83	0	0.00	0	0	0
Open Space - C	50541.54	0	0.00	0	0	0
Open Space - CH	428164.09	0	0.00	0	0	0
Open Space Mineral	5191.02	0	0.00	0	156	0
Open Space Recreation	15722.16	0	0.00	0	2,358	0
Open Space Water	17547.47	0	0.00	0	0	0
Other - PF / OS	287.39	0	0.00	0	0	0
Public Facility	9565.83	0	0.00	0	10	0
Totals	819,989.56	0	0.00	0	2,524	0
Totals	1,471,280.09			1,080,860	553,233	124,368,120,520

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

Printed on 09/16/2001 at 18:30:48

Table B-2.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
X Sphere
All Parcels

Study Area: Western Riverside

Scenario : Sphere | **Build Out**

Revenues	
Property Tax	47,898,959
Property Transfer Tax	2,618,868
Sales Tax	31,100,940
Federal In-Lieu Taxes	234,292
Forfeitures and Penalties	2,170,215
Franchise Taxes	3,130,676
Interest on Invested Funds	7,060,248
Miscellaneous Revenue	6,348,321
Motor Vehicle License Fees	19,482,268
Municipal Court Fines	4,325,673
Other Court Fines	239,712
Property Tax Administration	2,145,620
Rents and Concessions	116,739
Vehicle Code Fines	2,079,683
Total Revenues	128,952,214
Expenses	
Administrative & Fiscal	8,008,671
Capital Lease/Const./Contingency	9,338,221
Community and Social Services	4,673,510
Education, Recreation and Culture	105,166
Environment & Development	81,509
Environment & Development - Unicorp.	4,367,536
Fire Protection - Unicorp.	8,411,302
General Services	2,919,552
Health Services	6,241,679
Justice & Law Enforcement	32,245,382
Justice & Law Enforcement - Unicorp.	31,531,322
Total Expenses	107,923,850
Net Fiscal Impact	21,028,364
Revenue / Expenditure Ratio	1.19

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

Printed on 09/16/2001 at 19:02:15

Table B-2.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
X Sphere
All Parcels

Study Area: Western Riverside

Scenario : Sphere

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	2552.84	25,020,358	0.23	0	41,701	3,488,949,920
Commercial Office	164.36	5,369,334	0.75	0	17,898	689,067,950
Commercial Retail	2001.67	17,195,970	0.20	0	34,392	2,677,503,310
Commercial Tourist	243.84	1,991,578	0.19	0	3,983	315,333,160
Light Industrial	2509.59	33,232,565	0.30	0	32,265	3,751,781,690
Totals	7,472.30	82,809,805	0.25	0	130,239	10,922,636,030

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	6512.72	326	0.05	841	326	61,157,600
High	440.73	7,492	17.00	19,329	0	1,405,499,200
Low	14372.09	50,302	3.50	129,779	0	9,436,655,200
Medium	3963.96	25,766	6.50	66,476	0	4,833,701,600
Medium High	1184.92	13,034	11.00	33,628	0	2,445,178,400
Open Space Rural	8578.98	214	0.02	552	0	40,146,400
Desert	54.44	3	0.05	8	0	562,800
Rural Mountainous	30057.67	1,503	0.05	3,878	0	281,962,800
Rural	37563.33	5,635	0.15	14,538	0	1,057,126,000
Very High	38.37	1,151	30.00	2,970	0	215,927,600
Very Low	28569.09	34,283	1.20	88,450	0	6,431,490
Totals	131,336.30	139,709	1.06	360,449	326	26,209,408,4

Other	Acres	Units	Density	Population	Employment	Value
City	576.33	0	0.00	0	0	0
Freeway	1191.52	0	0.00	0	0	0
Indian	492.50	0	0.00	0	0	0
Open Space - C	18983.31	0	0.00	0	0	0
Open Space - CH	21216.98	0	0.00	0	0	0
Open Space Mineral	4284.87	0	0.00	0	129	0
Open Space Recreation	4011.70	0	0.00	0	602	0
Open Space Water	6550.37	0	0.00	0	0	0
Other - PF / OS	39.11	0	0.00	0	0	0
Public Facility	2910.46	0	0.00	0	146	0
Totals	60,257.15	0	0.00	0	877	0
Totals	199,065.75			360,449	131,442	37,132,044,430

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

Printed on 09/16/2001 at 18:55:07

Table B-3.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Retail 56%

	Build Out
Revenues	
Property Tax	157,608,827
Property Transfer Tax	8,287,235
Sales Tax	92,270,217
Federal In-Lieu Taxes	702,559
Forfeitures and Penalties	6,914,361
Franchise Taxes	9,965,814
Interest on Invested Funds	22,493,971
Miscellaneous Revenue	20,225,762
Motor Vehicle License Fees	58,420,483
Municipal Court Fines	13,781,693
Other Court Fines	763,275
Property Tax Administration	6,835,979
Rents and Concessions	371,366
Vehicle Code Fines	6,619,729
Total Revenues	405,261,271
Expenses	
Administrative & Fiscal	25,515,928
Capital Lease/Const./Contingency	29,751,921
Community and Social Services	14,014,215
Education, Recreation and Culture	335,058
Environment & Development	259,693
Environment & Development - Unicorp.	13,902,817
Fire Protection - Unicorp.	26,775,003
General Services	9,301,808
Health Services	18,716,604
Justice & Law Enforcement	102,734,984
Justice & Law Enforcement - Unicorp.	100,371,038
Total Expenses	341,679,069
Net Fiscal Impact	63,582,203
Revenue / Expenditure Ratio	1.18

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table B-3.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Retail 56%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	6899.67	67,623,631	0.23	0	112,706	9,429,739,635
Commercial Office	1175.69	31,461,744	0.61	0	104,872	4,130,229,500
Commercial Retail	4848.69	42,807,283	0.20	0	85,615	6,606,856,073
Commercial Tourist	1260.43	10,423,214	0.19	0	20,846	1,643,480,250
Heavy Industrial	1413.40	18,470,300	0.30	0	12,314	1,816,246,160
Light Industrial	11385.15	150,764,915	0.30	0	146,374	17,020,565,400
Totals	26,983.03	321,551,087	0.27	0	482,727	40,647,117,018

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	30565.71	1,528	0.05	3,942	1,528	286,652,800
High	1299.96	22,099	17.00	57,015	0	4,145,772,400
Low	50155.87	175,546	3.50	452,909	0	32,932,429,600
Medium	9248.04	60,112	6.50	155,089	0	11,277,011,200
Medium High	2522.66	27,749	11.00	71,592	0	5,205,712,400
Open Space Rural	142623.26	3,566	0.03	9,200	0	668,981,600
Desert	2969.22	148	0.05	382	0	27,764,800
Rural Mountainous	160024.49	8,001	0.05	20,643	0	1,500,987,600
Rural	143813.30	21,572	0.15	55,656	0	4,046,907,200
Very High	202.48	6,074	30.00	15,671	0	1,139,482
Very Low	77118.95	92,543	1.20	238,761	0	17,361,066
Totals	620,543.94	418,938	0.68	1,080,860	1,528	78,592,768,800

Other	Acres	Units	Density	Population	Employment	Value
City	213836.82	0	0.00	0	0	0
Freeway	3481.41	0	0.00	0	0	0
Indian	75651.83	0	0.00	0	0	0
Open Space - C	50541.54	0	0.00	0	0	0
Open Space - CH	428164.09	0	0.00	0	0	0
Open Space Mineral	5191.02	0	0.00	0	156	0
Open Space Recreation	15722.16	0	0.00	0	2,358	0
Open Space Water	17547.47	0	0.00	0	0	0
Other - PF / OS	287.39	0	0.00	0	0	0
Public Facility	9565.83	0	0.00	0	10	0
Totals	819,989.56	0	0.00	0	2,524	0
Totals	1,467,516.53			1,080,860	486,779	119,239,885,818

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

Printed on 09/16/2001 at 19:14:33

Table B-4.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Retail 35% | **Build Out**

Revenues	
Property Tax	154,527,169
Property Transfer Tax	8,148,468
Sales Tax	71,836,012
Federal In-Lieu Taxes	702,559
Forfeitures and Penalties	6,770,830
Franchise Taxes	9,761,797
Interest on Invested Funds	22,027,086
Miscellaneous Revenue	19,805,958
Motor Vehicle License Fees	58,420,483
Municipal Court Fines	13,495,612
Other Court Fines	747,582
Property Tax Administration	6,694,083
Rents and Concessions	363,846
Vehicle Code Fines	6,484,371
Total Revenues	379,785,856
Expenses	
Administrative & Fiscal	24,986,226
Capital Lease/Const./Contingency	29,134,283
Community and Social Services	14,014,215
Education, Recreation and Culture	328,104
Environment & Development	254,301
Environment & Development - Unicorp.	13,618,292
Fire Protection - Unicorp.	26,227,044
General Services	9,108,704
Health Services	18,716,604
Justice & Law Enforcement	100,602,250
Justice & Law Enforcement - Unicorp.	98,316,919
Total Expenses	335,306,942
Net Fiscal Impact	44,478,915
Revenue / Expenditure Ratio	1.13

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table B-4.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Retail 35%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	6899.67	67,623,631	0.23	0	112,706	9,429,739,635
Commercial Office	1175.69	31,461,744	0.61	0	104,872	4,130,229,500
Commercial Retail	2997.06	26,459,919	0.20	0	52,920	4,083,811,553
Commercial Tourist	1260.43	10,423,214	0.19	0	20,846	1,643,480,250
Heavy Industrial	1413.40	18,470,300	0.30	0	12,314	1,816,246,160
Light Industrial	11385.15	150,764,915	0.30	0	146,374	17,020,565,400
Totals	25,131.40	305,203,723	0.28	0	450,032	38,124,072,498

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	30565.71	1,528	0.05	3,942	1,528	286,652,800
High	1299.96	22,099	17.00	57,015	0	4,145,772,400
Low	50155.87	175,546	3.50	452,909	0	32,932,429,600
Medium	9248.04	60,112	6.50	155,089	0	11,277,011,200
Medium High	2522.66	27,749	11.00	71,592	0	5,205,712,400
Open Space Rural	142623.26	3,566	0.03	9,200	0	668,981,600
Desert	2969.22	148	0.05	382	0	27,764,800
Rural Mountainous	160024.49	8,001	0.05	20,643	0	1,500,987,600
Rural	143813.30	21,572	0.15	55,656	0	4,046,907,200
Very High	202.48	6,074	30.00	15,671	0	1,139,487
Very Low	77118.95	92,543	1.20	238,761	0	17,361,066
Totals	620,543.94	418,938	0.68	1,080,860	1,528	78,592,768,800

Other	Acres	Units	Density	Population	Employment	Value
City	213836.82	0	0.00	0	0	0
Freeway	3481.41	0	0.00	0	0	0
Indian	75651.83	0	0.00	0	0	0
Open Space - C	50541.54	0	0.00	0	0	0
Open Space - CH	428164.09	0	0.00	0	0	0
Open Space Mineral	5191.02	0	0.00	0	156	0
Open Space Recreation	15722.16	0	0.00	0	2,358	0
Open Space Water	17547.47	0	0.00	0	0	0
Other - PF / OS	287.39	0	0.00	0	0	0
Public Facility	9565.83	0	0.00	0	10	0
Totals	819,989.56	0	0.00	0	2,524	0
Totals	1,465,664.90			1,080,860	454,084	116,716,841,298

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

Printed on 09/16/2001 at 19:35:03

Table B-5.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Retail 23%

	Build Out
Revenues	
Property Tax	152,864,517
Property Transfer Tax	8,073,598
Sales Tax	60,811,046
Federal In-Lieu Taxes	702,559
Forfeitures and Penalties	6,693,390
Franchise Taxes	9,651,723
Interest on Invested Funds	21,775,187
Miscellaneous Revenue	19,579,461
Motor Vehicle License Fees	58,420,483
Municipal Court Fines	13,341,262
Other Court Fines	739,115
Property Tax Administration	6,617,525
Rents and Concessions	359,789
Vehicle Code Fines	6,411,342
Total Revenues	366,040,997
Expenses	
Administrative & Fiscal	24,700,435
Capital Lease/Const./Contingency	28,801,048
Community and Social Services	14,014,215
Education, Recreation and Culture	324,352
Environment & Development	251,392
Environment & Development - Unicorp.	13,464,782
Fire Protection - Unicorp.	25,931,403
General Services	9,004,519
Health Services	18,716,604
Justice & Law Enforcement	99,451,571
Justice & Law Enforcement - Unicorp.	97,208,656
Total Expenses	331,868,977
Net Fiscal Impact	34,172,021
Revenue / Expenditure Ratio	1.10

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table B-5.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : Retail 23%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	6899.67	67,623,631	0.23	0	112,706	9,429,739,635
Commercial Office	1175.69	31,461,744	0.61	0	104,872	4,130,229,500
Commercial Retail	1998.04	17,639,946	0.20	0	35,280	2,722,541,035
Commercial Tourist	1260.43	10,423,214	0.19	0	20,846	1,643,480,250
Heavy Industrial	1413.40	18,470,300	0.30	0	12,314	1,816,246,160
Light Industrial	11385.15	150,764,915	0.30	0	146,374	17,020,565,400
Totals	24,132.38	296,383,750	0.28	0	432,392	36,762,801,980

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	30565.71	1,528	0.05	3,942	1,528	286,652,800
High	1299.96	22,099	17.00	57,015	0	4,145,772,400
Low	50155.87	175,546	3.50	452,909	0	32,932,429,600
Medium	9248.04	60,112	6.50	155,089	0	11,277,011,200
Medium High	2522.66	27,749	11.00	71,592	0	5,205,712,400
Open Space Rural	142623.26	3,566	0.03	9,200	0	668,981,600
Desert	2969.22	148	0.05	382	0	27,764,800
Rural Mountainous	160024.49	8,001	0.05	20,643	0	1,500,987,600
Rural	143813.30	21,572	0.15	55,656	0	4,046,907,200
Very High	202.48	6,074	30.00	15,671	0	1,139,482
Very Low	77118.95	92,543	1.20	238,761	0	17,361,06
Totals	620,543.94	418,938	0.68	1,080,860	1,528	78,592,768,800

Other	Acres	Units	Density	Population	Employment	Value
City	213836.82	0	0.00	0	0	0
Freeway	3481.41	0	0.00	0	0	0
Indian	75651.83	0	0.00	0	0	0
Open Space - C	50541.54	0	0.00	0	0	0
Open Space - CH	428164.09	0	0.00	0	0	0
Open Space Mineral	5191.02	0	0.00	0	156	0
Open Space Recreation	15722.16	0	0.00	0	2,358	0
Open Space Water	17547.47	0	0.00	0	0	0
Other - PF / OS	287.39	0	0.00	0	0	0
Public Facility	9565.83	0	0.00	0	10	0
Totals	819,989.56	0	0.00	0	2,524	0
Totals	1,464,665.88			1,080,860	436,444	115,355,570,780

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

Printed on 09/16/2001 at 20:08:44

Table B-6.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Western Riverside

Scenario : SCAG 2025

	Build Out
Revenues	
Property Tax	78,791,875
Property Transfer Tax	4,602,285
Sales Tax	46,697,572
Federal In-Lieu Taxes	432,290
Forfeitures and Penalties	3,796,155
Franchise Taxes	5,480,602
Interest on Invested Funds	12,349,919
Miscellaneous Revenue	11,104,605
Motor Vehicle License Fees	35,946,601
Municipal Court Fines	7,566,505
Other Court Fines	419,538
Property Tax Administration	3,753,146
Rents and Concessions	204,493
Vehicle Code Fines	3,640,965
Total Revenues	214,786,551
Expenses	
Administrative & Fiscal	14,008,774
Capital Lease/Const./Contingency	16,334,426
Community and Social Services	8,623,061
Education, Recreation and Culture	183,959
Environment & Development	142,576
Environment & Development - Unicorp.	7,646,003
Fire Protection - Unicorp.	14,725,197
General Services	5,106,882
Health Services	11,516,480
Justice & Law Enforcement	56,403,663
Justice & Law Enforcement - Unicorp.	55,200,133
Total Expenses	189,891,154
Net Fiscal Impact	24,895,398
Revenue / Expenditure Ratio	1.13

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

Printed on 09/16/2001 at 20:36:48

Table B-6.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
__ Sphere
All Parcels

Study Area: Western Riverside

Scenario : SCAG 2025

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	2407.98	23,600,647	0.23	0	39,334	3,290,979,112
Commercial Office	410.31	10,980,148	0.61	0	36,600	1,441,450,020
Commercial Retail	3005.67	26,535,954	0.20	0	53,072	4,095,546,723
Commercial Tourist	439.89	3,637,702	0.19	0	7,275	573,574,640
Heavy Industrial	493.28	6,446,135	0.30	0	4,297	633,869,929
Light Industrial	3973.42	52,616,955	0.30	0	51,084	5,940,177,298
Totals	10,730.55	123,817,541	0.26	0	191,662	15,975,597,722

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	18706.22	935	0.05	2,412	935	175,406,000
High	795.57	13,525	17.00	34,895	0	2,537,290,000
Low	30695.39	107,434	3.50	277,180	0	20,154,618,400
Medium	5659.80	36,789	6.50	94,916	0	6,901,616,400
Medium High	1543.87	16,983	11.00	43,816	0	3,186,010,800
Open Space Rural	142623.26	3,566	0.03	9,200	0	668,981,600
Desert	1817.16	91	0.05	235	0	17,071,600
Rural Mountainous	97934.99	4,897	0.05	12,634	0	918,677,200
Rural	88013.74	13,202	0.15	34,061	0	2,476,695,200
Very High	123.92	3,718	30.00	9,592	0	697,4[illegible]0
Very Low	47196.80	56,636	1.20	146,121	0	10,624,9[illegible]00
Totals	435,110.72	257,776	0.59	665,062	935	48,358,777,600

Other	Acres	Units	Density	Population	Employment	Value
City	213836.82	0	0.00	0	0	0
Freeway	3481.41	0	0.00	0	0	0
Indian	75651.83	0	0.00	0	0	0
Open Space - C	50541.54	0	0.00	0	0	0
Open Space - CH	428164.09	0	0.00	0	0	0
Open Space Mineral	5191.02	0	0.00	0	156	0
Open Space Recreation	15722.16	0	0.00	0	2,358	0
Open Space Water	17547.47	0	0.00	0	0	0
Other - PF / OS	287.39	0	0.00	0	0	0
Public Facility	9565.83	0	0.00	0	10	0
Totals	819,989.56	0	0.00	0	2,524	0
Totals	1,265,830.83			665,062	195,121	64,334,375,322

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Appendix C

STUDY AREA: EASTERN RIVERSIDE COUNTY

Appendix C presents the detailed Fiscal Model results for unincorporated Eastern Riverside County as identified in Chapter 7 of this report. The General Fund tables show recurring revenues and costs, the County's net fiscal impact and the revenue-to-expenditure ratio at build out for the preferred plan land uses and various alternatives. The Development Summary tables show land use, population, housing and employment information plus the estimated total assessed valuation for these same alternatives. The tables are listed as follows:

C-1.1 General Fund Summary, Eastern Riverside County, Plan C-1
C-1.2 Development Summary, Eastern Riverside County, Plan C-2

C-2.1 General Fund Summary, Eastern Riverside County, Sphere C-3
C-2.2 Development Summary, Eastern Riverside County, Sphere C-4

C-3.1 General Fund Summary, Eastern Riverside County, Retail 56% C-5
C-3.2 Development Summary, Eastern Riverside County, Retail 56% C-6

C-4.1 General Fund Summary, Eastern Riverside County, Retail 35% C-7
C-4.2 Development Summary, Eastern Riverside County, Retail 35% C-8

C-5.1 General Fund Summary, Eastern Riverside County, Retail 23% C-9
C-5.2 Development Summary, Eastern Riverside County, Retail 23% C-10

C-6.1 General Fund Summary, Eastern Riverside County, SCAG 2025 ..... C-11
C-6.2 Development Summary, Eastern Riverside County, SCAG 2025 ..... C-12

Table C-1.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Plan — Build Out

Revenues	
Property Tax	53,817,321
Property Transfer Tax	2,717,809
Sales Tax	43,890,027
Federal In-Lieu Taxes	185,517
Forfeitures and Penalties	2,183,605
Franchise Taxes	3,140,153
Interest on Invested Funds	7,103,624
Miscellaneous Revenue	6,387,316
Motor Vehicle License Fees	15,426,465
Municipal Court Fines	4,352,347
Other Court Fines	240,672
Property Tax Administration	2,158,833
Rents and Concessions	116,809
Vehicle Code Fines	2,085,429
Total Revenues	143,805,927
Expenses	
Administrative & Fiscal	8,058,194
Capital Lease/Const./Contingency	9,395,962
Community and Social Services	3,700,582
Education, Recreation and Culture	105,811
Environment & Development	82,014
Environment & Development - Unicorp.	4,380,451
Fire Protection - Unicorp.	8,436,177
General Services	2,937,610
Health Services	4,942,291
Justice & Law Enforcement	32,444,754
Justice & Law Enforcement - Unicorp.	31,624,555
Total Expenses	106,108,401
Net Fiscal Impact	37,697,527
Revenue / Expenditure Ratio	1.35

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-1.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	779.40	7,638,912	0.23	0	12,732	1,065,203,820
Commercial Office	4.08	66,632	0.37	0	222	9,439,520
Commercial Retail	2035.59	15,323,600	0.17	0	30,647	2,495,680,280
Commercial Tourist	2541.76	20,759,831	0.19	0	41,520	3,286,973,265
Heavy Industrial	495.44	6,474,430	0.30	0	4,316	636,652,290
Light Industrial	8606.46	113,968,769	0.30	0	110,649	12,866,474,180
Totals	14,462.73	164,232,174	0.26	0	200,086	20,360,423,355

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	174236.61	8,712	0.05	22,477	8,712	1,634,371,200
High	273.82	4,655	17.00	12,010	0	873,278,000
Low	11301.29	39,555	3.50	102,052	0	7,420,518,000
Medium	3341.02	21,717	6.50	56,030	0	4,074,109,200
Medium High	1141.79	12,560	11.00	32,405	0	2,356,256,000
Open Space Rural	501704.84	12,543	0.03	32,361	0	2,353,066,800
Desert	19244.19	962	0.05	2,482	0	180,471,200
Rural Mountainous	883.32	44	0.05	114	0	8,254,400
Rural	23984.33	3,598	0.15	9,283	0	674,984,800
Very Low	5231.26	6,278	1.20	16,197	0	1,177,752,800
Totals	741,342.47	110,624	0.15	285,411	8,712	20,753,062,400

Other	Acres	Units	Density	Population	Employment	Value
City	195186.11	0	0.00	0	0	0
Freeway	4605.32	0	0.00	0	0	0
Indian	14056.67	0	0.00	0	0	0
Open Space - C	4324.76	0	0.00	0	0	0
Open Space - CH	314682.61	0	0.00	0	0	0
Open Space Mineral	789.25	0	0.00	0	24	0
Open Space Recreation	7575.92	0	0.00	0	1,136	0
Open Space Water	55574.07	0	0.00	0	0	0
Other - PF / OS	4.08	0	0.00	0	0	0
Public Facility	11156.87	0	0.00	0	30	0
Totals	607,955.66	0	0.00	0	1,190	0
Totals	1,363,760.86			285,411	209,988	41,113,485,755

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-2.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
X Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Sphere

	Build Out
Revenues	
Property Tax	23,116,442
Property Transfer Tax	1,093,149
Sales Tax	16,994,559
Federal In-Lieu Taxes	67,332
Forfeitures and Penalties	866,924
Franchise Taxes	1,245,448
Interest on Invested Funds	2,820,220
Miscellaneous Revenue	2,535,837
Motor Vehicle License Fees	5,598,877
Municipal Court Fines	1,727,944
Other Court Fines	95,485
Property Tax Administration	857,085
Rents and Concessions	46,293
Vehicle Code Fines	827,054
Total Revenues	57,892,649
Expenses	
Administrative & Fiscal	3,199,236
Capital Lease/Const./Contingency	3,730,351
Community and Social Services	1,343,088
Education, Recreation and Culture	42,008
Environment & Development	32,561
Environment & Development - Unicorp.	1,737,337
Fire Protection - Unicorp.	3,345,885
General Services	1,166,280
Health Services	1,793,754
Justice & Law Enforcement	12,881,098
Justice & Law Enforcement - Unicorp.	12,542,661
Total Expenses	41,814,259
Net Fiscal Impact	16,078,390
Revenue / Expenditure Ratio	1.38

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-2.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
X Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Sphere

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Commercial Retail	577.81	4,341,689	0.17	0	8,683	707,569,475
Commercial Tourist	1859.21	15,185,105	0.19	0	30,370	2,404,308,285
Light Industrial	4159.65	55,083,084	0.30	0	53,479	6,218,590,260
Totals	6,596.67	74,609,878	0.26	0	92,532	9,330,468,020

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	6375.82	319	0.05	823	319	59,844,400
Low	5504.25	19,265	3.50	49,704	0	3,614,114,000
Medium	1382.72	8,988	6.50	23,189	0	1,686,148,800
Medium High	487.24	5,360	11.00	13,829	0	1,005,536,000
Open Space Rural	23271.83	582	0.03	1,502	0	109,183,200
Desert	7134.35	357	0.05	921	0	66,973,200
Rural Mountainous	766.33	38	0.05	98	0	7,128,800
Rural	6949.84	1,042	0.15	2,688	0	195,479,200
Very Low	3498.86	4,199	1.20	10,833	0	787,732,400
Totals	55,371.24	40,150	0.73	103,587	319	7,532,140,000

Other	Acres	Units	Density	Population	Employment	Value
City	72.88	0	0.00	0	0	0
Freeway	1189.00	0	0.00	0	0	0
an	3088.82	0	0.00	0	0	0
Open Space - C	1453.43	0	0.00	0	0	0
Open Space - CH	29386.88	0	0.00	0	0	0
Open Space Recreation	1643.19	0	0.00	0	246	0
Open Space Water	3656.12	0	0.00	0	0	0
Public Facility	108.62	0	0.00	0	85	0
Totals	40,598.94	0	0.00	0	331	0
Totals	102,566.85			103,587	93,182	16,862,608,020

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-3.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Retail 56%

	Build Out
Revenues	
Property Tax	52,532,362
Property Transfer Tax	2,657,826
Sales Tax	35,519,511
Federal In-Lieu Taxes	185,517
Forfeitures and Penalties	2,124,810
Franchise Taxes	3,056,581
Interest on Invested Funds	6,912,372
Miscellaneous Revenue	6,215,350
Motor Vehicle License Fees	15,426,465
Municipal Court Fines	4,235,158
Other Court Fines	234,243
Property Tax Administration	2,100,707
Rents and Concessions	113,728
Vehicle Code Fines	2,029,982
Total Revenues	133,344,612
Expenses	
Administrative & Fiscal	7,841,210
Capital Lease/Const./Contingency	9,142,956
Community and Social Services	3,700,582
Education, Recreation and Culture	102,962
Environment & Development	79,806
Environment & Development - Unicorp.	4,263,900
Fire Protection - Unicorp.	8,211,714
General Services	2,858,508
Health Services	4,942,291
Justice & Law Enforcement	31,571,113
Justice & Law Enforcement - Unicorp.	30,783,117
Total Expenses	103,498,159
Net Fiscal Impact	29,846,453
Revenue / Expenditure Ratio	1.28

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-3.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Retail 56%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	779.40	7,638,912	0.23	0	12,732	1,065,203,820
Commercial Office	4.08	66,632	0.37	0	222	9,439,520
Commercial Retail	1146.04	8,627,187	0.17	0	17,254	1,405,068,019
Commercial Tourist	2541.76	20,759,831	0.19	0	41,520	3,286,973,265
Heavy Industrial	495.44	6,474,430	0.30	0	4,316	636,652,290
Light Industrial	8606.46	113,968,769	0.30	0	110,649	12,866,474,180
Totals	13,573.18	157,535,761	0.27	0	186,693	19,269,811,094

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	174236.61	8,712	0.05	22,477	8,712	1,634,371,200
High	273.82	4,655	17.00	12,010	0	873,278,000
Low	11301.29	39,555	3.50	102,052	0	7,420,518,000
Medium	3341.02	21,717	6.50	56,030	0	4,074,109,200
Medium High	1141.79	12,560	11.00	32,405	0	2,356,256,000
Open Space Rural	501704.84	12,543	0.03	32,361	0	2,353,066,800
Desert	19244.19	962	0.05	2,482	0	180,471,200
Rural Mountainous	883.32	44	0.05	114	0	8,254,400
Rural	23984.33	3,598	0.15	9,283	0	674,984,800
Very Low	5231.26	6,278	1.20	16,197	0	1,177,752,800
Totals	741,342.47	110,624	0.15	285,411	8,712	20,753,062,400

Other	Acres	Units	Density	Population	Employment	Value
City	195186.11	0	0.00	0	0	0
Freeway	4605.32	0	0.00	0	0	0
Indian	14056.67	0	0.00	0	0	0
Open Space - C	4324.76	0	0.00	0	0	0
Open Space - CH	314682.61	0	0.00	0	0	0
Open Space Mineral	789.25	0	0.00	0	24	0
Open Space Recreation	7575.92	0	0.00	0	1,136	0
Open Space Water	55574.07	0	0.00	0	0	0
Other - PF / OS	4.08	0	0.00	0	0	0
Public Facility	11156.87	0	0.00	0	372	0
Totals	607,955.66	0	0.00	0	1,532	0
Totals	1,362,871.31			285,411	196,937	40,022,873,494

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-4.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Retail 35%

	Build Out
Revenues	
Property Tax	51,900,176
Property Transfer Tax	2,628,314
Sales Tax	31,401,293
Federal In-Lieu Taxes	185,517
Forfeitures and Penalties	2,095,643
Franchise Taxes	3,015,122
Interest on Invested Funds	6,817,496
Miscellaneous Revenue	6,130,041
Motor Vehicle License Fees	15,426,465
Municipal Court Fines	4,177,023
Other Court Fines	231,054
Property Tax Administration	2,071,872
Rents and Concessions	112,200
Vehicle Code Fines	2,002,476
Total Revenues	128,194,692
Expenses	
Administrative & Fiscal	7,733,569
Capital Lease/Const./Contingency	9,017,445
Community and Social Services	3,700,582
Education, Recreation and Culture	101,549
Environment & Development	78,710
Environment & Development - Unicorp.	4,206,081
Fire Protection - Unicorp.	8,100,363
General Services	2,819,267
Health Services	4,942,291
Justice & Law Enforcement	31,137,716
Justice & Law Enforcement - Unicorp.	30,365,696
Total Expenses	102,203,269
Net Fiscal Impact	25,991,423
Revenue / Expenditure Ratio	1.25

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-4.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Retail 35%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	779.40	7,638,912	0.23	0	12,732	1,065,203,820
Commercial Office	4.08	66,632	0.37	0	222	9,439,520
Commercial Retail	708.38	5,332,613	0.17	0	10,665	868,496,758
Commercial Tourist	2541.76	20,759,831	0.19	0	41,520	3,286,973,265
Heavy Industrial	495.44	6,474,430	0.30	0	4,316	636,652,290
Light Industrial	8606.46	113,968,769	0.30	0	110,649	12,866,474,180
Totals	13,135.52	154,241,187	0.27	0	180,104	18,733,239,833

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	174236.61	8,712	0.05	22,477	8,712	1,634,371,200
High	273.82	4,655	17.00	12,010	0	873,278,000
Low	11301.29	39,555	3.50	102,052	0	7,420,518,000
Medium	3341.02	21,717	6.50	56,030	0	4,074,109,200
Medium High	1141.79	12,560	11.00	32,405	0	2,356,256,000
Open Space Rural	501704.84	12,543	0.03	32,361	0	2,353,066,800
Desert	19244.19	962	0.05	2,482	0	180,471,200
Rural Mountainous	883.32	44	0.05	114	0	8,254,400
Rural	23984.33	3,598	0.15	9,283	0	674,984,800
Very Low	5231.26	6,278	1.20	16,197	0	1,177,752,800
Totals	741,342.47	110,624	0.15	285,411	8,712	20,753,062,400

Other	Acres	Units	Density	Population	Employment	Value
City	195186.11	0	0.00	0	0	0
Freeway	4605.32	0	0.00	0	0	0
Indian	14056.67	0	0.00	0	0	0
Open Space - C	4324.76	0	0.00	0	0	0
Open Space - CH	314682.61	0	0.00	0	0	0
Open Space Mineral	789.25	0	0.00	0	24	0
Open Space Recreation	7575.92	0	0.00	0	1,136	0
Open Space Water	55574.07	0	0.00	0	0	0
Other - PF / OS	4.08	0	0.00	0	0	0
Public Facility	11156.87	0	0.00	0	85	0
Totals	607,955.66	0	0.00	0	1,245	0
Totals	1,362,433.65			285,411	190,061	39,486,302,233

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-5.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Retail 23%

	Build Out
Revenues	
Property Tax	51,559,088
Property Transfer Tax	2,612,392
Sales Tax	29,179,371
Federal In-Lieu Taxes	185,517
Forfeitures and Penalties	2,080,037
Franchise Taxes	2,992,939
Interest on Invested Funds	6,766,730
Miscellaneous Revenue	6,084,395
Motor Vehicle License Fees	15,426,465
Municipal Court Fines	4,145,917
Other Court Fines	229,348
Property Tax Administration	2,056,443
Rents and Concessions	111,382
Vehicle Code Fines	1,987,758
Total Revenues	125,417,782
Expenses	
Administrative & Fiscal	7,675,973
Capital Lease/Const./Contingency	8,950,288
Community and Social Services	3,700,582
Education, Recreation and Culture	100,793
Environment & Development	78,124
Environment & Development - Unicorp.	4,175,144
Fire Protection - Unicorp.	8,040,782
General Services	2,798,271
Health Services	4,942,291
Justice & Law Enforcement	30,905,819
Justice & Law Enforcement - Unicorp.	30,142,347
Total Expenses	101,510,414
Net Fiscal Impact	23,907,368
Revenue / Expenditure Ratio	1.23

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-5.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : Retail 23%

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	779.40	7,638,912	0.23	0	12,732	1,065,203,820
Commercial Office	4.08	66,632	0.37	0	222	9,439,520
Commercial Retail	472.26	3,555,075	0.17	0	7,110	578,997,804
Commercial Tourist	2541.76	20,759,831	0.19	0	41,520	3,286,973,265
Heavy Industrial	495.44	6,474,430	0.30	0	4,316	636,652,290
Light Industrial	8606.46	113,968,769	0.30	0	110,649	12,866,474,180
Totals	12,899.40	152,463,649	0.27	0	176,549	18,443,740,879

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	174236.61	8,712	0.05	22,477	8,712	1,634,371,200
High	273.82	4,655	17.00	12,010	0	873,278,000
Low	11301.29	39,555	3.50	102,052	0	7,420,518,000
Medium	3341.02	21,717	6.50	56,030	0	4,074,109,200
Medium High	1141.79	12,560	11.00	32,405	0	2,356,256,000
Open Space Rural	501704.84	12,543	0.03	32,361	0	2,353,066,800
Desert	19244.19	962	0.05	2,482	0	180,471,200
Rural Mountainous	883.32	44	0.05	114	0	8,254,400
Rural	23984.33	3,598	0.15	9,283	0	674,984,800
Very Low	5231.26	6,278	1.20	16,197	0	1,177,752,800
Totals	741,342.47	110,624	0.15	285,411	8,712	20,753,062,400

Other	Acres	Units	Density	Population	Employment	Value
City	195186.11	0	0.00	0	0	0
Freeway	4605.32	0	0.00	0	0	0
Indian	14056.67	0	0.00	0	0	0
Open Space - C	4324.76	0	0.00	0	0	0
Open Space - CH	314682.61	0	0.00	0	0	0
Open Space Mineral	789.25	0	0.00	0	24	0
Open Space Recreation	7575.92	0	0.00	0	1,136	0
Open Space Water	55574.07	0	0.00	0	0	0
Other - PF / OS	4.08	0	0.00	0	0	0
Public Facility	11156.87	0	0.00	0	85	0
Totals	607,955.66	0	0.00	0	1,245	0
Totals	1,362,197.53			285,411	186,506	39,196,803,279

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-6.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : SCAG 2025 — **Build Out**

Revenues	
Property Tax	21,684,595
Property Transfer Tax	1,280,962
Sales Tax	4,740,123
Federal In-Lieu Taxes	134,672
Forfeitures and Penalties	1,045,381
Franchise Taxes	1,512,305
Interest on Invested Funds	3,400,966
Miscellaneous Revenue	3,058,029
Motor Vehicle License Fees	11,198,457
Municipal Court Fines	2,083,661
Other Court Fines	115,694
Property Tax Administration	1,033,546
Rents and Concessions	56,516
Vehicle Code Fines	1,004,850
Total Revenues	52,349,757
Expenses	
Administrative & Fiscal	3,857,688
Capital Lease/Const./Contingency	4,498,119
Community and Social Services	2,686,345
Education, Recreation and Culture	50,659
Environment & Development	39,262
Environment & Development - Unicorp.	2,109,915
Fire Protection - Unicorp.	4,063,419
General Services	1,406,314
Health Services	3,587,733
Justice & Law Enforcement	15,532,253
Justice & Law Enforcement - Unicorp.	15,232,484
Total Expenses	53,064,191
Net Fiscal Impact	-714,434
Revenue / Expenditure Ratio	0.98

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table C-6.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: Eastern Riverside

Scenario : SCAG 2025

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	84.18	825,002	0.23	0	1,375	115,041,965
Commercial Office	0.44	7,196	0.38	0	24	1,019,439
Commercial Retail	219.84	1,654,949	0.17	0	3,310	269,533,491
Commercial Tourist	274.51	2,242,062	0.19	0	4,484	354,993,139
Heavy Industrial	53.51	699,238	0.30	0	466	68,758,419
Light Industrial	929.50	12,308,627	0.30	0	11,950	1,389,579,207
Totals	1,561.98	17,737,074	0.26	0	21,609	2,198,925,660

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	134510.66	6,726	0.05	17,353	6,726	1,261,797,600
High	197.70	3,361	17.00	8,671	0	630,523,600
Low	8159.53	28,558	3.50	73,680	0	5,357,480,800
Medium	2412.21	15,679	6.50	40,452	0	2,941,380,400
Medium High	824.37	9,068	11.00	23,395	0	1,701,156,800
Open Space Rural	362230.90	9,056	0.03	23,364	0	1,698,905,600
Desert	13894.30	695	0.05	1,793	0	130,382,000
Rural Mountainous	637.76	32	0.05	83	0	6,003,200
Rural	17316.68	2,598	0.15	6,703	0	487,384,800
Very Low	3776.97	4,532	1.20	11,693	0	850,203,200
Totals	543,961.08	80,305	0.15	207,187	6,726	15,065,218,000

Other	Acres	Units	Density	Population	Employment	Value
City	195186.11	0	0.00	0	0	0
Freeway	4605.32	0	0.00	0	0	0
Indian	14056.67	0	0.00	0	0	0
Open Space - C	4324.76	0	0.00	0	0	0
Open Space - CH	314682.61	0	0.00	0	0	0
Open Space Mineral	789.25	0	0.00	0	24	0
Open Space Recreation	7575.92	0	0.00	0	1,136	0
Open Space Water	55574.07	0	0.00	0	0	0
Other - PF / OS	4.08	0	0.00	0	0	0
Public Facility	11156.87	0	0.00	0	30	0
Totals	607,955.66	0	0.00	0	1,190	0
Totals	1,153,478.72			207,187	29,525	17,264,143,660

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Appendix D
STUDY AREA: FISCAL ANALYSIS AREAS

Appendix D presents the detailed Fiscal Model results for each of the unincorporated Fiscal Analysis Areas (FAA) within Riverside County as identified in Chapter 8 of this report. The General Fund tables show recurring revenues and costs, the County's net fiscal impact and revenue-to-expenditure ratio at build out for the preferred plan land uses and various alternatives. The Development Summary tables show land use, population, housing and employment information plus the estimated total assessed valuation for these same alternatives. The tables are listed as follows:

D-1.1 General Fund Summary, Fiscal Impact Area 1, Plan D-1
D-1.2 Development Summary, Fiscal Impact Area 1, Plan D-2

D-2.1 General Fund Summary, Fiscal Impact Area 2, Plan D-3
D-2.2 Development Summary, Fiscal Impact Area 2, Plan D-4

D-3.1 General Fund Summary, Fiscal Impact Area 3, Plan D-5
D-3.2 Development Summary, Fiscal Impact Area 3, Plan D-6

D-4.1 General Fund Summary, Fiscal Impact Area 4, Plan D-7
D-4.2 Development Summary, Fiscal Impact Area 4, Plan D-8

D-5.1 General Fund Summary, Fiscal Impact Area 5, Plan D-9
D-5.2 Development Summary, Fiscal Impact Area 5, Plan D-10

D-6.1 General Fund Summary, Fiscal Impact Area 6, Plan D-11
D-6.2 Development Summary, Fiscal Impact Area 6, Plan D-12

D-7.1 General Fund Summary, Fiscal Impact Area 7, Plan D-13
D-7.2 Development Summary, Fiscal Impact Area 7, Plan D-14

Table D-1.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA01

Scenario : Plan

	Build Out
Revenues	
Property Tax	53,470,208
Property Transfer Tax	2,667,637
Sales Tax	46,939,391
Federal In-Lieu Taxes	172,711
Forfeitures and Penalties	2,207,216
Franchise Taxes	3,171,205
Interest on Invested Funds	7,180,380
Miscellaneous Revenue	6,456,330
Motor Vehicle License Fees	14,361,571
Municipal Court Fines	4,399,404
Other Court Fines	243,121
Property Tax Administration	2,182,168
Rents and Concessions	117,880
Vehicle Code Fines	2,105,888
Total Revenues	145,675,110
Expenses	
Administrative & Fiscal	8,145,359
Capital Lease/Const./Contingency	9,497,595
Community and Social Services	3,445,130
Education, Recreation and Culture	106,954
Environment & Development	82,902
Environment & Development - Unicorp.	4,423,678
Fire Protection - Unicorp.	8,519,425
General Services	2,969,387
Health Services	4,601,123
Justice & Law Enforcement	32,795,697
Justice & Law Enforcement - Unicorp.	31,936,623
Total Expenses	106,523,873
Net Fiscal Impact	39,151,238
Revenue / Expenditure Ratio	1.36

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-1.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA01

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	3714.83	36,409,043	0.23	0	60,682	5,077,038,775
Commercial Office	413.38	9,329,231	0.52	0	31,097	1,252,929,635
Commercial Retail	2313.50	20,206,674	0.20	0	40,413	3,129,459,470
Commercial Tourist	446.70	3,648,392	0.19	0	7,297	577,662,060
Heavy Industrial	1413.40	18,470,300	0.30	0	12,314	1,816,246,160
Light Industrial	6421.77	85,038,561	0.30	0	82,562	9,600,405,970
Totals	14,723.58	173,102,201	0.27	0	234,365	21,453,742,070

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	1742.18	87	0.05	224	87	16,321,200
High	239.54	4,072	17.00	10,506	0	763,907,200
Low	11443.65	40,053	3.50	103,337	0	7,513,942,800
Medium	2799.84	18,199	6.50	46,953	0	3,414,132,400
Medium High	600.23	6,603	11.00	17,036	0	1,238,722,800
Open Space Rural	16101.97	403	0.03	1,040	0	75,602,800
Rural Mountainous	14846.55	742	0.05	1,914	0	139,199,200
Rural	21478.77	3,222	0.15	8,313	0	604,447,200
Very High	57.15	1,714	30.00	4,422	0	321,546,400
Very Low	23243.92	27,893	1.20	71,964	0	5,232,726
Totals	92,553.80	102,988	1.11	265,709	87	19,320,548,

Other	Acres	Units	Density	Population	Employment	Value
City	57121.99	0	0.00	0	0	0
Freeway	1656.16	0	0.00	0	0	0
Open Space - C	13334.57	0	0.00	0	0	0
Open Space - CH	48245.41	0	0.00	0	0	0
Open Space Mineral	3615.53	0	0.00	0	108	0
Open Space Recreation	4317.47	0	0.00	0	648	0
Open Space Water	7393.83	0	0.00	0	0	0
Other - PF / OS	96.45	0	0.00	0	0	0
Public Facility	7529.83	0	0.00	0	50	0
Totals	143,311.24	0	0.00	0	806	0
Totals	250,588.62			265,709	235,258	40,774,290,870

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-2.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA02

Scenario : Plan

	Build Out
Revenues	
Property Tax	32,858,859
Property Transfer Tax	1,887,068
Sales Tax	32,735,327
Federal In-Lieu Taxes	156,176
Forfeitures and Penalties	1,608,908
Franchise Taxes	2,317,522
Interest on Invested Funds	5,234,114
Miscellaneous Revenue	4,706,324
Motor Vehicle License Fees	12,986,594
Municipal Court Fines	3,206,871
Other Court Fines	177,532
Property Tax Administration	1,590,666
Rents and Concessions	86,319
Vehicle Code Fines	1,539,320
Total Revenues	101,091,600
Expenses	
Administrative & Fiscal	5,937,338
Capital Lease/Const./Contingency	6,923,017
Community and Social Services	3,115,293
Education, Recreation and Culture	77,964
Environment & Development	60,428
Environment & Development - Unicorp.	3,233,017
Fire Protection - Unicorp.	6,226,367
General Services	2,164,452
Health Services	4,160,611
Justice & Law Enforcement	23,905,549
Justice & Law Enforcement - Unicorp.	23,340,685
Total Expenses	79,144,721
Net Fiscal Impact	21,946,879
Revenue / Expenditure Ratio	1.27

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-2.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA02

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	2183.83	21,403,741	0.23	0	35,673	2,984,632,755
Commercial Office	298.29	7,017,002	0.54	0	23,390	936,890,910
Commercial Retail	2411.52	20,341,066	0.19	0	40,682	3,186,268,970
Commercial Tourist	17.23	140,751	0.19	0	282	22,285,565
Light Industrial	1820.15	24,102,863	0.30	0	23,401	2,721,086,380
Totals	6,731.02	73,005,423	0.25	0	123,428	9,851,164,580

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	7482.52	374	0.05	965	374	70,162,400
High	395.88	6,730	17.00	17,363	0	1,262,548,000
Low	10394.26	36,380	3.50	93,860	0	6,824,888,000
Medium	2395.99	15,574	6.50	40,181	0	2,921,682,400
Medium High	368.81	4,057	11.00	10,467	0	761,093,200
Open Space Rural	12691.69	317	0.03	818	0	59,469,200
Rural Mountainous	72491.28	3,625	0.05	9,353	0	680,050,000
Rural	35108.09	5,266	0.15	13,586	0	987,901,600
Very High	29.93	898	30.00	2,317	0	168,464,800
Very Low	16588.79	19,907	1.20	51,360	0	3,734,553,200
Totals	157,947.24	93,128	0.59	240,270	374	17,470,812

Other	Acres	Units	Density	Population	Employment	Value
City	83109.00	0	0.00	0	0	0
Freeway	660.14	0	0.00	0	0	0
Indian	4143.19	0	0.00	0	0	0
Open Space - C	4086.28	0	0.00	0	0	0
Open Space - CH	85239.95	0	0.00	0	0	0
Open Space Mineral	1425.91	0	0.00	0	43	0
Open Space Recreation	3394.15	0	0.00	0	509	0
Open Space Water	1707.48	0	0.00	0	0	0
Other - PF / OS	45.40	0	0.00	0	0	0
Public Facility	460.15	0	0.00	0	40	0
Totals	184,271.65	0	0.00	0	592	0
Totals	348,949.91			240,270	124,394	27,321,977,380

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-3.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA03

Scenario : Plan

	Build Out
Revenues	
Property Tax	58,585,023
Property Transfer Tax	3,027,845
Sales Tax	44,030,786
Federal In-Lieu Taxes	275,028
Forfeitures and Penalties	2,587,960
Franchise Taxes	3,732,445
Interest on Invested Funds	8,419,260
Miscellaneous Revenue	7,570,294
Motor Vehicle License Fees	22,869,636
Municipal Court Fines	5,158,321
Other Court Fines	285,809
Property Tax Administration	2,558,629
Rents and Concessions	139,154
Vehicle Code Fines	2,479,385
Total Revenues	161,719,575
Expenses	
Administrative & Fiscal	9,550,270
Capital Lease/Const./Contingency	11,135,746
Community and Social Services	5,486,089
Education, Recreation and Culture	125,409
Environment & Development	97,199
Environment & Development - Unicorp.	5,207,025
Fire Protection - Unicorp.	10,028,047
General Services	3,481,541
Health Services	7,326,915
Justice & Law Enforcement	38,452,334
Justice & Law Enforcement - Unicorp.	37,591,987
Total Expenses	128,482,562
Net Fiscal Impact	33,237,014
Revenue / Expenditure Ratio	1.25

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-3.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA03

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	707.37	6,932,885	0.23	0	11,555	966,752,275
Commercial Office	464.02	15,115,510	0.75	0	50,385	1,940,408,840
Commercial Retail	2905.14	28,106,941	0.22	0	56,214	4,216,706,355
Commercial Tourist	347.75	2,968,940	0.20	0	5,938	463,220,220
Light Industrial	2937.63	38,900,746	0.30	0	37,768	4,391,689,480
Totals	7,361.91	92,025,022	0.29	0	161,860	11,978,777,170

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	11175.79	559	0.05	1,442	559	104,868,400
High	531.12	9,029	17.00	23,295	0	1,693,840,400
Low	25977.32	90,921	3.50	234,576	0	17,056,779,600
Medium	3794.22	24,662	6.50	63,628	0	4,626,591,200
Medium High	985.75	10,843	11.00	27,975	0	2,034,146,800
Open Space Rural	5493.98	137	0.02	353	0	25,701,200
Rural Mountainous	24548.45	1,227	0.05	3,166	0	230,185,200
Rural	16537.22	2,481	0.15	6,401	0	465,435,600
Very High	115.41	3,462	30.00	8,932	0	649,471,200
Very Low	17232.70	20,679	1.20	53,352	0	3,879,380,400
Totals	106,391.96	164,000	1.54	423,120	559	30,766,400

Other	Acres	Units	Density	Population	Employment	Value
City	32450.84	0	0.00	0	0	0
Freeway	475.49	0	0.00	0	0	0
Indian	4729.27	0	0.00	0	0	0
Open Space - C	9146.50	0	0.00	0	0	0
Open Space - CH	7253.79	0	0.00	0	0	0
Open Space Mineral	149.59	0	0.00	0	4	0
Open Space Recreation	6210.12	0	0.00	0	932	0
Open Space Water	7221.43	0	0.00	0	0	0
Other - PF / OS	145.54	0	0.00	0	0	0
Public Facility	1506.93	0	0.00	0	146	0
Totals	69,289.50	0	0.00	0	1,082	0
Totals	183,043.37			423,120	163,501	42,745,177,170

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-4.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA04

Scenario : Plan

	Build Out
Revenues	
Property Tax	5,765,825
Property Transfer Tax	349,162
Sales Tax	3,998,029
Federal In-Lieu Taxes	33,616
Forfeitures and Penalties	283,833
Franchise Taxes	410,030
Interest on Invested Funds	923,390
Miscellaneous Revenue	830,279
Motor Vehicle License Fees	2,795,304
Municipal Court Fines	565,737
Other Court Fines	31,382
Property Tax Administration	280,618
Rents and Concessions	15,306
Vehicle Code Fines	272,412
Total Revenues	16,554,923
Expenses	
Administrative & Fiscal	1,047,412
Capital Lease/Const./Contingency	1,221,298
Community and Social Services	670,552
Education, Recreation and Culture	13,754
Environment & Development	10,660
Environment & Development - Unicorp.	572,042
Fire Protection - Unicorp.	1,101,678
General Services	381,833
Health Services	895,552
Justice & Law Enforcement	4,217,208
Justice & Law Enforcement - Unicorp.	4,129,843
Total Expenses	14,261,832
Net Fiscal Impact	2,293,092
Revenue / Expenditure Ratio	1.16

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-4.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA04

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	293.64	2,877,962	0.22	0	4,797	401,315,830
Commercial Retail	341.04	2,562,610	0.17	0	5,125	417,631,140
Light Industrial	177.13	2,345,621	0.30	0	2,277	264,808,280
Totals	811.81	7,786,193	0.22	0	12,199	1,083,755,250

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	2531.46	127	0.05	328	127	23,825,200
High	133.42	2,268	17.00	5,851	0	425,476,800
Low	741.07	2,594	3.50	6,693	0	486,634,400
Medium	50.15	326	6.50	841	0	61,157,600
Medium High	556.38	6,120	11.00	15,790	0	1,148,112,000
Desert	2969.22	148	0.05	382	0	27,764,800
Rural Mountainous	23857.60	1,193	0.05	3,078	0	223,806,800
Rural	6388.98	958	0.15	2,472	0	179,720,800
Very Low	5259.51	6,311	1.20	16,282	0	1,183,943,600
Totals	42,487.79	20,045	0.47	51,717	127	3,760,442,000

Other	Acres	Units	Density	Population	Employment	Value
City	41154.99	0	0.00	0	0	
Freeway	689.62	0	0.00	0	0	
Indian	30106.50	0	0.00	0	0	0
Open Space - C	23156.93	0	0.00	0	0	0
Open Space Recreation	1717.16	0	0.00	0	258	0
Open Space Water	16.17	0	0.00	0	0	0
Totals	96,841.37	0	0.00	0	258	0
Totals	140,140.97			51,717	12,584	4,844,197,250

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-5.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA05

Scenario : Plan

	Build Out
Revenues	
Property Tax	13,192,532
Property Transfer Tax	637,576
Sales Tax	6,100,396
Federal In-Lieu Taxes	65,030
Forfeitures and Penalties	520,056
Franchise Taxes	751,955
Interest on Invested Funds	1,691,903
Miscellaneous Revenue	1,521,299
Motor Vehicle License Fees	5,407,486
Municipal Court Fines	1,036,578
Other Court Fines	57,535
Property Tax Administration	514,167
Rents and Concessions	28,090
Vehicle Code Fines	499,615
Total Revenues	32,024,218
Expenses	
Administrative & Fiscal	1,919,124
Capital Lease/Const./Contingency	2,237,726
Community and Social Services	1,297,176
Education, Recreation and Culture	25,202
Environment & Development	19,532
Environment & Development - Unicorp.	1,049,090
Fire Protection - Unicorp.	2,020,409
General Services	699,614
Health Services	1,732,437
Justice & Law Enforcement	7,726,991
Justice & Law Enforcement - Unicorp.	7,573,879
Total Expenses	26,301,180
Net Fiscal Impact	5,723,039
Revenue / Expenditure Ratio	1.21

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-5.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA05

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Commercial Retail	641.06	4,816,960	0.17	0	9,634	785,024,840
Commercial Tourist	448.75	3,665,131	0.19	0	7,330	580,312,405
Light Industrial	28.48	377,123	0.30	0	366	42,575,210
Totals	1,118.29	8,859,214	0.18	0	17,330	1,407,912,455

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	7633.76	382	0.05	986	382	71,663,200
Low	1599.56	5,598	3.50	14,443	0	1,050,184,800
Medium	207.84	1,351	6.50	3,486	0	253,447,600
Medium High	11.50	126	11.00	325	0	23,637,600
Open Space Rural	108335.62	2,708	0.03	6,987	0	508,020,800
Rural Mountainous	24280.61	1,214	0.05	3,132	0	227,746,400
Rural	64300.23	9,645	0.15	24,884	0	1,809,402,000
Very Low	14794.03	17,753	1.20	45,803	0	3,330,462,800
Totals	221,163.15	38,777	0.18	100,046	382	7,274,565,200

Other	Acres	Units	Density	Population	Employment	Value
Indian	36672.88	0	0.00	0	0	0
Open Space - C	817.25	0	0.00	0	0	
Open Space - CH	287424.93	0	0.00	0	0	
Open Space Recreation	83.26	0	0.00	0	12	0
Open Space Water	1208.56	0	0.00	0	0	0
Public Facility	68.92	0	0.00	0	10	0
Totals	326,275.80	0	0.00	0	22	0
Totals	548,557.24			100,046	17,734	8,682,477,655

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-6.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA06

Scenario : Plan — Build Out

Revenues	
Property Tax	46,553,695
Property Transfer Tax	2,313,737
Sales Tax	39,058,340
Federal In-Lieu Taxes	152,801
Forfeitures and Penalties	1,835,869
Franchise Taxes	2,639,466
Interest on Invested Funds	5,972,370
Miscellaneous Revenue	5,370,134
Motor Vehicle License Fees	12,705,966
Municipal Court Fines	3,659,241
Other Court Fines	202,313
Property Tax Administration	1,815,040
Rents and Concessions	98,166
Vehicle Code Fines	1,752,880
Total Revenues	124,130,018
Expenses	
Administrative & Fiscal	6,774,945
Capital Lease/Const./Contingency	7,899,676
Community and Social Services	3,047,974
Education, Recreation and Culture	88,961
Environment & Development	68,954
Environment & Development - Unicorp.	3,681,984
Fire Protection - Unicorp.	7,091,020
General Services	2,469,802
Health Services	4,070,705
Justice & Law Enforcement	27,277,998
Justice & Law Enforcement - Unicorp.	26,581,987
Total Expenses	89,054,006
Net Fiscal Impact	35,076,013
Revenue / Expenditure Ratio	1.39

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-6.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA06

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	499.63	4,896,873	0.23	0	8,161	682,841,745
Commercial Office	4.08	66,632	0.37	0	222	9,439,520
Commercial Retail	1804.45	13,586,800	0.17	0	27,174	2,212,632,220
Commercial Tourist	2380.72	19,444,556	0.19	0	38,889	3,078,721,350
Heavy Industrial	437.91	5,722,615	0.30	0	3,815	562,723,795
Light Industrial	7753.21	102,669,846	0.30	0	99,679	11,590,885,260
Totals	12,880.00	146,387,322	0.26	0	177,940	18,137,243,890

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	60410.81	3,021	0.05	7,794	3,021	566,739,600
High	273.82	4,655	17.00	12,010	0	873,278,000
Low	10516.42	36,807	3.50	94,962	0	6,904,993,200
Medium	3206.44	20,842	6.50	53,772	0	3,909,959,200
Medium High	1113.16	12,245	11.00	31,592	0	2,297,162,000
Open Space Rural	170958.69	4,274	0.03	11,027	0	801,802,400
Desert	16896.69	845	0.05	2,180	0	158,522,000
Rural Mountainous	862.66	43	0.05	111	0	8,066,800
Rural	22039.74	3,306	0.15	8,529	0	620,205,600
Very Low	4231.98	5,078	1.20	13,101	0	952,632,800
Totals	290,510.41	91,116	0.31	235,078	3,021	17,093,361

Other	Acres	Units	Density	Population	Employment	Value
City	179313.86	0	0.00	0	0	0
Freeway	3243.94	0	0.00	0	0	0
Indian	12998.50	0	0.00	0	0	0
Open Space - C	3145.11	0	0.00	0	0	0
Open Space - CH	314682.61	0	0.00	0	0	0
Open Space Recreation	3089.91	0	0.00	0	463	0
Open Space Water	54493.08	0	0.00	0	0	0
Other - PF / OS	4.08	0	0.00	0	0	0
Public Facility	2523.34	0	0.00	0	85	0
Totals	573,494.43	0	0.00	0	548	0
Totals	876,884.84			235,078	181,509	35,230,605,490

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-7.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
All Parcels

Study Area: FAA07

Scenario : Plan — Build Out

Revenues	
Property Tax	7,263,625
Property Transfer Tax	404,043
Sales Tax	4,831,688
Federal In-Lieu Taxes	32,712
Forfeitures and Penalties	347,837
Franchise Taxes	500,829
Interest on Invested Funds	1,131,582
Miscellaneous Revenue	1,017,477
Motor Vehicle License Fees	2,720,120
Municipal Court Fines	693,307
Other Court Fines	38,370
Property Tax Administration	343,892
Rents and Concessions	18,648
Vehicle Code Fines	332,644
Total Revenues	19,676,774
Expenses	
Administrative & Fiscal	1,283,621
Capital Lease/Const./Contingency	1,496,720
Community and Social Services	652,517
Education, Recreation and Culture	16,855
Environment & Development	13,064
Environment & Development - Unicorp.	698,666
Fire Protection - Unicorp.	1,345,539
General Services	467,943
Health Services	871,465
Justice & Law Enforcement	5,168,253
Justice & Law Enforcement - Unicorp.	5,044,001
Total Expenses	17,058,644
Net Fiscal Impact	2,618,131
Revenue / Expenditure Ratio	1.15

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table D-7.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
__ Sphere
All Parcels

Study Area: FAA07

Scenario : Plan

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	279.77	2,742,038	0.23	0	4,570	382,361,980
Commercial Retail	231.14	1,736,800	0.17	0	3,474	283,048,060
Commercial Tourist	161.04	1,315,276	0.19	0	2,631	208,252,020
Heavy Industrial	57.53	751,816	0.30	0	501	73,928,560
Light Industrial	853.25	11,298,922	0.30	0	10,970	1,275,588,840
Totals	1,582.73	17,844,852	0.26	0	22,146	2,223,179,460

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	113825.80	5,691	0.05	14,683	5,691	1,067,631,600
Low	784.87	2,747	3.50	7,087	0	515,337,200
Medium	134.58	875	6.50	2,258	0	164,150,000
Medium High	28.63	315	11.00	813	0	59,094,000
Open Space Rural	330746.16	8,269	0.03	21,334	0	1,551,264,400
Desert	2347.50	117	0.05	302	0	21,949,200
Rural Mountainous	20.66	1	0.05	3	0	187,600
Rural	1944.59	292	0.15	753	0	54,779,200
Very Low	999.28	1,199	1.20	3,093	0	224,932,400
Totals	450,832.07	19,506	0.04	50,326	5,691	3,659,325,600

Other	Acres	Units	Density	Population	Employment	Value
City	15872.25	0	0.00	0	0	0
Freeway	1361.39	0	0.00	0	0	0
Indian	1058.18	0	0.00	0	0	0
Open Space - C	1179.65	0	0.00	0	0	0
Open Space Mineral	789.25	0	0.00	0	24	0
Open Space Recreation	4486.01	0	0.00	0	673	0
Open Space Water	1080.99	0	0.00	0	0	0
Public Facility	8633.53	0	0.00	0	30	0
Totals	34,461.25	0	0.00	0	727	0
Totals	486,876.05			50,326	28,564	5,882,505,060

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Appendix E

DERIVATION OF NET COUNTY COSTS: FISCAL YEAR 2000-2001

Based on the County of Riverside's budget for Fiscal Year 2000-2001, net county per capita and per employee cost factors are estimated. These factors are then applied against population and employment within the unincorporated areas to estimate General Fund operating and maintenance costs. These costs must be covered by General Fund revenues, net of specifically earmarked program revenues from non-General Fund sources.

E-1 Riverside County General Fund Net Costs: FY 2000-2001 ..... E-1

TABLE E-1 (page 1 of 3)
RIVERSIDE COUNTY GENERAL FUND FISCAL ANALYSIS
RIVERSIDE COUNTY GENERAL FUND NET COSTS: FISCAL YEAR 2000-2001
(In Constant 2001 Dollars)

Organization Code	Organization Name	Expenditures	Revenues	Net Cost	Marginal Factor[1]	Marginal Net Cost	Allocation of Marginal Net Costs[2]			
							Residential		Non-Residential	
							Share	Net Cost	Share	Net Cost
Administrative and Fiscal										
101	Board of Supervisors	$3,552,541	$2,266,739	$1,285,802	0.9	$1,157,222	0.75	$867,916	0.25	$289,305
102	Assessment Appeals Board	370,313	122,554	247,759	0.9	222,983	0.75	167,237	0.25	55,746
103	Executive Office	2,797,413	701,617	2,095,796	0.9	1,886,216	0.75	1,414,662	0.25	471,554
154	Legislative/Admin. Services	1,570,000	41,450	1,528,550	0.9	1,375,695	0.75	1,031,771	0.25	343,924
805	CFD/AD Administration	623,793	623,793	0	0.9	0	0.75	0	0.25	0
200	Assessor	14,302,538	8,458,336	5,844,202	0.9	5,259,782	0.75	3,944,836	0.25	1,314,945
210	Auditor-Controller	7,011,729	2,371,268	4,640,461	0.9	4,176,415	0.75	3,132,311	0.25	1,044,104
212	COW/CAP Reimbursement	-6,970,192	3,542,473	-10,512,665	0.9	-9,461,399	0.75	-7,096,049	0.25	-2,365,350
230	Treasurer-Tax Collector	7,206,602	6,264,491	942,111	0.9	847,900	0.75	635,925	0.25	211,975
250	County Counsel	3,643,538	481,000	3,162,538	0.9	2,846,284	0.75	2,134,713	0.25	711,571
260	HR: Human Resources	3,121,061	3,121,061	0	0.9	0	0.75	0	0.25	0
301	Registrar of Voters	5,791,078	2,059,763	3,731,315	1	3,731,315	0.75	2,798,486	0.25	932,829
278	HR: ADA Compliance	0	0	0	0.9	0	0.75	0	0.25	0
131	Contribution to Other Funds	23,061,150	0	23,061,150	0.9	20,755,035	0.75	15,566,276	0.25	5,188,759
320	Local Agency Formation Commission	346,787	78,000	268,787	0.9	241,908	0.75	181,431	0.25	60,477
310	Clerk-Recorder	9,477,116	9,398,182	78,934	1	78,934	0.75	59,201	0.25	19,734
140	Housing Authority	239,366	239,366	0	1	0	0.75	0	0.25	0
	Total Administrative and Fiscal	$76,144,833	$39,770,093	$36,374,740		$33,118,291		$24,838,718		$8,279,573
General Services										
340	Purchasing	$1,088,129	$178,033	$910,096	0.9	$819,086	0.75	$614,315	0.25	$204,772
341	Central Mail	839,028	460,200	378,828	0.9	340,945	0.75	255,709	0.25	85,236
362	Building Services: County Farm	7,500	7,500	0	0.9	0	0.75	0	0.25	0
363	Building Services	9,068,029	3,396,674	5,671,355	0.9	5,104,220	0.75	3,828,165	0.25	1,276,055
365	Real Property Lease/Utility	9,603,860	3,149,386	6,454,474	0.9	5,809,027	0.75	4,356,770	0.25	1,452,257
367	Property Management - Library	210,000	210,000	0	0.9	0	0.75	0	0.25	0
368	Property Management - Courts	488,507	488,507	0	0.9	0	0.75	0	0.25	0
369	Parking Structure	216,000	216,000	0	0.9	0	0.75	0	0.25	0
	Total General Services	$21,521,053	$8,106,300	$13,414,753		$12,073,278		$9,054,958		$3,018,319
Environment and Development: Countywide										
150	Habitat Conservation Agency	$0	$0	$0	0.9	$0	0.75	$0	0.25	$0
430	Agricultural Commissioner	3,391,037	3,016,567	374,470	0.9	337,023	0.75	252,767	0.25	84,256
	Total Environment and Development: Countywide	$3,391,037	$3,016,567	$374,470		$337,023		$252,767		$84,256
Environment and Development: Unincorporated										
480	TLMA: Building & Safety	$11,189,028	$11,157,006	$32,022	1	$32,022	0.84	$26,898	0.16	$5,124
481	TLMA: Code Enforcement	4,606,008	1,966,584	2,639,424	1	2,639,424	0.84	2,217,116	0.16	422,308
490	TLMA: Planning	4,898,835	3,375,414	1,523,421	1	1,523,421	0.84	1,279,674	0.16	243,747
502	TLMA: Surveyor	2,837,716	2,759,293	78,423	1	78,423	0.84	65,875	0.16	12,548
	Total Environment and Development: Unincorporated	$23,531,587	$19,258,297	$4,273,290		$4,273,290		$3,589,564		$683,726
Justice and Law Enforcement: Countywide										
130	Contribution to Trial Court	$27,574,976	$0	$27,574,976	0.9	$24,817,478	0.75	$18,613,109	0.25	$6,204,370
161	Confidential Court Orders	600,000	0	600,000	0.9	540,000	0.75	405,000	0.25	135,000
551	Courts: Superior Courts - Co	3,165,319	259,647	2,905,672	0.9	2,615,105	0.75	1,961,329	0.25	653,776

TABLE E-1 (page 2 of 3)
RIVERSIDE COUNTY GENERAL FUND FISCAL ANALYSIS
RIVERSIDE COUNTY GENERAL FUND NET COSTS: FISCAL YEAR 2000-2001
(In Constant 2001 Dollars)

Organization Code	Organization Name	Expenditures	Revenues	Net Cost	Marginal Factor[1]	Marginal Net Cost	Allocation of Marginal Net Costs[2]			
							Residential		Non-Residential	
							Share	Net Cost	Share	Net Cost
552	Courts: Revenue Recovery	2,976,240	2,976,240	0	0.9	0	0.75	0	0.25	0
555	Courts: IV-D Child Support	1,693,223	1,693,223	0	0.9	0	0.75	0	0.25	0
556	Courts: Grand Jury	385,658	0	385,658	0.9	347,092	0.75	260,319	0.25	86,773
557	Courts: Indigent Defense	9,636,322	1,791,000	7,845,322	0.9	7,060,790	0.75	5,295,592	0.25	1,765,197
560	District Attorney - Criminal	36,159,939	18,775,194	17,384,745	0.9	15,646,271	0.75	11,734,703	0.25	3,911,568
561	District Attorney - Family Support	40,833,977	40,833,977	0	0.9	0	0.75	0	0.25	0
562	District Attorney - Forensics	300,000	300,000	0	0.9	0	0.75	0	0.25	0
570	Public Defender	16,051,065	1,330,262	14,720,803	0.9	13,248,723	0.75	9,936,542	0.25	3,312,181
585	Sheriff: Support	23,637,780	14,513,825	9,123,955	0.9	8,211,560	0.75	6,158,670	0.25	2,052,890
591	Sheriff: Court Services	12,487,877	9,000,915	3,486,962	0.9	3,138,266	0.75	2,353,699	0.25	784,566
595	Sheriff: Administration	2,798,859	561,010	2,237,849	0.9	2,014,064	0.75	1,510,548	0.25	503,516
597	Sheriff: CAC Security	369,666	1,000	368,666	0.9	331,799	0.75	248,850	0.25	82,950
598	Sheriff: Training Center	4,306,285	2,250,328	2,055,957	0.9	1,850,361	0.75	1,387,771	0.25	462,590
600	Sheriff: Auto Theft	570,000	570,000	0	0.9	0	0.75	0	0.25	0
605	Sheriff: ADA Grant	1,204,841	1,204,841	0	0.9	0	0.75	0	0.25	0
587	Sheriff: Corrections	69,063,576	28,594,004	40,469,572	0.9	36,422,615	0.75	27,316,961	0.25	9,105,654
621	Probation: Juvenile Hall	21,526,831	13,605,099	7,921,732	0.9	7,129,559	0.75	5,347,169	0.25	1,782,390
622	Probation	17,790,752	14,810,653	2,980,099	0.9	2,682,089	0.75	2,011,567	0.25	670,522
623	Probation: Special Court Services	1,686,901	0	1,686,901	0.9	1,518,211	0.75	1,138,658	0.25	379,553
624	Probation: Court Placement	2,707,979	0	2,707,979	0.9	2,437,181	0.75	1,827,886	0.25	609,295
625	Probation: Youth Intervention	547,340	0	547,340	0.9	492,606	0.75	369,455	0.25	123,152
583	Sheriff: Coroner	4,670,842	2,024,548	2,646,294	0.9	2,381,665	0.75	1,786,248	0.25	595,416
593	Sheriff: Public Administrator	849,271	339,357	509,914	0.9	458,923	0.75	344,192	0.25	114,731
	Total Justice and Law Enforcement: Countywide	$303,595,519	$155,435,123	$148,160,396		$133,344,356		$100,008,267		$33,336,089
Justice and Law Enforcement: Unincorporated										
581	Sheriff, Patrol (less contract cities)	$104,911,194	$74,060,141	$30,851,053	1	$30,851,053	0.84	$25,914,885	0.16	$4,936,168
Fire Protection: Unincorporated										
421	Fire Protection: Forest[3]	$40,572,591	$31,342,747	$9,229,844	1	$9,229,844	0.84	$7,753,069	0.16	$1,476,775
Fire Protection: Countywide										
423	Fire Protection: Contracts	$20,246,244	$20,246,244	$0	1	$0	0.84	$0	0.16	$0
Health Services										
641	Mental Health: Public Guardian	$3,547,023	$2,954,698	$592,325	0.9	$533,093	1	$533,093	0	$0
668	HSA: Animal Control	4,552,996	2,825,125	1,727,871	0.9	1,555,084	1	1,555,084	0	0
135	Contribution to Health/Mental Health	106,633,651	97,754,857	8,878,794	0.9	7,990,915	1	7,990,915	0	0
642	Mental Health: Alcohol Abuse	0	0	0	0.9	0	1	0	0	0
643	Mental Health: Drug Abuse	0	0	0	0.9	0	1	0	0	0
644	Mental Health: Treatment Programs	68,188,861	67,911,221	277,640	0.9	249,876	1	249,876	0	0
645	Mental Health: Detention Programs	4,167,013	3,828,648	338,365	0.9	304,529	1	304,529	0	0
646	Mental Health: Administration	3,653,763	3,653,763	0	0.9	0	1	0	0	0
647	Mental Health: Substance Abuse	17,471,728	17,183,175	288,553	0.9	259,698	1	259,698	0	0
661	HSA: Public Health	30,894,758	26,088,812	4,805,946	0.9	4,325,351	1	4,325,351	0	0
663	HSA: Environmental Health	13,465,301	13,231,455	233,846	0.9	210,461	1	210,461	0	0
662	HSA: California Childrens' Services	7,092,186	5,237,059	1,855,127	0.9	1,669,614	1	1,669,614	0	0
681	HSA: Detention Health Services	9,694,602	1,191,364	8,503,238	0.9	7,652,914	1	7,652,914	0	0

TABLE E-1 (page 3 of 3)
RIVERSIDE COUNTY GENERAL FUND FISCAL ANALYSIS
RIVERSIDE COUNTY GENERAL FUND NET COSTS: FISCAL YEAR 2000-2001
(In Constant 2001 Dollars)

Organization Code	Organization Name	Expenditures	Revenues	Net Cost	Marginal Factor[1]	Marginal Net Cost	Allocation of Marginal Net Costs[2]			
							Residential		Non-Residential	
							Share	Net Cost	Share	Net Cost
683	HSA: Medically Indigent Services	11,219,726	9,421,000	1,798,726	0.9	1,618,853	1	1,618,853	0	0
682	HSA: Pediatrics/Child Abuse	0	0	0	0.9	0	1	0	0	0
	Total Health Services	$280,581,608	$251,281,177	$29,300,431		$26,370,388		$26,370,388		$0
Community and Social Services										
700	DPSS: Administration	$284,123,447	$277,904,929	$6,218,518	0.9	$5,596,666	1	$5,596,666	0	$0
701	DPSS: Mandated Client Services	23,530,572	20,174,284	3,356,288	0.9	3,020,659	1	3,020,659	0	0
702	DPSS: Categorical Aid	179,593,239	169,503,721	10,089,518	0.9	9,080,566	1	9,080,566	0	0
703	DPSS: Other Aid	1,887,820	200,000	1,687,820	0.9	1,519,038	1	1,519,038	0	0
710	Veterans Services	742,083	226,800	515,283	0.9	463,755	1	463,755	0	0
132	Contribution to Community	71,482	0	71,482	0.9	64,334	1	64,334	0	0
138	Domestic Violence Program	180,000	180,000	0	0.9	0	1	0	0	0
	Total Community and Social Services	$490,128,643	$468,189,734	$21,938,909		$19,745,018		$19,745,018		$0
Education, Recreation and Culture										
460	Cooperative Extension	$316,479	$0	$316,479	0.9	$284,831	0.75	$213,623	0.25	$71,208
750	Edward Dean Museum	262,500	112,500	150,000	1	150,000	0.75	112,500	0.25	37,500
	Total Education, Recreation and Culture	$578,979	$112,500	$466,479		$434,831		$326,123		$108,708
Capital Lease/Construction/Contingency										
364	Construction and Land Acquisition	$29,450,342	$26,450,342	$3,000,000	1	$3,000,000	0.75	$2,250,000	0.25	$750,000
121	Appropriation for Contingency	13,200,954	0	13,200,954	1	13,200,954	0.75	9,900,716	0.25	3,300,239
133	CORAL - Public Facility	15,342,014	9,581,454	5,760,560	1	5,760,560	0.75	4,320,420	0.25	1,440,140
134	CORAL - Equipment	2,695,554	1,968,325	727,229	1	727,229	0.75	545,422	0.25	181,807
144	Lease-Purchase - Long Term	3,357,765	1,251,904	2,105,861	1	2,105,861	0.75	1,579,396	0.25	526,465
155	Leased Court Facilities	2,523,854	2,523,854	0	1	0	0.75	0	0.25	0
142	Interest on Transactions	20,184,898	6,363,084	13,821,814	1	13,821,814	0.75	10,366,361	0.25	3,455,454
	Total Capital Lease/Construction/Contingency	$86,755,381	$48,138,963	$38,616,418		$38,616,418		$28,962,314		$9,654,105
	Total	$1,451,958,669	$1,118,957,886	$333,000,783		$308,393,790		$246,816,071		$61,577,719

Note: 1. The marginal factor of 0.9 indicates costs are projected to increase at a marginal rate of 90 percent of new growth. A marginal factor of 1 indicates costs are projected to increase in direct proportion to new growth.

2. Net countywide costs are allocated 75 percent to residential development and 25 percent to non-residential development, based on the shares of population and employment to the combined total County population and employment.
Net costs for unincorporated services are allocated 84 percent to residential development and 16 percent to non-residential development, based on the shares of population and employment to the combined unincorporated County population and employment.

3. Based on discussion with County Fire Department staff, fire protection costs for the unincorporated areas are increased by $1,000,000 to $40,572,591 from the County Budget amount of $39,572,591.

Source: Stanley R. Hoffman Associates, Inc.
County of Riverside, *FY 2000-01 Final Budget*
State of California, Department of Finance, *E-5 County/City Population and Housing Estimates, January 1,2000*
Southern California Association of Governments, *Projections 2000*, Riverside County Employment Estimates

Appendix F

EXISTING DEVELOPMENT: GENERAL FUND AND DEVELOPMENT SUMMARY

The General Fund fiscal summary for unincorporated Riverside County for existing development is presented in Table F-1.1. The fiscal model was calibrated using the County's Fiscal Year 2001-2001 budget and the estimated existing development for unincorporated Riverside County as presented in Table F-1.2.

F-1.1 General Fund Summary, Riverside County F-1
F-1.2 Development Summary, Riverside County F-2

Table F-1.1
Riverside County Fiscal Model
General Fund Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
Non-Vacant Parcels

Study Area: Riverside County
Scenario : Existing

	Build Out
Revenues	
Property Tax	38,204,689
Property Transfer Tax	2,123,012
Sales Tax	19,439,475
Federal In-Lieu Taxes	260,390
Forfeitures and Penalties	2,115,557
Franchise Taxes	3,058,098
Interest on Invested Funds	6,882,550
Miscellaneous Revenue	6,188,545
Motor Vehicle License Fees	21,652,430
Municipal Court Fines	4,216,739
Other Court Fines	234,006
Property Tax Administration	2,091,598
Rents and Concessions	114,214
Vehicle Code Fines	2,031,819
Total Revenues	108,613,122
Expenses	
Administrative & Fiscal	7,806,898
Capital Lease/Const./Contingency	9,102,953
Community and Social Services	5,194,099
Education, Recreation and Culture	102,520
Environment & Development	79,455
Environment & Development - Unicorp.	4,266,479
Fire Protection - Unicorp.	8,216,677
General Services	2,845,994
Health Services	6,936,950
Justice & Law Enforcement	31,432,997
Justice & Law Enforcement - Unicorp.	30,801,743
Total Expenses	106,786,765
Net Fiscal Impact	1,826,357
Revenue / Expenditure Ratio	1.01

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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Table F-1.2
Riverside County Fiscal Model
Development Summary

(in constant 2001 dollars)

X CCO Overlay
X RV Overlay
_ Sphere
Non-Vacant Parcels

Study Area: Riverside County

Scenario : Existing

Non-Residential	Acres	Sq. Ft.	FAR	Population	Employment	Value
Business Park	618.76	6,064,445	0.23	0	10,107	845,653,173
Commercial Office	71.43	1,638,648	0.53	0	5,462	219,558,316
Commercial Retail	1244.26	10,320,675	0.19	0	20,641	1,625,671,652
Commercial Tourist	450.43	3,710,732	0.19	0	7,421	585,832,895
Heavy Industrial	265.65	3,471,469	0.30	0	2,314	341,361,120
Light Industrial	2122.31	28,104,115	0.30	0	27,286	3,172,806,659
Totals	4,772.84	53,310,084	0.26	0	73,231	6,790,883,815

Residential	Acres	Units	Density	Population	Employment	Value
Agriculture	85084.06	4,254	0.05	10,975	4,254	622,487,820
High	463.55	7,880	17.00	20,330	0	1,153,080,400
Low	17757.83	62,152	3.50	160,352	0	9,094,702,160
Medium	3935.24	25,579	6.50	65,994	0	3,742,975,070
Medium High	679.99	7,480	11.00	19,298	0	1,094,548,400
Open Space Rural	12894.65	322	0.03	831	0	47,118,260
Desert	1277.59	64	0.05	165	0	9,365,120
Rural Mountainous	31183.57	1,559	0.05	4,022	0	228,128,470
Rural	46148.34	6,922	0.15	17,859	0	1,012,896,260
Very High	36.62	1,099	30.00	2,835	0	160,816,670
Very Low	31634.22	37,961	1.20	97,939	0	5,554,833,130
Totals	231,095.66	155,272	0.67	400,600	4,254	22,720,951,760

Other	Acres	Units	Density	Population	Employment	Value
City	109217.04	0	0.00	0	0	0
Freeway	5.85	0	0.00	0	0	0
Indian	4250.28	0	0.00	0	0	0
Open Space - C	4192.28	0	0.00	0	0	0
Open Space - CH	6530.64	0	0.00	0	0	0
Open Space Mineral	733.17	0	0.00	0	22	0
Open Space Recreation	5905.37	0	0.00	0	886	0
Open Space Water	2917.52	0	0.00	0	0	0
Other - PF / OS	113.22	0	0.00	0	0	0
Public Facility	497.67	0	0.00	0	173	0
Totals	134,363.04	0	0.00	0	1,081	0
Totals	370,231.54			400,600	78,566	29,511,835,575

Note: Totals may not add exactly due to rounding
Source: Riverside County Planning Department

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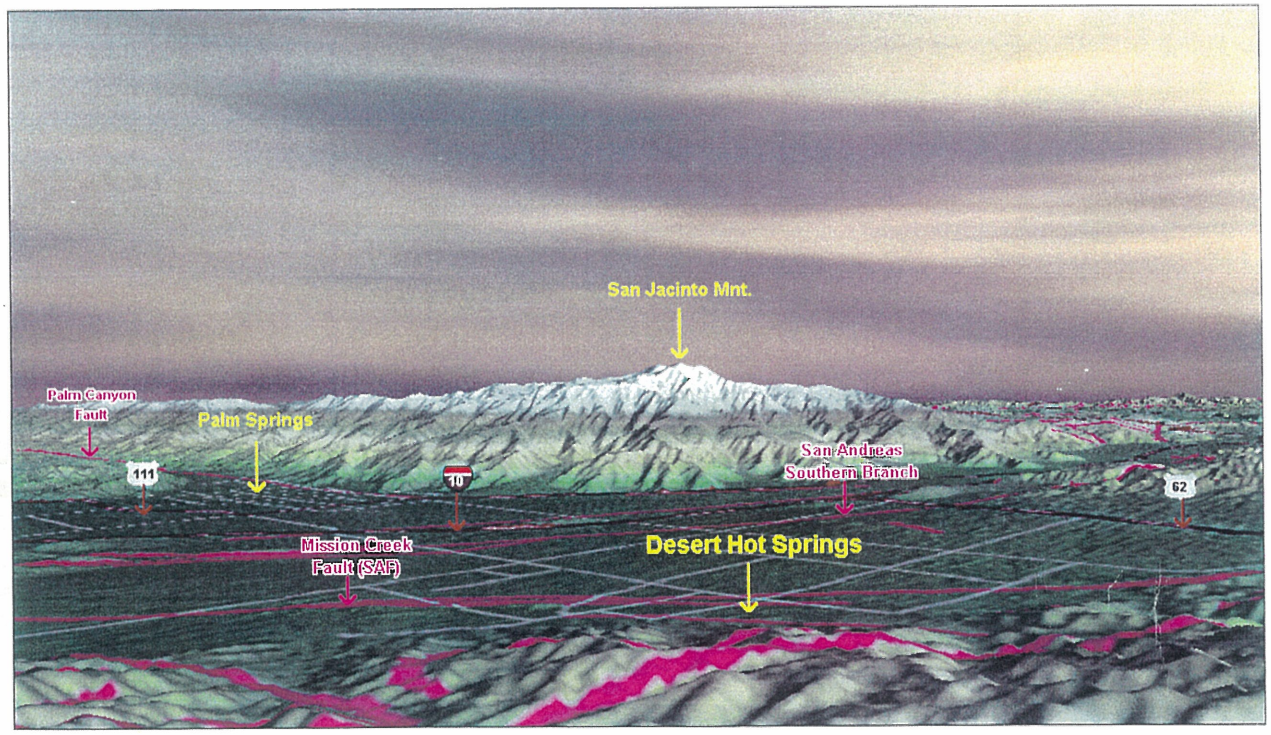
Appendix H:
Safety Element Technical Background Report

Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan



Prepared for the Department of Regional Planning, County of Riverside

August, 2000

Prepared by: ***Earth Consultants International***

Earth Consultants International

BOARD of SUPERVISORS

RIVERSIDE COUNTY PLAN

Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

August 1, 2000

Prepared for:

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Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

CHAPTER 1: SEISMIC HAZARDS

1.1 Introduction

While the County of Riverside is at risk from many natural and man-made hazards, the event with the greatest potential for loss of life or property and economic damage is an earthquake. This is true for most of southern California, since damaging earthquakes are frequent, affect widespread areas, trigger many secondary effects, and can overwhelm the ability of local jurisdictions to respond. In Riverside County, earthquake-triggered geologic effects include ground shaking, fault rupture, landslides, liquefaction, subsidence, and seiches, all of which are discussed below. Earthquakes can also cause human-made hazards such as urban fires, dam failures, and toxic chemical releases.

Earthquakes are caused by movement of rock along a break called a fault. The movement releases pent-up strain energy in the form of waves, which travel outward in all directions. These seismic waves cause the Earth to vibrate, and this shaking is what we feel in an earthquake.

Most earthquakes occur along plate boundaries. The outer portion of the Earth consists of enormous chunks of rock called plates, which slowly collide, separate, and grind past each other. Frictional forces resist plate movements and the plate edges lock together. Much strain energy builds up as plates keep trying to move. Eventually, frictional forces are exceeded, the locked edges move, and all the stored strain energy is released in seismic waves.

Earthquake risk is very high in the heavily populated, western portion of Riverside County, due to the presence of three of California's most active faults, the San Andreas, the San Jacinto and the Elsinore. Risk is moderate in the eastern portion of the County that includes Blythe.

In California, recent earthquakes in or near urban environments have caused relatively few casualties. This is due more to luck than design. For example, when a portion of the Nimitz Freeway in Oakland collapsed at rush hour during the 1989, M_w 7.1 Loma Prieta earthquake, it was unusually empty because so many were watching the World Series. Nonetheless, California's urban earthquakes have resulted in significant economic losses. Riverside County is at risk from larger, more damaging earthquakes than the moderate-sized, M_w 6.7 Northridge earthquake, which in 1994 caused 54 deaths and $20-$30 billion in damage.

Earthquakes are a fact of life in southern California. Although it is not possible to prevent them, their destructive effects can be minimized. Comprehensive hazard mitigation programs that include the identification and mapping of hazards, prudent planning, public education, emergency exercises, enforcement of building codes, and expedient retrofitting and rehabilitation of weak structures can significantly reduce the scope of an earthquake disaster. Local governments, emergency relief organizations, and residents must take action, to develop and implement policies and programs that can reduce the effects of earthquakes.

1.1.1 Faults

What is a fault?

Geologists visualize a fault as a plane of breakage between rocks, like a page between thick book covers, which meets the surface at some angle. Most of the major faults in southern California are ***strike-slip***. When a strike-slip fault ruptures in an earthquake, the rocks on either side of the fault move horizontally, in opposite directions. In a ***right lateral strike-slip*** fault movement, rock on the opposite side of the fault moves to the right. Principal faults of the San Andreas system are right lateral strike-slip. There are also ***dip-slip*** faults. With dip-slip earthquakes, the two sides of the fault move up or down relative to each other. When the overhanging side of the fault moves down, by convention it is called a ***normal dip-slip*** fault. When the overhanging side moves up, it is a ***reverse dip-slip*** fault. As always, nature is more subtle than our definitions, and in reality, many faults combine vertical and horizontal motion. These are called ***oblique-slip*** faults.

On average, strike-slip faults are nearly vertical. That is, they meet the horizontal surface of the earth at a 90 degree angle. In contrast, dip-slip faults typically meet the surface at a non-vertical angle, and usually dip from the horizontal in the range of 45 to 60 degrees. ***Thrust*** faults are a particular type of low-angle, reverse fault, which dip 25 to 35 degrees from the horizontal. The San Fernando, Northridge, Whittier Narrows and Sierra Madre earthquakes all occurred on thrust faults. Some faults do not extend all the way to the surface of the earth, and are referred to as "blind". These faults are difficult to detect before they cause an earthquake, although some do bend the surface into characteristic, small hills.

Why do we have faults in southern California?

In southern California, most of the faults have developed to allow for the motion between the North American and Pacific tectonic plates (Atwater, 1970). Most of the major fault zones in southern California are roughly parallel with the plate

boundary, and accommodate horizontal motion across right-lateral strike-slip faults. Reverse/thrust faults occur where regions of the crust are pushed together and are thus experiencing compression. In the Transverse Ranges north of Riverside County, there are reverse faults undergoing compression. Normal faults occur in areas where the Earth's crust is being pulled apart and extending. Some regions in Riverside County that are extending are Lake Elsinore, Temecula Valley, Beaumont Plain, and the Imperial Valley.

Current faulting in southern California, associated with the boundary of tectonic plates, has been ongoing for the past few hundred million years. The San Andreas fault system has been active during about the past 20 million years (late Tertiary Period) and is obviously still active today. Some faults associated with earlier portions of the San Andreas Fault System have subsequently been abandoned and are no longer active (see Powell, 1993). There are yet older fault systems associated with tectonic plate interactions during the Paleozoic Era (570 to 245 million years ago), the Mesozoic Era (245 to 66 million years ago), and the early to mid Tertiary Period prior to the development of the San Andreas Fault System (66 to ~20 million years ago).

Faults are evaluated in terms of their location and lateral extent (zones), age (activity), total displacement, slip rate, and type (style of deformation, i.e., reverse, normal or strike-slip).

What is a fault zone?

A ***fault zone*** represents a collection of relatively smaller scale fault ***segments*** and fault ***strands*** which typically have a similar strike, dip, and sense of movement. However, faults can exist within a particular fault zone which display motion contrary to the overall motion. Sometimes a number of strands are collectively referred to as a fault segment, if the faults are closely associated and are believed capable of all rupturing (moving) during a single earthquake. Individual fault strands and fault segments within a major fault zone are often designated with separate names. The individual strand refers to a single, fairly continuous mappable fault at a map scale of approximately 1:24,000. For example, the Wildomar fault strand is part of the Temecula segment, which is part of the Elsinore fault zone.

How do we determine the age of a fault?

The estimated age ("activity") indicated for each fault in this Background Report is subdivided into categories based on the best estimate from the available data for the date of the last rupture on each fault. We adopted the age designations utilized

in the California fault map prepared by Jennings (1994). The categories include:

- **Historical** (ruptured in past 200 years)
- **Active** (ruptured during past 11,000 years; Holocene)
- **Potentially Active** (rupture age < ~700,000 years ago; late Pleistocene)
- **Inactive**:
  - **Quaternary** (last ruptured < 1.6 million yeas ago)
  - **Pre-Quaternary** (age unknown but available evidence suggests that it has not ruptured during the past 1.6 million years).
  - **Late Cenozoic** (ruptures between 1.6 and 11.2 million years ago)

How Do We Measure Fault Movement?

Motion on faults is described by their ***total displacement*** (kilometers) and ***slip rate*** (provided in terms of millimeters per year-mm/yr). The total displacement is usually determined by evaluating geologic features that were around before the fault formed, and which have subsequently been split apart (offset) by the cumulative movement of many earthquakes on the fault over hundreds of thousands to millions of years. The slip rate is determined by a number of methods, all of which measure an amount of offset accrued during an estimated amount of time. The slip rate is then determined by dividing measured offset by the period of time required for the fault to accrue that much displacement. Slip rate data are utilized to estimate how fast a fault is storing up "energy" between earthquakes, and to estimate the recurrence time for large events.

The ***recurrence time***, sometimes referred to as "repeat time" or "return time", represents the average amount of time that elapses between major earthquakes on that fault. Repeat times for fault zones are estimated in a number of ways. The most specific involve fault trenching studies that investigate earthquakes that have occurred during the past thousands of years. Trenching studies have shown that faults with larger slip rates often have shorter recurrence times between major earthquakes. This makes sense. A large slip rate indicates rocks that are moving (due to current plate motions) at a relatively fast pace. But most of the time, the rocks are locked together by frictional forces at the fault. The more the rocks are trying to move, the faster strain energy will build up, and the more often will the forces of friction be exceeded. The fault will rupture and the rocks will move more often, releasing the strain energy in more frequent, large earthquakes.

1.1.2 Causes of Earthquake Damage

The ***three primary agents of earthquake damage***, ordered by their likelihood to occur extensively, are:

1) Strong Ground Shaking: This causes the vast majority of earthquake damage. There are many ways that seismic waves can cause damaging ground shaking, but few of them will affect any particular location in a single earthquake. Characterization of shaking potential can require analyses of maximum ground movement (displacement), velocity and acceleration, the duration of potential strong shaking, and the lengths (periods) of waves that control each of these factors during a given earthquake. Horizontal ground acceleration is frequently responsible for widespread damage to structures. It is commonly measured as a percentage of g, the acceleration of gravity. In general, the degree of shaking can depend upon:

Source effects - These include earthquake size, location, distance. The bigger and closer the earthquake is, the more likely damage will be. The exact way that rocks move along the fault can also influence shaking, as can the orientation of the fault in the ground. The 1995 Kobe, Japan earthquake was about the same size as the 1994 Northridge, CA, earthquake, but caused much worse damage, because in Kobe, the fault directed seismic waves into the city. During the Northridge earthquake, the fault directed waves away from populated areas.

Path effects - Seismic waves change direction as they travel through the Earth's contrasting layers, just as light bounces (reflects) and bends (refracts) as it moves from air to water. Sometimes this can focus seismic energy at one location, and cause damage in unexpected areas.

Site effects - Seismic waves slow down in the loose sediments and weathered rock at the earth's surface. As they slow, their energy converts from speed to amplitude, which increases shaking. This is identical to the behavior of ocean waves. As the waves slow down near shore, their crests grow higher. Sometimes, too, seismic waves get trapped at the surface and resonate. Whether resonance will occur depends on the period (the length) of the incoming waves. Waves, soils and buildings all have resonant periods. When these match, tremendous damage can occur.

2) Liquefaction/Ground Failure: Portions of the County of Riverside are susceptible to liquefaction and landslides or rockfall, very destructive secondary effects of strong seismic shaking.

Liquefaction occurs primarily in saturated, loose, fine to medium-grained soils in areas where the groundwater table is within 50 feet of the surface. Shaking suddenly increases pore water pressure, causing the soils to lose strength and behave as liquid. Excess water pressure is vented upward through fissures and soil cracks and a water-soil slurry bubbles onto the ground surface. The resulting features are called "sand boils, sand blows" or "sand volcanoes." Liquefaction-related effects include loss of bearing strength, ground oscillations, lateral spreading, and flow failures or slumping. Site-specific geotechnical studies are the only practical and reliable way of determining the liquefaction potential of a site.

Landslides and Rockfall There are predictable relationships between local geology and mass wasting processes like landslides and rockfall. Slope stability is dependent on many factors and their interrelationships. Rock type and pore water pressure are possibly the most important factors, followed by slope steepness due to natural or man-made undercutting. In addition, many existing landslides and soil slumps have been mapped within the County, and where slopes have failed before, they will fail again. Field investigation enables identification of failure-prone slopes before an earthquake occurs.

3) Primary Ground Rupture/Faulting: Primary ground damage due to earthquake fault rupture typically results in a relatively small percentage of the total damage in an earthquake, but being too close to a rupturing fault can cause profound damage. It is difficult to reduce this hazard through structural design. The primary mitigative technique is to set back from, and avoid, active faults. The challenge comes in identifying all active faults. Faults throughout southern California have formed over millions of years. Some of these faults are generally considered inactive under the present geologic conditions. Other faults are known to be active. Such faults have either generated earthquakes in historical times (a scant 200 years), or show geologic and geomorphic indications of relatively recent movement. Faults that have moved in the relatively recent geological past are generally presumed to be the most likely candidates to generate damaging earthquakes in the lifetimes of residents, buildings or communities.

1.1.3 General Tectonic Setting

Earthquakes in Southern California occur as a result of movement between the Pacific and North American plates. Faults of the San Andreas system are used to mark the boundary between the plates, but the deformation, faulting and associated earthquakes occur in a broadly distributed zone that stretches from offshore to Nevada. Thus, the San Andreas is one of a system of plate-bounding faults. Most of the movement between the plates occurs along the San Andreas fault, which bisects Riverside County. The rest of the motion is distributed among northwest-trending, strike-slip faults of the San Andreas system (principally the San Jacinto, Elsinore, Newport-Inglewood and Palos Verdes faults); several east-trending thrust faults which bound the Transverse Ranges; and the Eastern Mojave Shear Zone (a series of faults east of the San Andreas, responsible for the 1992 Landers and the 1999 Hector Mine earthquakes).

Given the 1986 Palm Springs, 1987 Whittier Narrows, 1987 Imperial Valley, 1991 Sierra Madre, 1992 Landers, 1994 Northridge, and 1999 Hector Mine earthquakes, southern Californians may feel that we have had our share of earthquakes in the last few years. However, some researchers suggest that far too few earthquakes have occurred in Southern California in the last 200 years to account for the rate of movement between the Pacific and North American plates. The data suggest that Southern California is due for either numerous, moderate (M_w 6 - 7), Northridge-like earthquakes, or a few, larger (M_w 7.2 or greater) earthquakes.

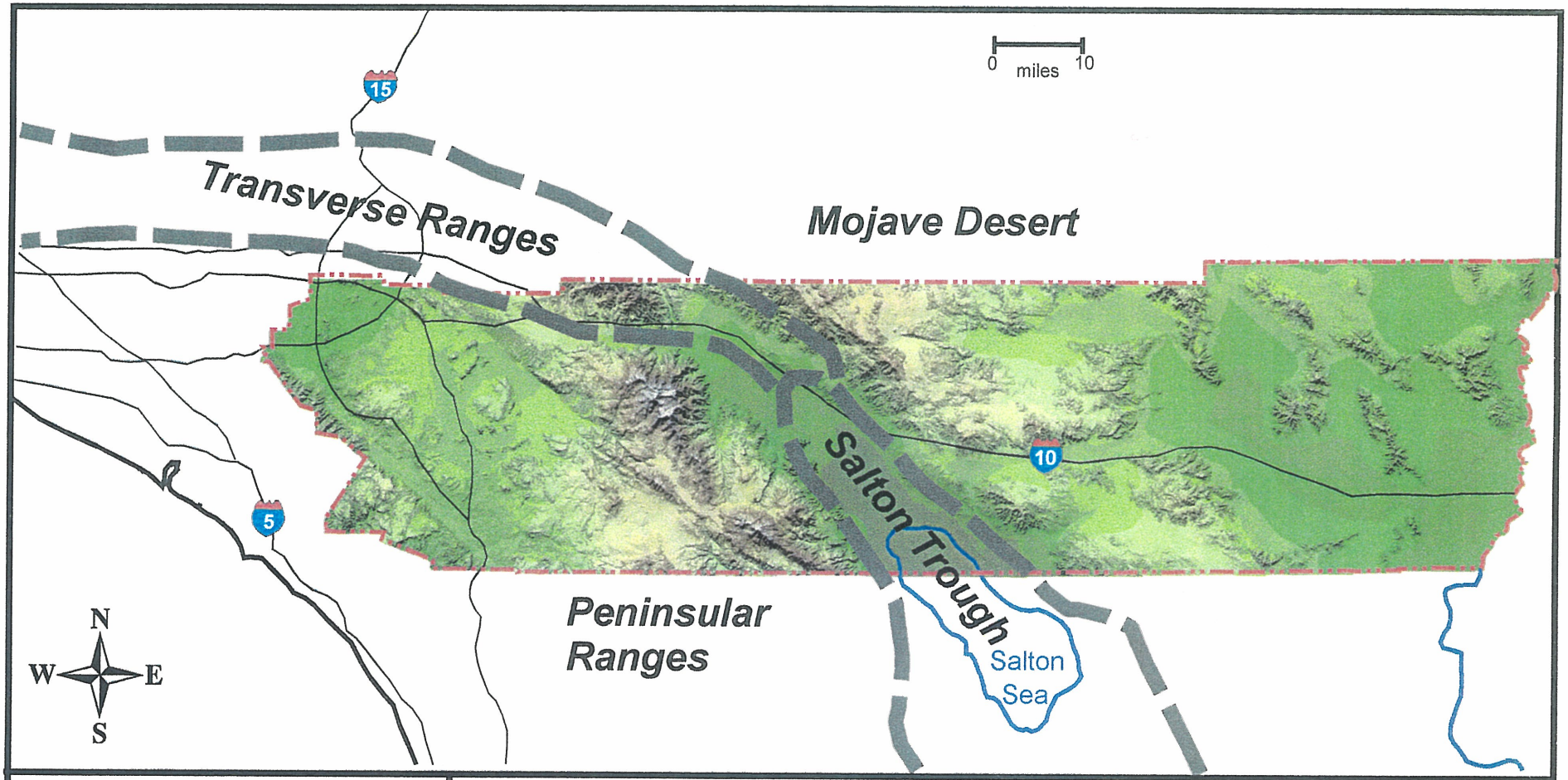
Earthquakes could occur in any of the four major geologic provinces in the County of Riverside. These provinces are characterized by different active tectonic stress regimes and geomorphology (Figure 1-1). In each province, the stresses of plate motion create different styles of faults and surficial features.

Peninsular Ranges: The western portion of Riverside County and most of its population are in the Peninsular Range province. The Santa Ana and San Jacinto Mountains are part of the Peninsular Ranges, and were built by movement along earthquake faults. This province is dominated by right-lateral strike-slip faulting associated with the San Jacinto and Elsinore faults. However, all types of faulting may be found in this block, such as in the Elsinore Trough. The communities of Temecula and Murrieta and many agricultural areas of southwestern Riverside County lie in this broad structural depression, formed by active faulting along faults of the Elsinore fault system.

Salton Trough: The desert communities and farmland of the Coachella Valley in central Riverside County are located within the Salton Trough province. Here, the

plates are separating and spreading centers exist. The spreading centers continue to the south, into the Gulf of California. At present, the Salton Trough is cut off from the Gulf of California by an accumulation of sediment at the mouth of the Colorado River. The Trough is filled with sediment three miles thick, derived primarily from the Colorado River. Periodically during the last 10,000 years, the Trough has been inundated with water. The most recent inundation formed the Salton Sea in 1905.

Transverse Ranges: Throughout most of the western U. S. are northwest-trending geologic features, a consequence of current plate motions. The trend of the Transverse Range province is a startling exception. These mountains run west to east from west of Santa Barbara to east of San Bernardino. The easternmost San Bernardino Mountains lie in north-central Riverside County. Many of southern California's recent damaging earthquakes occurred on faults that have built the Transverse Ranges, including: the 1971 Sylmar M_w 6.7, the 1991 Sierra Madre M_w 5.8, and the 1994 Northridge M_w 5 6.7. Although most of this province is located north and west of Riverside County, populated areas such as Riverside, Norco and Corona are at risk from Transverse Range earthquakes occurring on the nearby Cucamonga or Sierra Madre fault systems, about 20 to 25 miles to the north.



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Map of Geologic Provinces of the Riverside County Area

Figure 1 - 1

Mojave Desert: The Mojave Desert province consists of the eastern half of the County, and includes the Blythe area. Compared to the rest of Riverside County, this province has a moderate to low rate of seismicity and very few mapped faults. However, just north of the County, there are numerous active right-lateral strike-slip faults in the Mojave Desert province. These have recently produced the 1992 Landers M_w 7.3 and the 1999 Hector Mine M_w 7.1 earthquakes.

More detailed information about the sediments and bedrock types in Riverside County can be found in Chapter 2 - Slope and Soil Instability Hazards.

1.1.4 Common Designations of Earthquake Hazard Potential

Earthquake Size and Impact: Earthquakes are classified according to their ***moment*** (a measure of the energy released when a fault ruptures), their ***magnitude*** (a measure of maximum ground motion) or their ***intensity*** (a qualitative assessment of an earthquake's effects at a given location). A given earthquake will have one moment, and in principle, one magnitude (although there are several methods of calculating magnitude, which give slightly different results). However, earthquakes can produce several intensities, because effects generally decrease with distance from the earthquake. The most commonly used seismic intensity scale, called the Modified Mercalli Intensity (MMI) scale, has 12 levels of damage. The higher the number, the greater the damage (Table 1-1).

The strength of seismic ground shaking at any given site is a function of many factors. Of primary importance are the size of the earthquake, its distance, the paths the waves take as they travel through the Earth, the rock or soils underlying the site, and topography (particularly whether a site sits in a valley, or atop a hill). The amount of damage also depends on the size, shape, age, and engineering characteristics of the affected structures.

The interaction of ground motion and human-made structures is complex. Governing factors include a structure's height, construction, and stiffness, a soil's strength and resonant period, and the period of high-amplitude seismic waves. Waves come in different lengths and thus repeat their motions with varying frequency. Long waves are called long period or low frequency. Short waves are called short period or high frequency. In general, long period seismic waves, which are characteristic of large earthquakes, are most likely to damage long period structures such as high-rise buildings and bridges. Shorter period seismic waves, which tend to die out quickly, will most often cause damage in nearby earthquakes, and they will damage shorter period structures such as one- and two-story buildings. Very short period waves are most likely to cause non-structural damage,

such as to equipment. In different situations, ground displacement, velocity and acceleration can cause damage.

Planning and Design Earthquakes: The largest earthquake expected in an area under the current tectonic environment is termed the ***maximum credible*** (MCE) or characteristic earthquake. A ***maximum probable*** earthquake (MPE) is the earthquake most likely to occur in a specified period of time, (such as 30 to 500 years). Generally, the longer the time period (recurrence interval) between earthquakes, the larger the earthquake will be, because there has been time to store more strain energy. The recurrence interval of concern will depend on the planned use, lifetime, or importance of a facility, The more critical the structure, the longer the recurrence interval chosen and the larger the ***design earthquake,*** that is, the earthquake that a community is designed to withstand.

Geologists, seismologists, engineers and urban planners typically use maximum credible and maximum probable earthquakes to evaluate the seismic hazard of a region. If we plan for worst-case scenario, smaller earthquakes that are more likely to occur can be dealt with readily. Buildings and other structures must meet seismic design parameter values. For example, they must withstand a certain peak acceleration, a given duration of strong shaking, or a particular period of seismic waves. When these values are derived from maximum credible earthquakes, they help to establish safety margins.

Although earthquakes occur often in Southern California, hundreds or thousands of years can elapse between earthquakes on any particularly portion of a fault. Many southern California faults have not caused earthquakes in historic times, and fewer yet have caused a maximum credible earthquake in historic times. Therefore, estimates of maximum credible and maximum probable earthquakes for a given fault are based on the length of the fault, style of faulting, and other characteristics. Earthquake size often depends on how many segments of a fault give way at one time. The more segments that rupture, the greater the energy release and the bigger the earthquake.

When a fault has not ruptured in historic times, data obtained from trenching excavations across the fault (paleoseismic studies) provide valuable insight into how often the fault ruptures, and how big its earthquakes get.

Fault Activity: The State of California, under the guidelines of the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1997), classifies faults according to the following criteria:

Active faults show proven displacement of the ground surface within about the last 11,000 years (Holocene Epoch); and

Potentially Active faults show evidence of movement within the last 1.6 million years.

The State definition of an active fault is designed to gauge the surface rupture potential of a fault. The assumption is that if a fault has not moved in the last 11,000 years, it is unlikely to be the source of a damaging earthquake in the future. For residential subdivisions, a fault that has not moved in the last 11,000 years, as determined from direct geologic evidence, is presumed to be ***not active***. These are reasonable assumptions, but it can be difficult to ascertain when a fault has moved.

Although potentially active faults are considered less likely to generate earthquakes than active faults, in reality, most potentially active faults have been insufficiently studied to determine whether they are active or not. In this study, both active and potentially active faults are treated as candidate earthquake sources.

Regardless of which fault causes an earthquake, there will always be ***aftershocks.*** By definition, these are smaller earthquakes that happen close to the ***mainshock*** (the biggest event of the sequence) in time and space. These smaller earthquakes occur as the earth adjusts to the regional stress changes created by the mainshock. The bigger the mainshock, the greater the number of aftershocks, and the larger they will be. Generally, it takes a magnitude of about 5.5 to damage buildings. Any major earthquake will produce aftershocks large enough to cause damage, especially to already-weakened structures.

On average, the largest aftershock is 1.2 magnitude units less than the mainshock, Thus, a magnitude 6.9 earthquake will tend to produce aftershocks up to magnitude 5.7 in size. This is an average, thus there are many cases where the largest aftershock is larger than the average would predict. Post-disaster response must take large, damaging aftershocks into account.

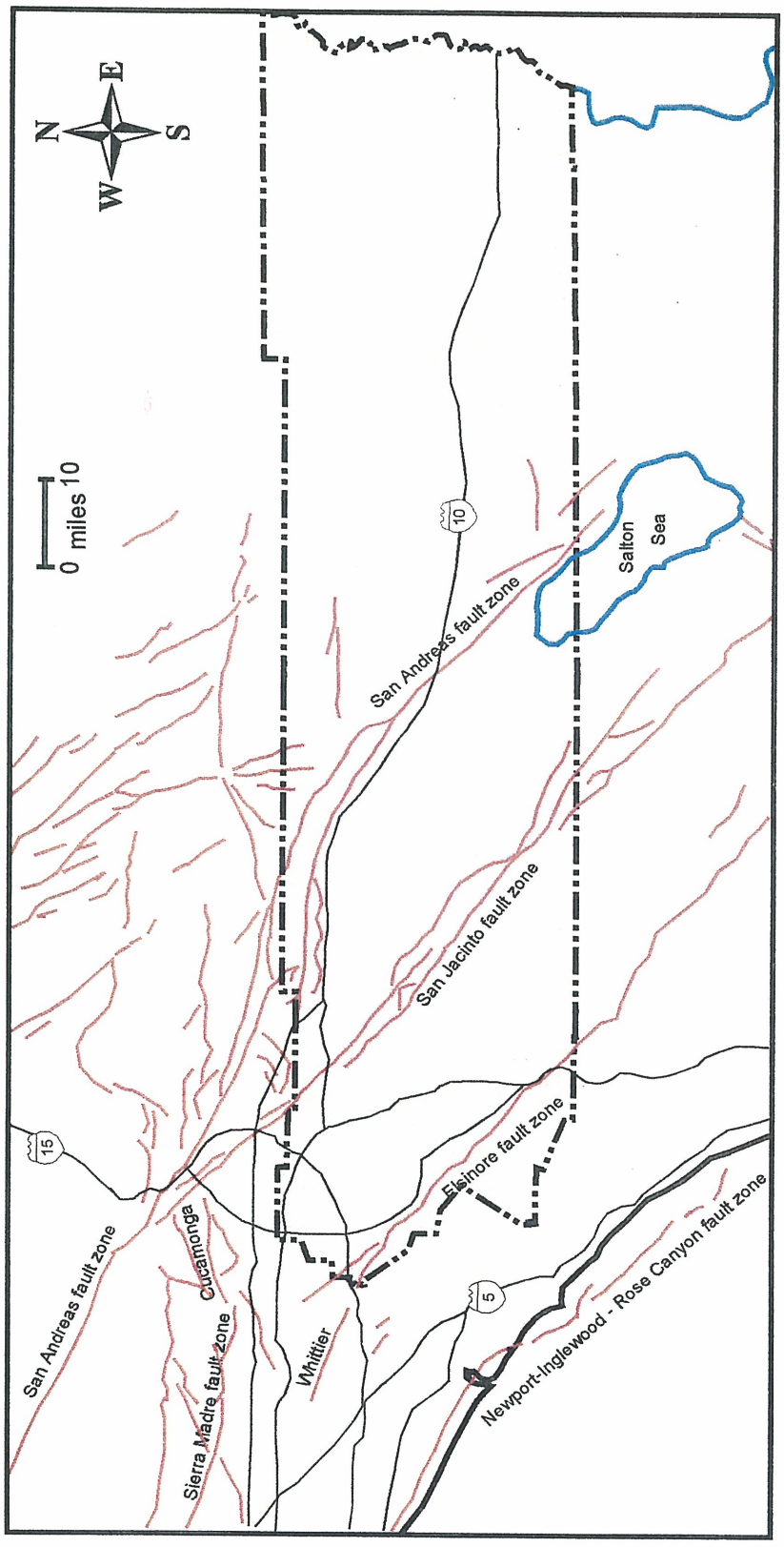

Figure 1-2: Regional Faulting of the Riverside County Area

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TABLE 1-1: ABRIDGED MODIFIED MERCALLI INTENSITY SCALE AND RELATION TO OTHER PARAMETERS

Intensity Value and Description		Average peak Velocity (centimeters per second)	Average peak acceleration (g is gravity = 9.80 meters per second squared)
I.	Not felt except by a very few under especially favorable circumstances (I Rossi-Forel)		
II.	Felt only by a few persons at rest, especially on upper floors of high-rise buildings. Delicately suspended objects may swing. (I to II Rossi-Forel scale)		
III.	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibration like passing of truck. Duration estimated. (III Rossi-Forel scale)		
IV.	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like a heavy truck striking building. Standing automobiles rocked noticeably. (IV to V Rossi-Forel scale)	1-2	0.015g-0.02g
V.	Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. (V to VI Rossi-Forel scale)	2-5	0.03g-0.04g
VI.	Felt by all, many frightened and run outdoors. Some heavy furniture moved, a few instances of fallen plaster and damaged chimneys. Damage slight. (VI to VII Rossi-Forel scale)	5-8	0.06g-0.07g
VII.	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars. (VIII Rossi-Forel scale)	8-12	0.10g-0.15g
VIII.	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed. (VIII+ to IX Rossi-Forel scale)	20-30	0.25g-0.30g
IX.	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (IX+ Rossi-Forel scale	45-55	0.50g-0.55g
X.	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks (X Rossi-Forel scale)	More than 60	More than 0.60g
XI.	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely Out of service. Earth slumps and land slips in soft ground. Rails bent greatly.		
XII.	Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown into air.		

Primary Source: Bolt (1993)

1.1.5 Laws to Mitigate Earthquake Hazard

The Alquist-Priolo Special Studies Zones Act was signed into law in 1972. In 1994 it was renamed the Alquist-Priolo Earthquake Fault Zoning Act (A-P Act). The primary purpose of the Act is to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault (Hart and Bryant, 1997). This State law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. Surface rupture is the most easily avoided seismic hazard.

The A-P Act requires the State Geologist (Chief of the Division of Mines and Geology) to delineate "Earthquake Fault Zones" along faults which are "sufficiently active" and "well-defined." Sufficiently active faults show evidence of Holocene surface displacement along one or more or their segments. Well-defined faults are clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The boundary of an "Earthquake Fault Zone" is generally about 500 feet from major active faults, and 200 to 300 feet from well-defined minor faults. The A-P Act dictates that cities and counties withhold development permits for sites within an Alquist-Priolo Earthquake Fault Zone, until geologic investigations demonstrate that the sites are not threatened by surface displacements from future faulting (Hart and Bryant, 1997).

Alquist-Priolo Earthquake Fault Zone mapping has been completed by the State Geologist for the 45 quadrangles in Riverside County. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones. Projects include all land divisions and most structures for human occupancy. State law exempts single family wood-frame and steel-frame dwellings which are less than three stories and are not part of a development of four units or more. However, local agencies can be more restrictive than state law requires.

Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings will not be constructed across active faults. An evaluation and written report of a specific site must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (generally 50 feet).

The A-P Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. ***The Seismic Hazards Mapping Act***, passed in 1990, addresses non-surface fault rupture earthquake hazards, including strong ground shaking, liquefaction and seismically-induced landslides.

The California Department of Conservation, Division of Mines and Geology (DMG) is the principal State agency charged with implementing the 1990 Seismic Hazard Mapping Act (SHMA). Pursuant to the SHMA, the DMG is directed to provide local governments with seismic hazard zone maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures. The goal is to minimize loss of life and property by identifying and mitigating seismic hazards. The seismic hazard zones delineated by the DMG are referred to as "zones of required investigation". Site-specific geotechnical hazard investigations are required by SHMA when construction projects fall within these areas. The DMG , pursuant to the 1990 SHMA, has not completed any mapping for Riverside County, nor is any planned for the foreseeable future (DMG, 2000). However, this study provides seismic hazard mapping and information that meets the intent of the Seismic Hazards Mapping Act, and local agencies should require site-specific geotechnical hazard investigations based on this mapping.

Real Estate Disclosure Requirements. Effective June 1, 1998, the Natural Hazards Disclosure Act requires that sellers of real property and their agents provide prospective buyers with a "Natural Hazard Disclosure Statement" when the property being sold lies within one or more state-mapped hazard areas. If a property is located in a Seismic Hazard Zone as shown on a map issued by the State Geologist, the seller or the seller's agent must disclose this fact to potential buyers. The law specifies two ways in which this disclosure can be made. One is to use the new Natural Hazards Disclosure Statement as provided in Section 1102.6c of the California Civil Code. The other way is to use the Local Option Real Estate Disclosure Statement as provided in Section 1102.6a of the California Civil Code. The Local Option Real Estate Disclosure Statement can be substituted for the Natural Hazards Disclosure Statement only if the Local Option Statement contains substantially the same information and substantially the same warning as the Natural Hazards Disclosure Statement.

1.2 Major Earthquake Sources in Riverside County

Many faults have the potential to generate strong ground shaking, surface fault rupture and secondary damage in Riverside County (see Figure 1-2). For the faults that pose the greatest threat to the County, summaries of current technical data and professional views are described in the next sections. Additional detail on Riverside County faults is provided in Appendix C.

1.2.1 San Andreas Fault Zone

Because of its relatively frequent (high recurrence rate), large earthquakes, the San Andreas fault is considered the "Master Fault", controlling the seismic hazard in Southern California. In the vicinity of Riverside County, the San Andreas fault zone is comprised of three segments: 1) the San Bernardino Mountains segment, 2) the Coachella Valley segment, and 3) the Mojave Desert segment. Between Cajon and San Gorgonio Passes, the County is bisected by the San Bernardino segment. The Coachella Valley segment of the San Andreas runs along the northeastern margin of the Coachella Valley.

The last major earthquake on the southern San Andreas fault was the 1857 M_w8.0 Fort Tejon quake that ruptured the San Andreas from central California, near Parkfield, to Cajon Pass, about 15 miles north of the County. For this study, the "Southern Segment" is considered a simultaneous rupture of the San Bernardino and Coachella Valley segments. Paleoseismic evidence indicates that such simultaneous rupture has occurred at least twice since 1450.

The San Bernardino Mountains segment extends in a westerly to northwesterly direction between the Cajon Pass area and the San Gorgonio Pass (Figure 1-3). This segment is structurally complex because the fault makes a left-step, and bends to trend in a more westerly direction. Associated compression is expressed as a zone of reverse, lateral and oblique-slip deformation that is accommodated by several subparallel fault strands. The most important of these are the Mission Creek, San Gorgonio Pass, and Banning faults.

Several estimates of slip rate obtained independently indicate that the San Bernardino Mountains segment has a slip rate of 24± 6 mm/yr, with an average recurrence interval of 146 years (WGCEP, 1995). Paleoseismic studies at Wrightwood indicate that there have been six surface-rupturing earthquakes on this segment since AD 1192, with the most recent five events occurring, on average, every 106 years. The most recent surface-rupturing earthquake on this segment is thought to have occurred in 1812 (Jacoby and others, 1988). Stein and others

(1992) indicate that the Landers earthquake sequence may have caused stress changes that advanced the occurrence of the next great San Andreas earthquake on this segment by 8 to 22 years. The Working Group on California Earthquake Probabilities (1995) estimated that this segment has a 28% probability of rupturing in the time period between 1994 and 2024 (Figure 1-3). An earthquake of magnitude 7.3 on the San Bernardino Mountains segment could produce peak horizontal ground accelerations as high as 0.53 g (Table 1-1) in Riverside County. If this fault segment breaks along with the Mojave or Coachella segments (e.g. Southern Segment, Table 1-2), a much larger portion of the County would be subjected to strong ground motions.

The Coachella Valley segment extends from the San Gorgonio Pass to the Salton Sea. It has not produced large, surface-rupturing earthquakes in historic times (Sieh and Williams, 1990). Paleoseismic studies suggest that the last surface-rupturing earthquake on this segment occurred around A.D. 1680. Studies at Indio indicate that prior to 1680, earthquakes on this fault segment occurred at an average recurrence interval of 220 years. The data also suggest that the Coachella Valley and San Bernardino Mountain segments ruptured simultaneously in earthquakes that occurred around 1680 and 1450. The segment is creeping at a rate of about 2-4 mm/year, and has a long-term slip rate of about 25 ± 5 mm/yr (WGCEP, 1995). This segment has an estimated 22% probability of rupturing before the year 2024 and is estimated capable of producing a magnitude 7.1 earthquake (WGCEP, 1995).

The Mojave segment extends from the Cajon Pass area, the southern limit of the 1857 rupture, (about 30 kilometers (km) north of Riverside County) north some 100 km (WGCEP, 1995). The 1988 Working Group calculated the recurrence interval for this segment using the 1857 displacement. The 1995 Working Group retained the slip rate of 30 mm/yr, characteristic displacement of 4.5 ± 1.0 m and derived repeat time of 150 years, but increased the uncertainties to ±8 mm/yr and ±1.5 m, respectively. Rupturing alone, the Mojave segment is estimated capable of producing a magnitude 7.1 earthquake.

Table 1-2: Fault Source Parameters for Riverside County

Fault Name and Geometry (1)	Distance from County (km)	Length		Slip Rate		Maximum Magnitude (2)	Maximum PGA (3)	Average Return Interval (yrs)	Comments
		(km)	+/-	(mm/yr)	+/-				
San Andreas-Coachella (rl-ss)	0	95	10	25	5	7.1	0.51	na	Slip rate based on Sieh and Williams (1990); Sieh (1986); Keller et al. (1982); Bronkowski (1981). Model assumes slip only in S. San Andreas events.
San Andreas-San Bernardino (rl-ss)	0	107	11	24	6	7.3	0.53	146	Slip rate reported by Weldon and Sieh (1985).
San Andreas (southern) (rl-ss)	0	203	20	24	6	7.4	0.48	220	Rupture of San Bernardino and Coachella segments. Slip rate based on Coachella segment.
San Andreas-Mojave (rl-ss)	>30	99	10	30	7	7.1	0.25	150	Slip rate based on Sieh (1984), Salyards et al. (1992), and WGCEP (1995).
San Jacinto-Coyote Creek (rl-ss)	0	40	4	4	2	6.8	0.48	175	Slip rate and fault length from WGCEP (1995).
San Jacinto-Anza (rl-ss)	0	90	9	12	6	7.2	0.52	250	Slip rate and fault length from WGCEP (1995).
San Jacinto-San Jacinto Valley (rl-ss)	0	42	4	12	6	6.9	0.49	83	Slip rate and fault length from WGCEP (1995).
San Jacinto-San Bernardino (rl-ss)	0	35	4	12	6	6.7	0.53	100	Slip rate and fault length from WGCEP (1995).
Elsinore-Temecula (rl-ss)	0	42	4	5	2	6.8	0.47	240	Slip rate and fault length from WGCEP (1995).
Elsinore-Glen Ivy (rl-ss)	0	38	4	5	2	6.8	0.48	340	Reported slip rates vary from 3.0-7.2 (Millman and Rockwell, 1986)
Whittier (rl-ss)	0	37	4	2	1	6.8	0.48	641	Slip rate based on Rockwell et al. (1990); Gath et al. (1992) description of offset drainage.
Chino-Central Ave. (rl-r-o)	0	28	3	1	1	6.7	0.47	882	Unconstrained slip rate based on assumptions of slip transfer between Elsinore and Whittier faults.

1. STYLE OF FAULT: (ss) strike slip, (r) reverse, (n) normal, (o) oblique SENSE OF SLIP: (rl) right lateral, (ll) left lateral
2. Maximum moment magnitude calculated from rupture area regressions (type "all") (from Wells and Coppersmith, 1994).
3. Maximum estimated horizontal peak ground acceleration as a percentage of gravity on bedrock, at closest Riverside County location (from CDMG).

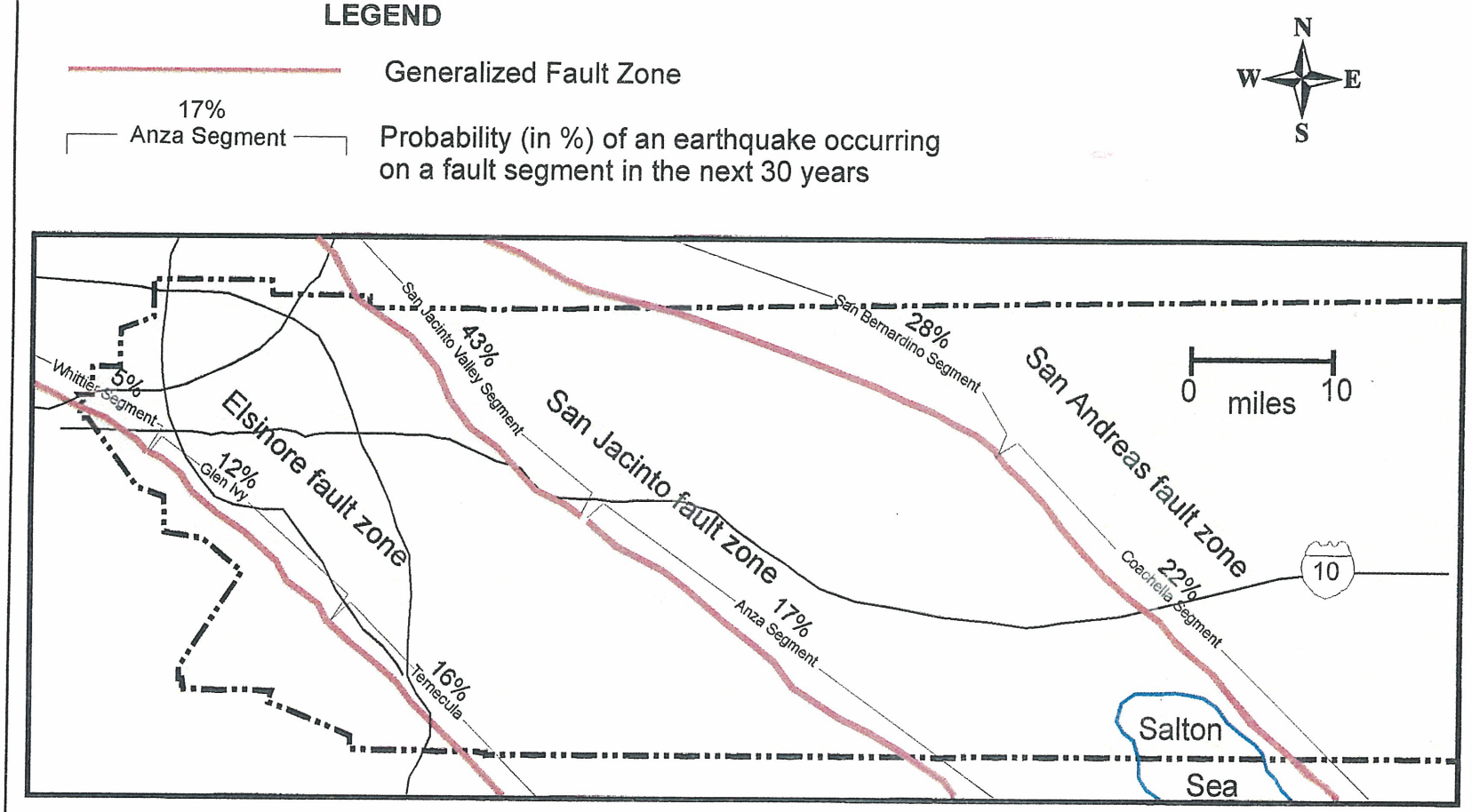

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Figure 1-3: Fault Segments and Earthquake Probabilities in Riverside County

1.2.2 San Jacinto Fault Zone

The San Jacinto Fault Zone consists of a series of closely spaced faults that form the western margin of the San Jacinto Mountains. The fault zone extends from its junction with the San Andreas fault in San Bernardino, southeasterly toward the Brawley area, where it continues south of the international border as the Imperial transform fault. The San Jacinto fault zone has a high level of historical seismic activity, with at least ten damaging (M_w 6 - 7) earthquakes having occurred on this fault zone between 1890 and 1986. Earthquakes on the San Jacinto in 1899 and 1918 caused fatalities in the Riverside County area. Offset across this fault is predominantly right-lateral, similar to the San Andreas fault, although Brown (1990) has suggested that dip-slip motion contributes up to 10% of the net slip. The segments of the San Jacinto fault that are of most concern to Riverside County are the San Bernardino, San Jacinto Valley and Anza segments.

Fault slip rates on the various segments of the San Jacinto are less well constrained than for the San Andreas fault, but the available data suggest slip rates of 12 ± 6 mm/yr for the northern segments of the fault, and slip rates of 4 ± 2 mm/yr for the southern segments (WGCEP, 1995). For large ground-rupturing earthquakes on the San Jacinto fault, various investigators have suggested a recurrence interval of 150 to 300 years (Petersen and Wesnousky, 1994). The Working Group on California Earthquake Probabilities (1995) has estimated that the San Bernardino, San Jacinto Valley and Anza segments have a 37%, 43%, and 17% probability, respectively, of rupturing in the period between 1994 and 2024.

Maximum credible earthquakes of magnitudes 6.7, 6.9 and 7.2 are expected on the San Bernardino, San Jacinto Valley and Anza segments, respectively, capable of generating peak horizontal ground accelerations of 0.48 to 0.53 g (Table1-1, 1-2) in the County of Riverside.

1.2.3 Elsinore Fault Zone

The Elsinore fault zone parallels the San Jacinto and is part of the same right-lateral crustal plate strain system as the San Andreas and the San Jacinto. Segments in Riverside County are the Whittier, Glen Ivy, Temecula, and Julian segments. The most apparent displacements on the Whittier-Elsinore have been vertical, as evidenced by the steep scarp (an earthquake-built cliff) along the Santa Ana Mountains. The Elsinore branches into the Whittier fault near Santa Ana Canyon, where it borders the Puente Hills to the southwest and the Chino fault to the northeast. Maximum credible earthquakes of M_w 6.7 to 6.8 are assigned for the Chino, Whittier, Glen Ivy and Temecula segments of the Elsinore fault. Major

ground rupturing events on these fault segments would generate peak ground accelerations of 0.47 to 0.48 g for Riverside County (Table1-1, 1-2). WGCEP (1995) estimates probabilities of 5% to 16% for these events to occur in the 1994 to 2024 time period.

1.2.4 Cucamonga Fault Zone

The Cucamonga fault zone, a youthful member of the Transverse Ranges family of thrust faults (Morton and Matti, 1987), is not in Riverside County but creates a hazard there. It is the eastward extension of the Sierra Madre fault, one of the most hazardous of southern California's faults. The Cucamonga fault zone is the known Transverse Ranges fault that is closest to the County of Riverside. It is comprised of a series of east-west trending, north-dipping reverse faults that displace Holocene sediments (Ziony and Jones, 1989). This frontal fault zone extends from the southern margin of San Gabriel Mountains to the southern margin of the San Bernardino Mountains, disrupting modern alluvial fans and sediments associated with the upper Santa Ana River Valley. This provides evidence that the Cucamonga fault zone is active.

Measurements of the fault-plane dips and determination of surface offsets for thrust fault scarps suggest minimum slip rates between 4.5 and 5.5 mm/yr (Morton et al., 1987). Taking into account uncertainties in Carbon-14 age dating of offset materials, WGCEP (1988) assigned a slip rate of 5.0 ± 2.0 mm/yr and maximum magnitude of 7.0 to the Cucamonga fault.

1.3 Riverside County Seismicity

In Figure 1-4 and Table 1-3 are the epicenters and magnitudes of historical earthquakes that have caused significant ground shaking or secondary damage in Riverside County. These data are provided by the Southern California Earthquake Center Data Center (SCEC-DC, 1999). Several of these earthquakes have resulted in Modified Mercalli Intensity (MMI) VII (severe) ground shaking in Riverside County. Fatalities were reported in Riverside County as a result of San Jacinto fault earthquakes in 1899 and 1918. Recently, MMI VI shaking occurred in the southern Coachella Valley region of Riverside County during the October 1999 M_w 7.1 Hector Mine earthquake.

Table 1-3: Historical Earthquakes Impacting Riverside County

Date	Magnitude	Max MMI in Riverside County	Distance from Riverside County
Dec. 8, 1812; 7:00 am	7.5	VIII	Wrightwood; 18 miles north
July 22, 1899; 12:32 pm,	5.7	VII	Cajon Pass; 18 miles north
Dec. 25, 1899; 4:25 am	6.5	VIII	San Jacinto Valley, 6 fatalities in County
May 15, 1910; 7:47 am	6.0	VII	near Lake Elsinore
April 21, 1918; 2:32 pm	6.8	VIII	San Jacinto Valley, 1 fatality in County
March 10, 1933; 5:54 pm	6.4	V	Long Beach; 19 miles west
Dec. 4, 1948; 3:43 pm	6.0	VII	Desert Hot Springs
Sept. 12, 1970; 7:30 am	5.2	V	Lytle Creek; 18 miles north
July 8, 1986; 2:21 am	6.0	VII	North Palm Springs
Oct. 1, 1987; 7:42 am	5.9	IV	Whittier-Narrows; 21 miles west
June 26, 1988; 8:05 am	4.7	IV	Upland; 11 miles west
Feb. 28, 1990; 3:43 pm	5.4	V	Upland; 12 miles west
June 28, 1991; 7:43 am	5.8	IV	Sierra Madre; 18 miles northwest
April 22, 1992; 9:50 pm	6.1	VII	Joshua Tree
June 28, 1992; 4:57 am	7.3	VII	Landers; 8 miles north
June 28, 1992; 8:05 am	6.4	VI	Big Bear; 10 miles north
Jan. 17, 1994; 4:31 am	6.7	III	Northridge; 64 miles northwest
Oct. 16, 1999; 2:40 am	7.1	VI	Hector Mine; 20 miles north

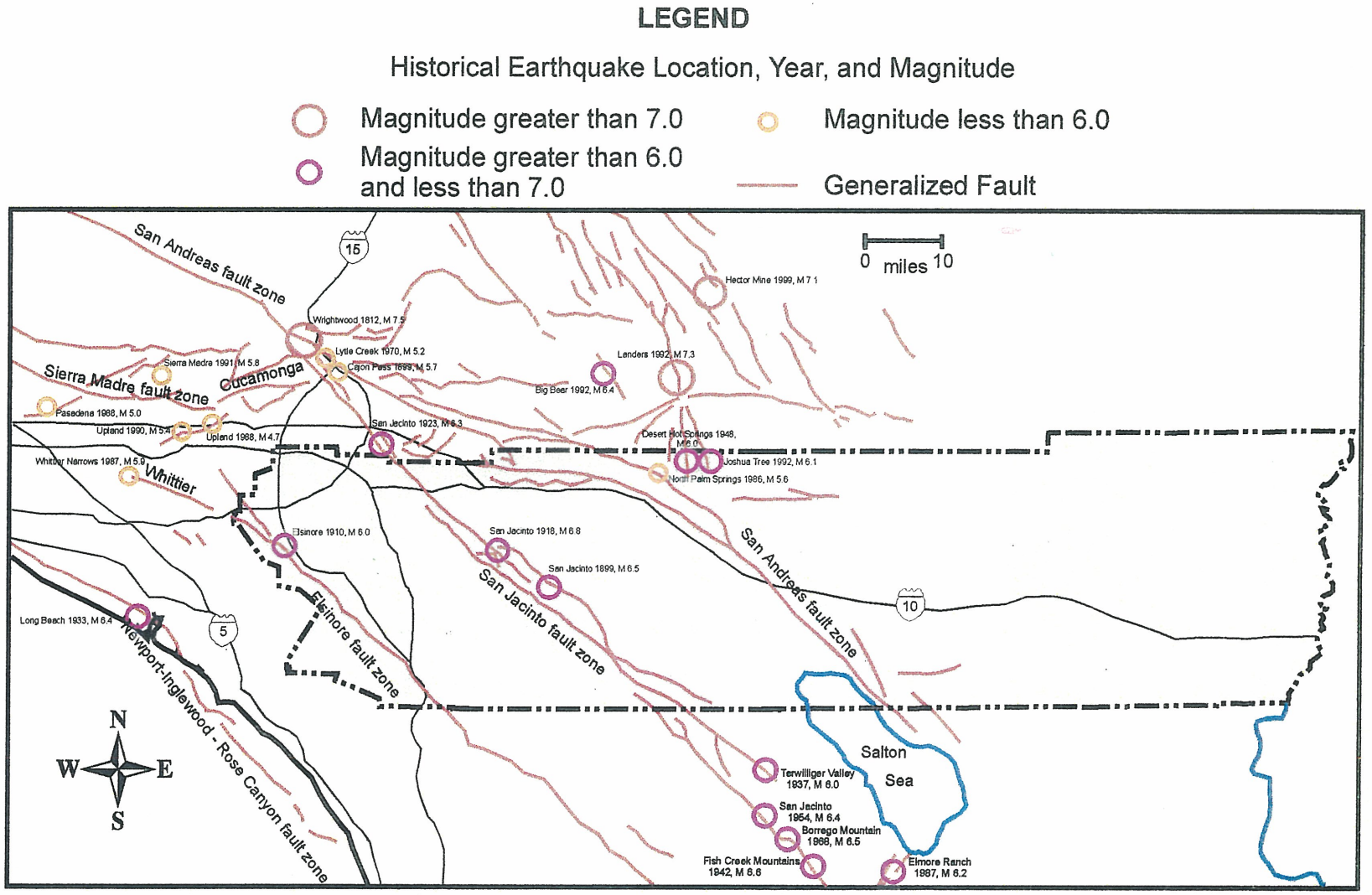


Figure 1-4: Notable Historical Earthquakes in the Riverside County Region

1.3.1 Past Damaging Earthquakes

Below is a summary of historical earthquakes significant to Riverside County. Locations and sizes of earthquakes that occurred before good instrumental recordings became available (before ~1940) have been estimated. Generally, the older sizes and locations have big error margins.

1812 Wrightwood (formerly known as the "San Juan Capistrano Earthquake"): With a magnitude of approximately 7.5, this earthquake occurred on December 8, 1812 during the mid-morning hours. The epicenter is relatively uncertain, but, based upon tree ring and paleoseismology data (Jacoby and others, 1988; Sieh and others, 1989), appears to be on the San Andreas fault near Wrightwood, about 18 miles north of the County of Riverside. This earthquake is often referred to as the "San Juan Capistrano" earthquake, due to the death toll at the mission. It is thought that this quake ruptured the Mojave segment of the San Andreas, possibly resulting in as much as 106 miles of surface rupture -- roughly, the length of the San Andreas fault between Tejon Pass and Cajon Pass.

1899 Cajon Pass This estimated magnitude 5.7 earthquake was felt over most of southern California, with intensities reaching VIII in the epicentral area, somewhere near Lytle Creek and Cajon Pass, about 18 miles north of Riverside County. Triggered landslides blocked both the Lytle Creek Canyon road and the road through Cajon Pass. The heaviest damage to buildings occurred in San Bernardino, Highland, and Patton. Damage was also reported in Redlands, Pomona, Riverside, Pasadena, and Los Angeles, though it was mostly minor. No deaths were reported, and the number of injuries is uncertain (Townley, 1939).

1899 San Jacinto This devastating earthquake occurred in west-central Riverside County, near the town of San Jacinto, on December 25, 1899 at 4:25 am PST, with an estimated magnitude of 6.5. The epicenter of this earthquake was not well located, but involved the San Jacinto fault. The damage pattern suggests the epicenter shown on Figure 1-3. This location is not far from the epicenter of the 1918 San Jacinto earthquake. Damage was greatest in the towns of San Jacinto and Hemet, where nearly all brick buildings were either badly damaged or destroyed. Also hit hard was the Soboba Indian Reservation, where six people were killed by falling adobe walls. Chimneys were thrown down and walls cracked in Riverside. Other outlying areas reported minor damage.

1910 Elsinore The Elsinore earthquake struck on May 15, 1910 at 7:47 am, PST with an epicenter estimated near Lake Elsinore in western Riverside County. The earthquake most likely occurred on the Elsinore fault, and was preceded by moderate foreshocks on April 10 and May 12. The Elsinore earthquake was not a particularly strong or damaging quake. What is notable about this quake is that best estimates place it on the Elsinore fault zone, along which there are no historical recordings of earthquakes of magnitude 6 or larger.

1918 San Jacinto The approximately magnitude 6.8 earthquake occurred on April 21, 1918 at 2:32 pm PST on the San Jacinto fault in west-central Riverside County. According to intensity isoseismals that rely heavily on damage reports, most of the damage occurred in the business districts of the towns of San Jacinto and Hemet, where large masonry structures collapsed. Luckily, the earthquake struck on a Sunday afternoon, when the business districts were empty. Several people were injured and one death was reported. Two miners were trapped in a mine near Winchester, but were eventually rescued, uninjured.

1933 Long Beach This magnitude 6.4 earthquake struck on March 10, 1933 at 5:54 pm, PST, about 19 miles west of Riverside County. While referred to as the Long Beach earthquake due to the extensive damage in the Long Beach area, its epicenter was actually 3 miles south of Huntington Beach. This earthquake occurred on the Newport-Inglewood fault zone, a system of right-lateral strike-slip faults. There was no surface rupture associated with this earthquake, which resulted in 120 deaths and over $50 million in property damage. Most of the damaged buildings were of unreinforced masonry. Many school buildings were destroyed. Fortunately, however, the children were gone for the day. The Long Beach earthquake has the greatest death toll of any historical southern California earthquake. Yet the toll would have been much more tragic if the collapsed school buildings had been occupied. The fact that the relatively recent urban earthquakes (1971 M_w 6.7 Sylmar; 1989 M_w 7.1 Loma Prieta; and 1994 M_w 6.7 Northridge) all had far fewer fatalities despite much larger populations may stand as testimony to improvement of the life-safety aspects of modern building codes. This is the earthquake that changed building codes and required masonry to be reinforced. The 1933 Long Beach earthquake also led to the passage of the Field Act, which gave the State Division of Architecture authority and responsibility for approving design and supervising construction of public schools.

1948 Desert Hot Springs This magnitude 6.0 earthquake struck on December 4, 1948 at 3:43 pm PST. The fault involved is believed to be the Banning fault. Shaking was felt over a large area (central Arizona, parts of Mexico, Santa Catalina Island, and Bakersfield), and caused notable damage in regions far from the epicenter. In the Los Angeles area, a 5,800-gallon water tank split open, water pipes were broken at UCLA, and in Pasadena, plaster cracked and fell from many buildings. In San Diego, a water main broke. In Escondido and Corona, walls cracked. The administration building of Elsinore High School was permanently closed due to the damage it sustained, as was a building at the Emory School in Palm Springs. Closer to the epicenter, landslides and ground cracks were reported, and a road leading to the Morongo Indian Reservation was badly damaged (Louderback, 1949). In Palm Springs, the City hit hardest by the quake, thousands of dollars of merchandise was thrown from shelves and destroyed. Part of a furniture store collapsed. Two people were injured when the shaking induced a crowd to flee a movie theater in panic. Numerous other instances of minor structural damage were reported. Fortunately, despite much damage, no lives were lost.

1970 Lytle Creek This magnitude 5.2 earthquake occurred on September 12th at 7:31 am PST about 18 miles north of Riverside County. The Lytle Creek earthquake struck the area near Cajon Pass, knocking a San Bernardino radio station off the air, and causing landslides and rockfalls in the Transverse Ranges. Several roads were blocked or partially blocked. The quake caused some unusual damage in areas a fair distance from the epicenter. Power was disrupted in the Santa Monica Mountains northwest of Hollywood. A high-pressure water system in a Riverside aerospace plant was damaged, leading to a subsequent boiler explosion that injured four people. More typical minor damage also occurred, primarily in the Lytle Creek area (intensity VII on the Modified Mercalli Scale) and to a lesser degree in the nearby towns of Colton, Crestline, Cucamonga, Fontana, Glendora, Highland, Mt. Baldy, Rialto, Rubidoux, and Wrightwood (Lander, 1971).

1986 North Palm Springs This magnitude 6.0 earthquake occurred on July 8, 1986 at 2:21 am PDT, along either the Banning fault or the Garnet Hill fault. The epicenter was about 6 miles northwest of Palm Springs in north-central Riverside County. The 1986 North Palm Springs earthquake was responsible for at least 29 injuries and the destruction or damage of 51 homes in the Palm Springs-Morongo Valley area. It also triggered landslides. Damage caused by this quake was estimated at over $4 million. Ground cracking was observed along the Banning, Mission Creek, and Garnet Hill faults, but these cracks were due to shaking, not surface rupture (Person, 1986).

1987 Whittier Narrows This magnitude 5.9 earthquake occurred on October 1st at 7:42 am PDT, about 21 miles west of the County of Riverside. This earthquake occurred on a previously unknown, concealed thrust fault now known as the Puente Hills fault. It resulted in eight fatalities and $358 million in property damage (SCEC-DC, 1999). Severe damage was confined mainly to communities east of Los Angeles and near the epicenter, particularly the "Uptown" district of Whittier, the old downtown section of Alhambra and the "Old Town" section of Pasadena. These areas had high concentrations of unreinforced masonry buildings. Residences which sustained damage usually were constructed of masonry, were not fully anchored to foundations, or were houses built over garages with large door openings. Many chimneys collapsed and in some cases, fell through roofs. Wood frame residences sustained relatively little damage.

1988 Upland This magnitude 4.7 event occurred on June 26, about 3 km (2 miles) NW of Upland, about 11 miles west of Riverside County (Person, 1988). The event occurred on the San Jose fault. The 1988 Upland earthquake caused minor damage in the epicentral area, but would have been of relatively little note were it not for the possibility that it may have been triggered by the Whittier Narrows earthquake -- 9 months earlier, and 20 km away. These kinds of causal connections are of great interest as they offer some hope of more accurately forecasting earthquake probabilities.

1990 Upland This magnitude 5.4 earthquake occurred on February 28th (Person, 1990), about 12 miles of Riverside County on the San Jose fault. The 1990 Upland earthquake was much more damaging than the quake of 1988. In the 1990 earthquake, 38 people sustained minor injuries, and damage was considerable near the epicenter. The quake was felt as far to the northeast as Las Vegas, Nevada, and as far south as Ensenada, Mexico.

1991 Sierra Madre This magnitude 5.8 earthquake occurred on June 28th at 7:43 am PDT, about 12 miles northeast of Pasadena and 18 miles northwest of Riverside County. The earthquake occurred on the Clamshell-Sawpit Canyon fault, an offshoot of the Sierra Madre fault zone in the San Gabriel Mountains. Because of its depth and moderate size, it caused no surface rupture, though it triggered rockslides that blocked some mountain roads. Two deaths resulted from this earthquake - one person was killed in Arcadia, and one person in Glendale died from a heart attack. In all, at least 100 others were injured, though the injuries were mostly minor. Roughly $40 million in property damage occurred in the San Gabriel Valley. (SCEC-DC, 1999).

1992 Joshua Tree This magnitude 6.1 earthquake struck on April 22, 1992 at 9:50 pm PDT, in north-central Riverside County. This event was preceded by a magnitude 4.6 foreshock. The Joshua Tree earthquake raised some alarms due to its proximity to the San Andreas fault. A San Andreas Hazard Level B alert was declared, meaning that the San Andreas fault had a 5 - 25% chance of generating an even larger earthquake within 3 days. Roughly two months and 6,000 aftershocks later, a larger earthquake did occur, but to the north, near Landers, away from the San Andreas. Aftershocks of the Joshua Tree quake suggest that the causative fault is a north-northwest-trending, right-lateral strike-slip fault at least 15 km long (Jones and others, 1995). The Eureka Peak fault is a likely candidate.

1992 Landers On the morning of June 28, 1992, most people in southern California were awakened at 4:57 am PDT by the largest earthquake to strike California in 40 years. Named "Landers" after a small desert community near its epicenter, the earthquake had a magnitude of 7.3 and occurred about 8 miles north of Riverside County. Centered in the Mojave Desert, approximately 120 miles from Los Angeles, the earthquake caused relatively little damage for its size (Brewer, 1992). It released about four times as much energy as the very destructive Loma Prieta earthquake of 1989, but fortunately, it did not claim as many lives (one child died when a chimney collapsed). The power of the earthquake was illustrated by the length of the ground rupture it left behind. More than 50

miles of surface rupture occurred. The average right-lateral strike-slip displacement was 10 - 15 feet, while a maximum of 18 feet observed. The earthquake ruptured 5 separate faults: Johnson Valley, Landers, Homestead Valley, Emerson, and Camp Rock faults (Rymer, 1992). Nearby faults also experienced triggered slip and minor surface rupture. The Landers earthquake triggered seismicity throughout the western United States. Before this occurred, the seismological community was convinced such triggering did not happen.

1992 Big Bear This magnitude 6.4 earthquake struck about 3 hours after the Landers earthquake on June 28, 1992. The epicenter was about 10 miles north of Riverside County. This earthquake is technically considered an aftershock of the Landers earthquake (indeed, the largest aftershock), although the Big Bear earthquake occurred over 20 miles west of the Landers rupture, on a fault with a different orientation and sense of slip than those involved in the main shock. From Big Bear aftershocks, the causative fault appears to be a northeast-trending left-lateral fault. This orientation and slip are considered "conjugate" to the faults which slipped in the Landers rupture. Additionally, there is evidence that the Big Bear mainshock and aftershocks may have ruptured conjugate faults. The Big Bear earthquake did not break the ground surface, and, in fact, no surface trace of a fault with the proper orientation has been found in the area. The Big Bear earthquake caused a substantial amount of damage in the Big Bear area, but fortunately, it claimed no lives.

1994 Northridge This magnitude 6.7, January 17, 1994 event was far enough from Riverside County to cause little or no direct damage. However, long-range economic impact of this $20-$30 billion earthquake affected all of southern California, and in fact had global consequences.

1999 Hector Mine Southern California's most recent large earthquake was a widely felt magnitude 7.1. It occurred on October 18, 1999, in a remote region of the Mojave Desert, 47 miles east-southeast of Barstow. Modified Mercalli Intensity VI (Table 1-1) shaking was reported in the southern Coachella Valley, but most County felt reports were in the MMI V range (SCEC-DC, 1999). The Hector Mine earthquake is not considered an aftershock of the M_w 7.3 Landers earthquake of 1992, although subsequent analysis will explore the relationship between these two events, which occurred on similar, north-northwest trending strike-slip faults within the Mojave Shear Zone. Hector Mine ruptured the Lavic Lake fault. Geologists documented a 40-km long surface rupture and a maximum right-lateral strike-slip offset of about 5 meters.

1.3.2 Seismicity of Riverside County

Some History

Figure 1-5 and Plate 1-1 show the locations and sizes of 47,375 earthquakes that were recorded in and adjacent to Riverside County between 1868 and August, 1999. The map locates ***epicenters***, which are the surface projections of the earthquakes' initiation points inside the earth. The plotted earthquakes have magnitudes that range from 0.8 to 6.8. Almost all of these earthquakes (96%) are under magnitude 3.0, too small to be felt by people.

Our knowledge of seismicity improves as the quality of our recording methods improve. Before 1932, southern California had no network of ***seismometers***

(instruments that record ground shaking), and records of earthquakes were public reports like newspapers. People are less sensitive than seismometers to ground shaking. Consequently, before 1932, we only have records of the largest earthquakes - generally magnitude 4 and greater. On the map, there are 44 earthquakes before 1932.

The Southern California Seismic Network (SCSN), started in 1932, was the first regional seismic network, and it remains the most forward-thinking. Its contribution to hazard reduction and basic research cannot be overstated. The SCSN is a collaborative effort of the United States Geological Survey and the California Institute of Technology. Digital data from the SCSN is archived by the Southern California Earthquake Center Data Center.

From 1932 to 1981, as the SCSN grew, so did the catalog of smaller earthquakes. Since 1983, the SCSN has had a complete record of earthquakes to about the magnitude 1.8 level. This adds a huge number of earthquakes to the catalog, as the number of earthquakes increases approximately ten-fold with each decrease in magnitude point. So, for every magnitude 4 that occurs, there are 10 magnitude 3 earthquakes, 100 magnitude 2 earthquakes, and 1000 magnitude 1 earthquakes. Thus, 97% of the earthquakes in Figure 1-5 (Plate 1-1) have occurred since 1981.

Using a three-dimensional velocity inversion program, Hauksson (*in press*) accurately determined earthquake locations for all of the digitally catalogued SCSN data in southern California, that is, from 1981 to August, 1999. Figure 1-5 and Plate 1-1 map Hauksson's most reliable results within Riverside County, earthquakes with magnitudes greater than 0.8, observed by eight or more seismometer stations.

Determinations of earthquake locations and sizes have also improved considerably since 1868, due to the creation and growth of the SCSN. Currently, the SCSN has seismometers at more than 250 sites around southern California. This allows smaller earthquakes to be more accurately located, as well as simply detected. Before 1932, rough estimates of earthquake size and location were made by identifying regions where the most people felt the earthquake, or the most structures experienced damage. In 1935, Charles Richter developed the first quantitative method to calculate earthquake magnitude, called "the Richter scale" by the media, and "M_L, the local magnitude scale" by scientists. Richter's method was based on the amplitude of ground shaking on a Wood-Anderson seismometer situated 100 km from the earthquake. Local magnitude remains a fast and reliable method of determining earthquake size for smaller events, but underestimates the size of larger earthquakes. Magnitude based on energy release, ***M_w, moment magnitude***, is more accurate for larger earthquakes (see Aki, 1966; Brune, 1968;

Hanks and Kanamori, 1979; Kanamori and Anderson, 1975). The larger earthquakes in Figure 1-5 and Plate 1-1 have M_w magnitudes, the others are M_L.

Prior to the existence of modern seismograph networks like the SCSN, to estimate the approximate location and size of an earthquake, a shaking map was constructed based on some version of the Mercalli Intensity Scale (Table 1-1). Such maps defined intensity zones based on observations of damage and other effects associated with ground shaking. These maps typically displayed a bull's-eye pattern, with the highest intensities in the middle. The earthquake was assumed to be near the center of the bull's-eye. For earthquakes that pre-date quantitative magnitude determinations, magnitudes can be estimated by using the magnitudes of more recent earthquakes that generated similar intensity maps.

Seismicity Patterns

In the time span of this map, nearly all of the earthquakes in Riverside County (and elsewhere) occur within known active fault zones. This holds true for earthquakes of all sizes. There are nine earthquakes in Figure 1-5 and Plate 1-1 with magnitudes greater than 6.0 (see section 1.3.1 and Table 1-3 for details of these events, see Figure 1-4 for their locations). One occurred on the southern portion of the Eureka Peak fault. The other eight occurred on the major fault zones: five, including the largest (M_w 6.8), ruptured the San Jacinto fault zone; two occurred on the San Andreas fault zone; and one was on the Elsinore fault zone.

Earthquakes on Figure 1-5 and Plate 1-1 can be classified as "significant" (larger events), "foreshocks and aftershocks" (earthquakes that are smaller than significant events, but close in time and space, and that are physically, causally related the significant event), and "background" or "microseismicity" (small earthquakes, not associated with significant events). Earthquakes observed along the Elsinore fault zone, the San Gorgonio Pass fault zone, between major fault zones, and in the eastern portion of the County are "background".

Note how the significant earthquakes are too infrequent to identify fault locations, but the smaller epicenters of "background" and "aftershocks" define the map traces of many faults. Some portions of the San Andreas fault in southern Riverside County have been documented to ***creep***, that is, the rocks along the fault slip readily, and this is thought to account for the abundant small earthquakes there (Jennings, 1994). The lack of small earthquakes on the rest of the southern San Andreas is one indication that this portion of the fault is locked in place by friction. After the next great earthquake(s) on the southern segments of the San Andreas, these locked segments will also be defined by epicenters of aftershocks.

It is also worth noting the paucity of earthquakes in the eastern half of the County. In part, this is an artifact of data coverage, as there are fewer seismometers in this portion of the network. However, the lack of earthquakes is also consistent with the lack of mapped active or potentially active faults in this region.

Depth of Seismicity

Most earthquakes occur in the upper 15 kilometers (about 9 miles) of the earth's crust, where rocks are cool and brittle enough to lock due to friction and store strain energy. Many major earthquakes begin 10-15 kilometers beneath the surface, near the bottom of the brittle portion of the crust (see dePalo and Slemmons, 1990). Then the fault rupture propagates up towards the surface. In the lower crust, deeper than 15 kilometers, the rocks are hotter and, when subjected to plate motion stresses, tend to be ductile and flow plastically. Thus the majority of earthquakes shown in Figure 1-5 and Plate 1-1 are shallower than 15 kilometers. However, there are notable exceptions.

The San Gorgonio Pass fault zone exhibits some of the deepest earthquakes in southern California. Here, abundant seismicity occurs at depths of 15 to 25 kilometers (Nicholson et al, 1986; Seeber and Armbruster, 1995; Magistrale and Sanders, 1996). This is thought to be because upper crustal material has been pushed deeper due to motion within this complex fault system. This upper crustal material is still relatively cold and brittle, and therefore continues to store strain energy.

1.3.3 Earthquake Geographic Information System Coverage for Riverside County

As part of this study, seismic data were imported into a geographic information system (GIS) coverage for Riverside County, described below. The data utilized were seismicity catalogs dating from 1931 (the beginning of the Southern California Seismic Network) to the present. Data tables linked to each event include magnitude, depth, and year.

Coverage Description: Earthquake locations in Riverside County (Plate 1-1)
Coverage distribution file name: quakes.e00; quakes3.e00 (quake.e00 represents all earthquake locations under 3.0. quakes3.e00 represents all earthquakes over 3.0.)

Coverage Area: Riverside County
Source: Earth Consultants International

Accuracy: The earthquakes are plotted to an accuracy of 1:24,000.

Earthquake Location References:

Earthquake locations for events occurring from 1858 to 1931:
Blake, T. F., 1996, EQFAULT- Computer software for deterministic site parameters, Version 2.20.

Earthquake locations for events occurring between 1932 to 1980:
Earthquake data recorded by the Southern California Seismic Network (SCSN, which is operated jointly by the Seismological Laboratory at Caltech and the U.S. Geological Survey, Pasadena, California), and catalogued by the Southern California Earthquake Center Data Center (SCEC-DC).

Earthquake locations for events occurring between 1981 to 1999:
Hauksson, E. (in press), Crustal structure and seismicity distribution adjacent to the Pacific and North America plate boundary in southern California: submitted to Journal of Geophysical Research.

Figure 1-5:

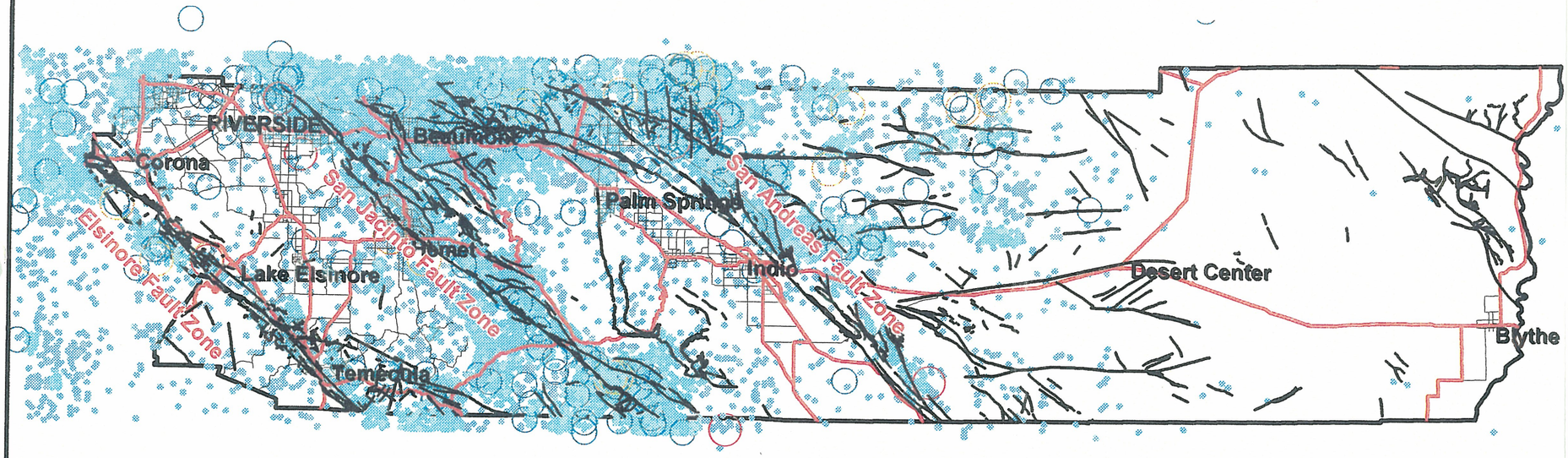
Seismicity

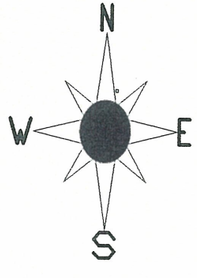
of

Riverside County

(1890-1999)

(Summary of GIS Data, for additional detail see Plate 1-1 in-pocket)





Scale: 1:1,000,000

10 0 10 20 30

Miles

Earth Consultants International

MAGNITUDE

- 6 to 7
- 5 to 6
- 4 to 5
- Less than 4

- Faults
- Highways
- Major Roads

1.4 Fault Rupture

Figure 1-6 and Plate 1-2 illustrate all fault traces mapped to date in Riverside County, regardless of geologic age. Not all of these traces are currently considered active based on guidelines of the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 1997). The State law classifies faults according to criteria detailed in 1.1.2. Additional fault information is provided in Appendix C.

Alquist-Priolo Earthquake Fault Zones (A-P Zones) have been designated by the California Division of Mines and Geology for the Elsinore, San Jacinto and San Andreas fault zones in Riverside County (Figure 1-7). In addition, the County of Riverside (1991) applied special studies zone criteria for the Agua Caliente fault zone between the Elsinore and San Jacinto faults in southern Riverside County (Figure 1-7). All of these faults have high rates of displacement (> 5 mm/yr, which is about the rate that fingernails grow) and thus are rapidly accumulating strain energy to be released in earthquakes. Inevitably, the A-P Zones will expand with time. As faults are studied, offshoot faults called splays are ongoingly discovered.

Within these A-P Zones and special studies zones, State and Riverside County law requires that proposed tracts of four or more dwelling units investigate the potential for and setback from ground rupture hazards. This is typically accomplished by excavation of a trench across the site, determining the location of faulting and establishing building setbacks. The exclusion of other types of buildings is arbitrary, and increases risk to the community. Given the high degree of earthquake hazard in Riverside County, special fault hazard studies should be completed for all proposed structures designed for human occupancy within the zones outlined on Figure 1-7 (and Plate 1-3, described in 1.4.2).

1.4.1 Geographic Information System Coverage of Faults

Detailed geographic information system coverage for faults (Plate 1-2) are provided as part of this study. These coverages, their resolution and data sources are described below:

Coverage Description: Faults in Riverside County
Coverage distribution file name: faults.e00
Coverage Area: Riverside County
Source: Earth Consultants International
Accuracy: 100 to 500 feet

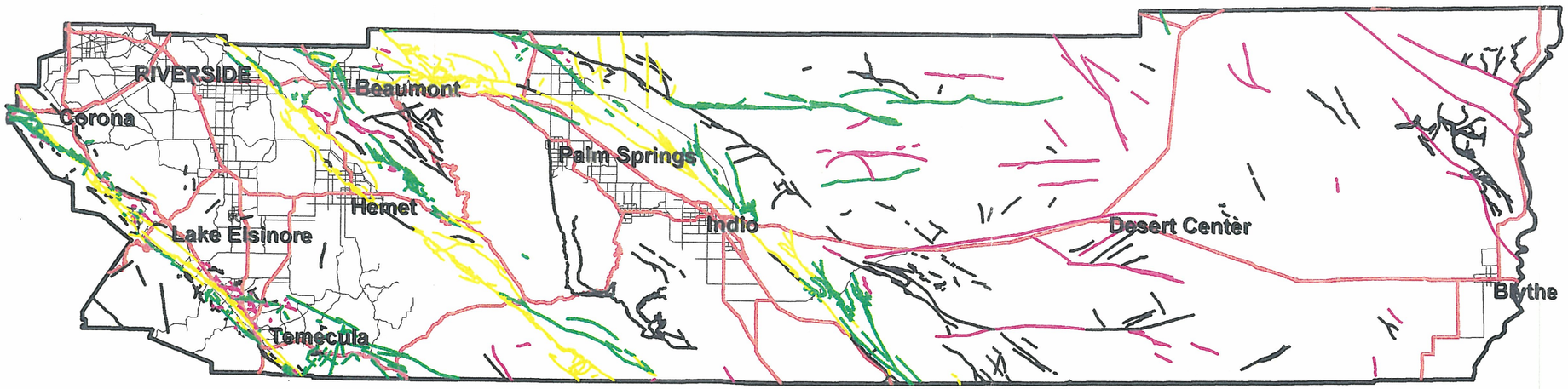
Figure 1-6:

Mapped Faulting

in

Riverside County

(Summary of GIS Data, for additional detail see Plate 1-2 in-pocket)



Earth Consultants International

Faults Activity

- Historic
- Historic (creep)
- Holocene
- Late Quaternary
- Quaternary
- Pre-Quaternary

Major Roads

Highways

N

W E

S

Scale: 1:1,000,000

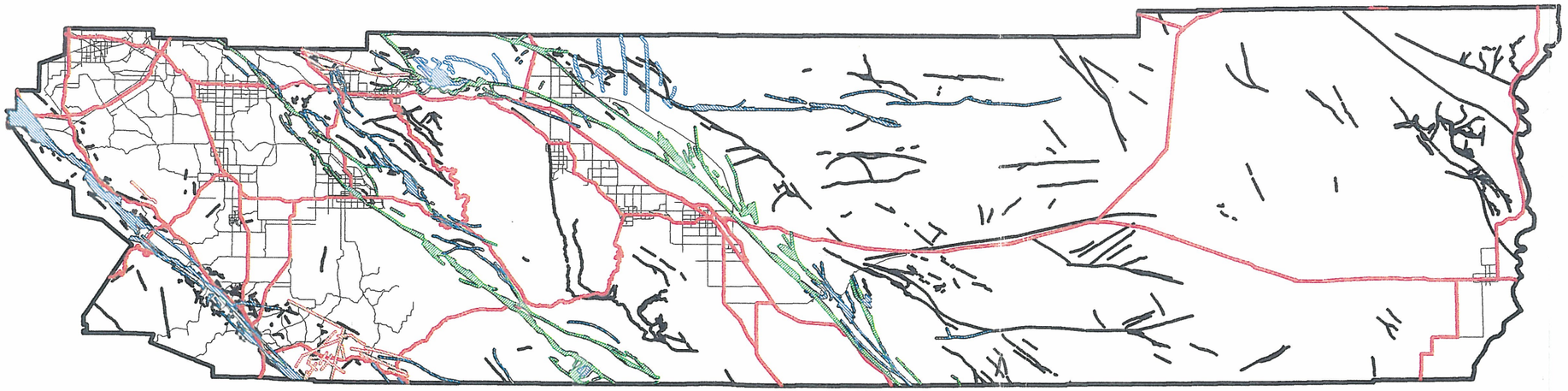
10 0 10 20 30

Miles

Figure 1-7:

Earthquake Fault Studies Zones in Riverside County

(Summary of GIS Data, for additional detail see Plate1-3 in-pocket)



Earth Consultants International

N

W E

S

Scale: 1:1,000,000

10 0 10 20 30

Miles

Major Roads

Highways

Faults

Fault Zones

Alquist-Priolo Zone

Existing County Zone

Recommended Zone

More than 4,300 faults and fault segments are included in the GIS database. Data tables linked to the faults include the fault name, length, age and information on location (e.g. certain, concealed, queried, etc.). The faults shown on Plate 1-2 are typically accurate to within 100 to 500 feet; however, some faults are better constrained than others as a consequence of the geologic field relations (their visibility in the field), or the quality of the geologic maps from which the data were acquired. Most of the faults that are Holocene to Late Quaternary in age are accurate to within 100-300 feet because their locations were typically retrieved from detailed (small-scale) geologic maps. However, in regions where these faults are "concealed" by younger sediments, their locations become progressively less accurate.

Many of the Holocene to Late Quaternary age faults are shown to exist, even when buried under younger sediments, due to their potential to rupture through the sediments to the surface. The older, pre-Quaternary faults are typically not shown under young sediments, as they are not potentially active.

This coverage may not show all potentially active faults, either within the special studies zones (see Fault Zones, below) or outside their boundaries. The faults shown on the map were not field checked and the quality of available data is highly varied.

The source maps used for this coverage were 1974 State of California, Department of Conservation 7.5 minute quadrangle topographic maps. Other references for the fault locations compiled on Plate 1-2, can be found in Appendix D.

1.4.2 Geographic Information System Coverage of Fault Special Studies Zones

Detailed geographic information system coverage for fault special studies zones are provided as part of this study (Plate 1-3). These coverages, their resolution and data sources are described below:
Coverage Description: Fault Special Studies Zones in Riverside County
Coverage distribution file names: apzones.e00; apzonept.e00; apcounty.e00; ap-eci.e00
Coverage Area: Riverside County
Source: Earth Consultants International
Accuracy: 1:24,000.

The source maps digitized for this coverage were 1974, 1980, 1988, 1993 and 1995 Official Earthquake Fault Zone, State of California, Department of Conservation 7.5 minute quadrangle topographic maps (Table 1-4 and Figure 1-8).

Table 1-4:
Alquist-Priolo Earthquake Fault Zone Maps Available for Riverside County

Map Name	Date	Map Name	Date	Map Name	Date
Alberhill	1980	Joshua Tree South	1993	SE Idyllwild	1974
Beaumont	1995	Lake Mathews	1980	SE Morongo Valley	1974
Bucksnort Mtn	1974	Lakeview	1988	SE San Gorgonio Mtn	1974
Cabazon	1995	Mecca	1974	Seven Palms Valley	1980
Cathedral City	1974	Mortmar	1974	Sunnymead	1974
Clark Lake NE	1974	Murrieta	1990	SW Idyllwild	1974
Collins Valley	1974	Myoma	1974	SW Lost Horse	1974
Corona South	1980	NE Hemet	1974	SW Morongo Valley	1974
Desert Hot Springs	1980	NE Thousand Palms	1974	SW Palm Desert	1974
Durmid	1974	NW Idyllwild	1974	SW San Gorgonio Mtn	1974
El Casco	1995	Orocopia	1974	Temecula	1990
Elsinore	1980	Pechanga	1990	Thermal Canyon	1974
Frink NW	1988	Redlands	1977	Whitewater	1995
Hemet	1980	Salton	1974	Wildomar	1980
Indio	1974	San Jacinto	1980	Yucca Valley South	1993

LEGEND

Alberhill 1980

Index of available official California Division of Mines and Geology Earthquake Fault Zone Maps, showing year of issue (R=revised), and approximate location of fault zone.

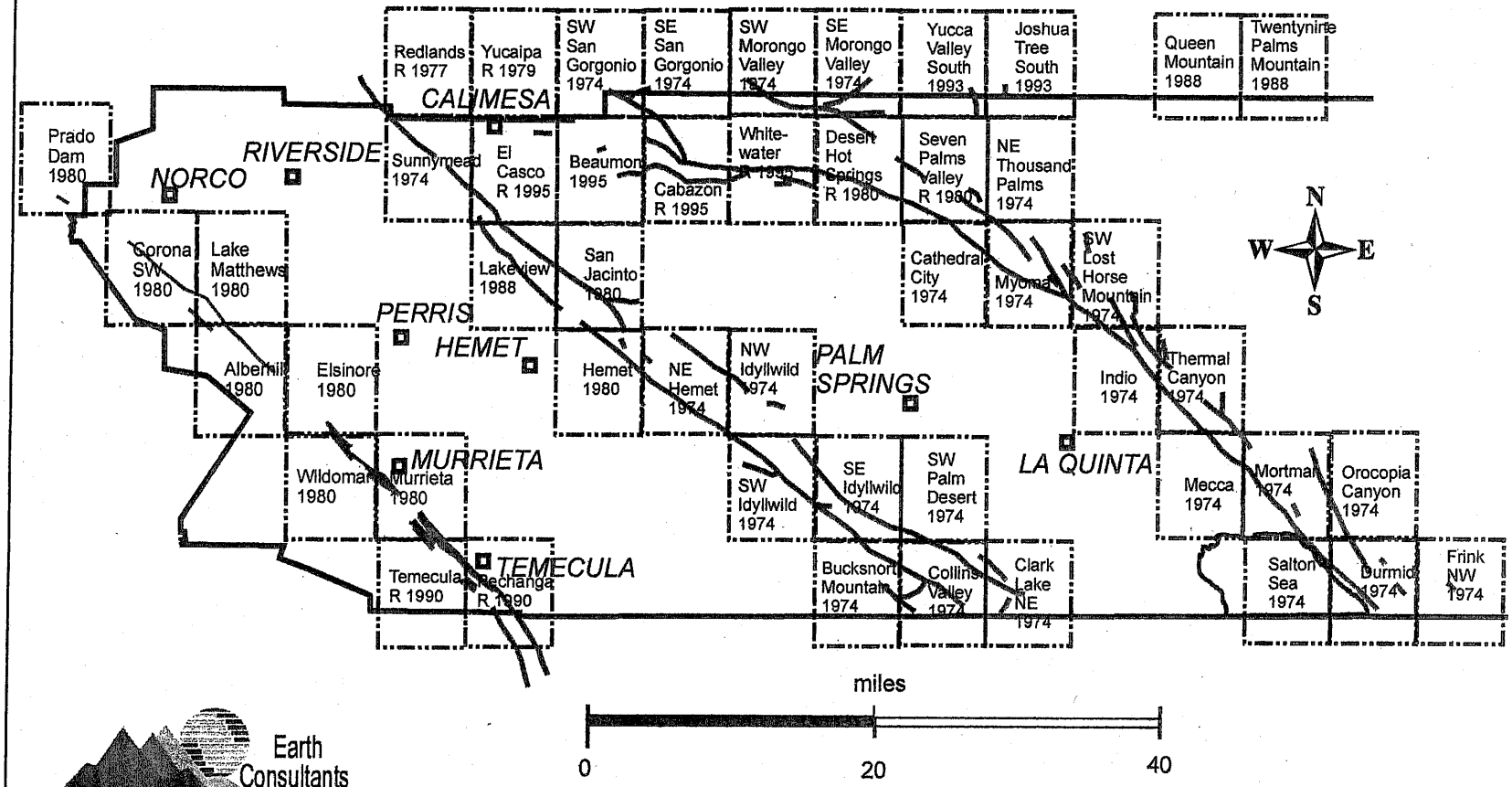


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Figure 1-8: Index of Official Earthquake Fault Zone Maps for Riverside County

1.5 Expected Earthquake Analyses

To increase the earthquake resistance of structures, institutions and communities, it is often useful to study the effects of a particular earthquake (a deterministic or design earthquake scenario). It is also important to consider the overall likelihood of damage from a plausible suite of earthquakes. This approach is called probabilistic seismic hazard analysis (PSHA), and takes into account the recurrence rates of likely, damaging earthquakes on each fault in the area, as well as the potential ground motion that may result from each of these earthquakes. As is true for most earthquake-prone regions, many potential earthquake sources pose a threat to the County of Riverside. Which earthquake to consider depends on the application of the analysis.

1.5.1 Design Earthquakes

A ***maximum probable earthquake*** (MPE) is the largest earthquake a fault is predicted capable of generating within a specified time period of concern, say 30 or 100 years. Maximum probable earthquakes are most likely to occur within the time span of most development, and therefore, are commonly used in assessing seismic risk. Nevertheless, the ***maximum credible earthquake*** (MCE), i.e. the largest earthquake a fault is believed capable of generating, is considered in a number of planning and engineering decisions. For example, MCEs are used in the design of critical facilities like dams, fire stations, and emergency operation centers. They are also used in urban and emergency planning to identify and mitigate the risk of worst-case scenarios.

For design purposes, a worst case scenario earthquake (the MCE) for Riverside County is a magnitude 7.9 based on the rupture of the entire southern segment of the San Andreas fault from Cajon Pass to the Salton Sea. While other scenarios will expose portions of the County to intense ground shaking locally that is locally as severe as the MCE, the MCE exposes most of the County to very high intensity ground shaking.

Below are estimate of several key ground shaking parameters near the fault rupture zone for the MCE, expressed as a percentage of gravity. Peak ground acceleration, the maximum acceleration achieved at a site, often turns out to be the earthquake effect that causes most damage to buildings. The periods, 0.3 seconds and 1.0 second represent lengths of seismic waves that commonly damage structures. All of these values are well above the threshold for heavy damage (see Table 1-1).

Table 1-5: Probable Earthquake Scenarios for Riverside County

Event		Maximum Magnitude (Mw)	Chance of Occurring in 30 Years	Comments
Fault	Segment			
San Andreas	San Bernardino	7.3	28%	Very high intensity ground shaking throughout the San Bernardino Valley, including north central Riverside County.
San Andreas	Coachella	7.1	22%	Very high intensity ground shaking throughout the Coachella Valley, impacting desert resort communities and agriculture.
San Jacinto	San Jacinto Valley	6.9	43%	Highest probability of occurrence of any southern California fault. Brought closer to failure as a result of stress field changes caused by the 1992 Landers earthquake.
San Jacinto	Anza Segment	7.2	17%	This event would be very destructive within the communities of Hemet and San Jacinto.
Elsinore	Temecula Segment	6.8	16%	Has not produced any significant earthquakes in historic time.
Elsinore	Glen Ivy Segment	6.8	16%	Would be very destructive in the communities of Lake Elsinore, Murrieta, and Temecula.
Whittier	Whittier	6.8	5%	Has not broken in over 1600 years (WGCEP, 1995). Would cause significant landsliding and lifeline damage in the Chino Hills - Corona area.

These design parameters for the MCE are utilized in the loss estimation presented in Section 1.8 of this report. With horizontal ground displacements as great as twenty-five feet along the fault and intense ground shaking that could last more than 60 seconds, damage and losses in the County as a result of the MCE or other major San Andreas fault earthquake would be extensive.

Additionally, the County of Riverside must consider events on several faults. Earthquakes that are likely to occur during the design life of most buildings could be generated by segments of the Elsinore, San Jacinto or San Andreas faults. These have been evaluated by the Working Group on California Earthquake Probabilities (1995) and illustrated in Figure 1-3. Based on this segmentation, there are seven probable earthquakes that threaten Riverside County, as shown in Table 1-5. The event with the greatest probability of occurrence in 30 years (43%)

is a M_w 6.9 rupture of the San Jacinto Valley segment of the San Jacinto fault. The San Jacinto event is considered the Maximum Probable Earthquake (MPE) for Riverside County.

Section 1.8 of this report provides loss estimates for eight specific (scenario) earthquakes and provides additional detail on the MCE and MPE based on these ground shaking parameters. These events will cause damage to vulnerable structures, such as potentially hazardous buildings, and may result in localized ground failures in the County. Fortunately, thanks to the County's mostly modern building stock, life-safety is threatened to a much lesser degree than it would be with older buildings. However, estimated economic losses are substantial (see 1.8).

1.5.2 Probabilistic Earthquake Hazard Assessment.

This type of hazard assessment is utilized by the U.S. Geological Survey in producing national seismic hazard maps that are modified and adopted into the Uniform Building Code (UBC). The most recent mapping produced for the 1997 UBC includes data from the California Division of Mines and Geology (DMG, 1996). Development of these maps requires three steps: 1) delineating earthquake sources; 2) defining the potential distribution of seismicity for each of these sources; and 3) calculating the potential ground motions from attenuation relations for all the model earthquakes. Attenuation relations estimate the amount that shaking will be modified (amplified or reduced) as waves travel from the fault plane to a locale.

USGS and DMG scientists in the National Seismic Hazard Mapping Program have produced maps indicating the probabilistic ground shaking parameters for the County of Riverside (Figure 1-9). Table 1-6 has been prepared to list the probabilistic ground shaking, in terms of peak horizontal ground acceleration on bedrock, associated with twenty-four of the County's incorporated cities. This table indicates that, with the exception of Blythe, the cities are exposed to very high and extremely high values that for the most part exceed 50% of the force of gravity with a 10% chance of occurring in 50 years. In addition, the communities along the San Jacinto fault (Moreno Valley, San Jacinto and Hemet) have a greater risk of ground shaking than those along the San Andreas. This is a result of the higher probability of a future San Jacinto earthquakes versus San Andreas earthquakes.

Values of peak horizontal ground acceleration at bedrock and are expressed as a percent of the force of gravity. Generally, values greater than 25-30% of gravity are capable of substantial damage to structures (see Table 1-1). Liquefaction and landslides can occur at 10% of gravity. When values exceed 100% of gravity, the

force of gravity is exceeded and objects become airborne.

These probabilistic ground motion values for the County of Riverside are among the highest in southern California and are the result of the County's proximity to major fault systems with high earthquake recurrence rates.

The careful reader will have observed that the predicted ground accelerations in Table 1-2 are lower than those values in Table 1-6. In part, near-fault ground motions may be underestimated by the methods of Table 1-2. Additionally, the difference exists because Table 1-2's values are based on deterministic analyses. Because Riverside County is close to so many active faults, the probabilistic assessment of risk is higher than that for any individual fault.

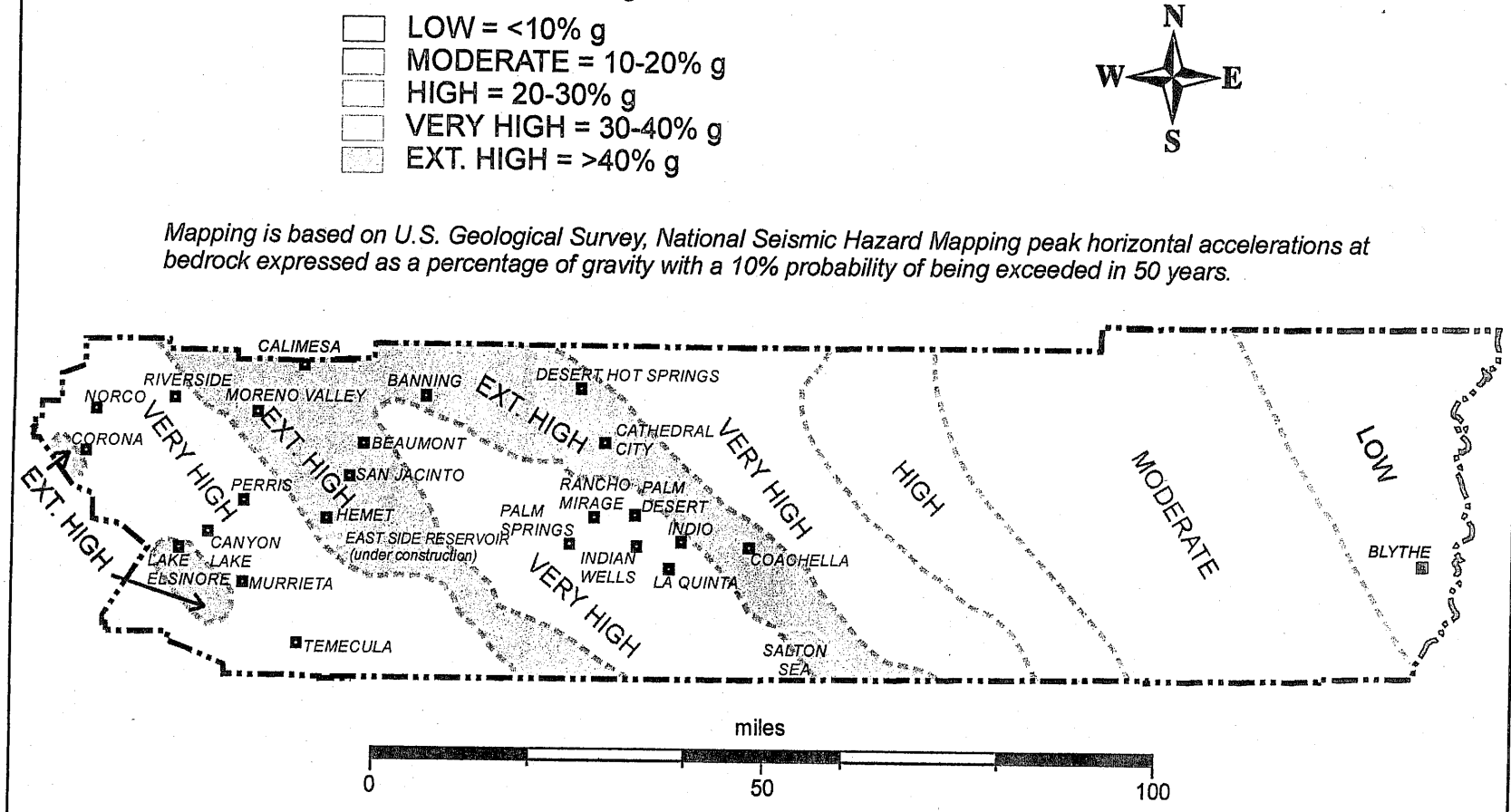

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Figure 1-9: Probabilistic Acceleration Contour Mapping for Riverside County

Table 1-6: Probabilistic Earthquake Accelerations for Riverside County

CITY	10% PE* in 50 yr	5% PE in 50 yr	2% PE in 50 yr
Moreno Valley	84.40	101.52	123.07
San Jacinto	82.30	99.44	120.14
Hemet	80.20	97.31	119.11
Desert Hot Springs	75.14	96.57	118.77
Beaumont	66.01	76.64	98.91
Calimesa	66.01	76.64	98.91
Coachella	61.90	78.13	103.10
Indio	61.90	78.13	103.10
Lake Elsinore	59.11	77.14	102.07
Corona	56.06	74.42	99.79
Murrieta	56.06	74.42	99.79
Temecula	56.06	74.42	99.79
Norco	56.06	74.42	99.79
Banning	55.86	69.91	79.83
Rancho Mirage	54.73	70.98	90.79
Perris	54.73	70.98	90.79
Canyon Lake	54.73	70.98	90.79
Riverside	53.64	65.41	76.20
La Quinta	48.45	61.17	76.00
Indian Wells	48.45	61.17	76.00
Palm Desert	48.45	61.17	76.00
Palm Springs	48.16	57.22	73.47
Cathedral City	48.16	57.22	73.47
Blythe	9.51	11.77	15.31

PE is probability of exceedence, e.g., the given value has a 10% chance of being exceeded in 50 years. Values are peak horizontal ground acceleration on bedrock and are expressed as a percent of the force of gravity.

1.5.3 Foreshocks on Strike-Slip Faults

A ***foreshock*** is an earthquake that is smaller than a mainshock, precedes it, and is causally related to it. Foreshocks are quite common. For California, Jones (1984) has determined that half of the magnitude 5.0 and greater, strike-slip earthquakes are preceded by immediate foreshocks (earthquakes within 72 hours and 10 kilometers of their mainshock). Almost all foreshocks occur less than 72 hours before the mainshock. If and when it becomes possible to distinguish foreshocks from background seismicity, foreshocks will become an effective short-term prediction tool. So far, scientists can only recognize foreshocks in hindsight, *after* the mainshock has occurred. Yet the existence of foreshocks can still help prepare for destructive earthquakes on the San Andreas fault.

In 1991, a Working Group, chaired by Jones and Sieh, made the following observations from Agnew and Jones (1991) and Jones (1984, 1985):

- When an earthquake occurs, it is either a foreshock or a "background" event.
- Since it is possible that the earthquake may be a foreshock, it increases the probability that a larger earthquake will occur within 72 hours and 10 km.
- How much the probability increases will depend on how anomalous it is, that is, on the background seismicity patterns in the vicinity.
- Smaller earthquakes are more common than larger earthquakes. A magnitude 1.0 earthquake anywhere along the San Andreas fault will only marginally increase the chance of a larger earthquake occurring within 72 hours.
- On the other hand, if a magnitude 5.0 earthquake occurs within 10 km of the San Andreas fault, the probability of a major (magnitude at least 7.5) earthquake within 72 hours increases significantly.
    - Around San Bernardino, where there is a fairly high level of background seismicity near the San Andreas fault, the occurrence of a magnitude 5.0 raises the short-term probability of a larger event by 1-5%.
    - Around Mecca Hills, northeast of the Salton Sea, there is very little background seismicity. A magnitude 5 is quite anomalous, and raises the short-term probability at least 25%.

Table 1-7 shows the Working Group calculations of the threshold magnitude required to raise the short-term probability by different specific amounts for different portions of the San Andreas fault. The areas are distinguished by their varying levels of background seismicity.

Table 1-7: Magnitude of possible foreshock required to reach a specified probability level for four microseismic regions of the southern San Andreas fault (Working Group, 1991).

Level Probability of M_w 7.5 in 72 hr	B 5-25%	C 1-5%	D 0.1-1%
San Bernardino	5.8	5.0	3.9
San Gorgonio	6.1	5.3	4.2
Palm Springs	5.2	4.5	3.4
Mecca Hills	4.9	4.2	3.1

From these observations and calculations, the Working Group developed a short-term hazard notification system for the southern San Andreas fault (Table 1-8). The system designated when U.S. Geological Survey scientists would notify their supervisors and emergency response personnel, regarding increased short-term probabilities along the southern San Andreas. Note that there is no "A level" alert, because the Working Group felt that there was not yet a "meaningful way to estimate short-term probability above 25%".

Table 1-8: Alert levels and response for anomalous earthquake activity along the southern San Andreas fault (from Working Group, 1991).

Level	Probability of M_w> 7.5 earthquake in next 72 hours	Expected time between occurrences of alerts at this level	USGS action
D	0.1% to 1%	6 months	Notify scientists involved in data collection and OES Ontario office
C	1% to 5%	5 years	As for Level D; also notify Comm. Officer, OES Sacramento, and USGS Menlo Park chief.
B	5% to 25%	28 years	As for Levels C and D, and also notify USGS Director, and CDMG State Geologist; start intensive monitoring

OES is Office of Emergency Services; CDMG is California Division of Mines and Geology

This system could be adapted by the County of Riverside to respond to short-term increases in hazard from the San Andreas fault. For example, at level D, emergency response equipment might be moved out of any collapsible structures, and some gas lines could be put on automatic cut-off. At level B, all non-essential leave for key personnel could be postponed.

Certainly, thoughtfulness and care must be exercised to construct a system that will enhance public safety without promoting rumors or fear. Also, the system must not be a substitute for long-term mitigation efforts. Such potential difficulties do not reduce the usefulness of short-term, pre-event response plans.

Over time, new data and additional research should allow similar systems to be developed for other major southern California faults.

1.5.4 Uses and Limitations of Seismic Hazard Mapping

The Seismic Hazard Maps developed for this study do not show areas that automatically should be excluded from development. Instead, they show areas where the potential for damage from the mapped hazard is great. Thus it is prudent to conduct geologic investigations to identify and mitigate the hazard prior to development. It is less costly to incorporate hazard mitigation into a structure before it is built than to later try to add mitigating features.

One-plan-fits-all design of mitigation features is not feasible. The hazards present at each site and the multiplicity of structural configurations makes it impossible to predict how much mitigation will cost without scrutiny of the individual site. In some areas, it may be possible to adequately mitigate liquefaction hazard by strengthening the foundation to withstand displacements of 1½ feet, typically costing only $3,000-4,000. Expert engineers indicate that in many locations this simple measure could reduce the payout for repair of liquefaction damage from an average of $65,000 to $70,000 to about $10,000 to $15,000. Insurance industry representatives indicate that such potential savings could be passed on to consumers in the form of lower earthquake insurance premiums. In other cases, however, the cost of mitigation is likely to be much greater. For example, expensive sites include those likely to experience more that 1 foot of liquefaction-caused displacement or with significant landslide hazard.

In the past, land-use planners have often assumed that lower density developments were appropriate where geologic hazards are present. However, planners may find that the high cost of mitigating liquefaction hazards along streams, bays, canals,

and coastal zones requires a higher density of development to be economically feasible.

Due to the complex nature of earthquake occurrence, damage and mitigation, there will always be uncertainties associated with seismic hazard mapping. It must be remembered that:

- Seismic Hazard Zone Maps may not show all areas that have the potential for liquefaction, landsliding, strong ground shaking or other earthquake and geologic hazards.
- A single earthquake capable of causing liquefaction or triggering landslide failures will not uniformly affect the entire area zoned.
- The identification and location of liquefaction and earthquake-induced landslide hazard areas are based on available data, of variable quality. The information depicted on the maps has been drawn as accurately as possible at 1:24,000-scale.
- Information on the Seismic Hazard Zone Maps is not sufficient to serve as a substitute for the geologic and geotechnical site investigations required under the Seismic Hazard Mapping Act or the Alquist-Priolo Earthquake Fault Zoning Act.

1.6 Secondary Earthquake Hazards

Secondary earthquake hazards are those separate from, but induced by, the primary effects of strong ground shaking and fault rupture. Secondary geologic hazards include ground and slope failures and seiches, discussed below. (More broadly, secondary hazards also include non-geologic effects such as fires and toxic chemical spills).

1.6.1 Liquefaction

Liquefaction is a process by which water-saturated materials (including soil, sediment, and certain types of volcanic deposits) lose strength and may fail during strong ground shaking. Liquefaction is defined as "the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore-water pressure" (Youd, 1973). Liquefaction occurs worldwide, commonly during moderate to great earthquakes. In California, liquefaction-related ground failures occurred in 1857 (Fort Tejon earthquake), 1906 (San Francisco earthquake), 1933 (Long Beach earthquake), 1971 (San Fernando earthquake), 1973 (Point Mugu earthquake), 1979 and 1981 (Imperial Valley earthquakes), 1989 (Loma Prieta earthquake), and 1994 (Northridge earthquake), and others. Four kinds of ground failure commonly result from liquefaction: lateral spread, flow failure, ground oscillation, and loss of bearing strength.

Lateral Spread: Lateral displacement of surficial blocks of sediment as the result of liquefaction in a subsurface layer is called a lateral spread. Once liquefaction transforms the subsurface layer into a fluidized mass, gravity plus inertial forces caused by the earthquake may move the mass downslope towards a cut slope or free face (such as a river channel or a canal). Lateral spreads most commonly occur on gentle slopes that range between 0.3° and 3°, and commonly displace the surface by several meters to tens of meters. Such movement typically damages pipelines, utilities, bridges, and other structures having shallow foundations. During the 1906 San Francisco earthquake, lateral spreads causing displacement of only a few feet damaged every major pipeline. Thus, liquefaction compromised the ability to fight fires - and fires caused about 85 percent of the damage to San Francisco.

Flow Failure: The most catastrophic mode of ground failure caused by liquefaction, flow failure usually occurs on slopes greater than 3°. The flows are principally liquefied soil or blocks of intact material riding on a liquefied subsurface zone. Displacements are commonly tens of meters, but in favorable circumstances, material gets displaced for tens of miles, at velocities of tens of miles per hour. The extensive damage to Seward and Valdez, Alaska, during the 1964 Great Alaskan earthquake was caused by submarine flow failures.

Ground Oscillation: When liquefaction occurs at depth but the slope is too gentle to permit lateral displacement, the soil blocks that are not liquefied may separate from one another and oscillate on the liquefied zone. The resulting ground oscillation may be accompanied by the opening and closing of fissures (cracks) and sand boils (upward flowing sediment). These can potentially damage structures and underground utilities.

Loss of Bearing Strength: When a soil loses strength and liquefies, loss of bearing strength may occur beneath a structure, possibly causing the building to settle and tip. If the structure is buoyant, it may float upward. During the 1964 Niigata, Japan, earthquake, buried septic tanks rose as much as 3 feet and structures in the Kwangishicho apartment complex tilted as much as 60°.

Research into liquefaction in past earthquakes has linked liquefaction to certain hydrologic and geologic settings. Water-saturated, cohesionless, granular materials at depths of less than 50 feet are prone to liquefaction. To identify an area having significant potential for liquefaction, a liquefaction susceptibility map and a liquefaction opportunity map must be developed. The former depicts areas where the geology and hydrology are favorable for liquefaction. The latter summarizes information about the potential for strong earthquake shaking. When considered together, the two maps determine the liquefaction potential- the relative likelihood that an earthquake will cause liquefaction in an area.

1.6.2 Guidelines for Delineating Liquefaction Hazard Zones

In 1997 and 1998, the California Division of Mines and Geology (1997 and 1998) developed guidelines for delineating, evaluating, and mitigating seismic hazards in California. In 1999, a Southern California Earthquake Center sponsored group published "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction in California". The SCEC (1999) publication was a result of requests from city and county Building Officials for assistance in the development of procedures to implement the Seismic Hazards Mapping Act (see Section 1.1.3) for projects requiring their review. The guidelines in assessing liquefaction potential for this study are based on DMG (1997 and 1998), as well as SCEC (1999), and are summarized below:

Liquefaction Mapping Criteria: Liquefaction Hazard Zones are areas meeting one or more of the following criteria:

- Areas known to have experienced liquefaction during historic earthquakes. Field studies following past earthquakes indicate liquefaction tends to recur

at many sites during successive earthquakes (Youd, 1984). There are many published accounts of liquefaction occurrences. Areas so delineated should be included in the Liquefaction Hazard Zones.

- All areas of uncompacted fills containing liquefaction-susceptible material that are saturated, nearly saturated, or may be expected to become saturated. In some areas there has been a practice of creating useable land by dumping artificial fill on tidal flats or in large deep ravines. Standard geologic criteria are of little use in characterizing soils within these fills which are less homogeneous than natural deposits. For example, there is no reason to assume lateral stratification in these fills and the validity of extrapolating subsurface data is questionable. Evidence for filling can be found by examining maps showing old shorelines, by comparing old and modern topographic maps, by studying logs of boreholes, and by obtaining reports or original plans of specific projects involving reclaimed land.

- Areas where sufficient existing geotechnical data and analyses indicate that the soils are potentially liquefiable. The vast majority of liquefaction hazard areas are underlain by recently deposited sand and/or silty sand. These deposits are not randomly distributed, but occur within a narrow range of sedimentary and hydrologic environments.

Geologic criteria for assessing these environments are commonly used to define bounds of susceptibility zones derived from other criteria, such as geotechnical analysis (Youd, 1991). Groundwater data should be compiled from well logs and geotechnical borings. Analysis of aerial photographs of various vintages may reveal zones of flooding, sediment accumulation, or evidence of historic liquefaction. Quaternary geology should be mapped and age estimates assigned based on ages reported in the literature, stratigraphic relationships and soil profile descriptions. In many areas of Holocene and Pleistocene deposition, geotechnical and hydrologic data are compiled. Geotechnical investigation reports with Standard Penetration Test (SPT) and/or Cone Penetration Test (CPT) and grain size distribution data can be used for liquefaction resistance evaluations.

For sand and silty sand, there are currently two reliable, in-situ (in place) approaches for quantitative evaluation of the soil's resistance to cyclic pore pressure generation and/or liquefaction. These are: (1) correlations and analyses based on in-situ Standard Penetration Test (SPT) (ASTM D1586) (ASTM, 1990) data, and (2) correlations and analyses based on in-situ Cone Penetration Test (CPT) (ASTM D3441) (ASTM, 1990) data.

Seed and others (1971, 1983, 1985), provide guidelines for performing "standardized" SPT, and also provide correlations for conversion of penetration resistance obtained using most of the common alternate combinations of equipment and procedures in order to develop equivalent "standardized" penetration resistance-- (N1)60. This "standardized" penetration resistance can then be used as a basis for evaluation of liquefaction resistance.

Cone penetration test (CPT) tip resistance (qc) may also be used as a basis for evaluation of liquefaction resistance, either by direct empirical comparison between qc-values to "equivalent" SPT resistance or by use of correlations between (N1)60 data and case histories of seismic performance (Robertson, et al., 1985; Seed and De Alba, 1986).

Some gravelly soils are also potentially vulnerable to liquefaction. The best available technique for quantitative evaluation of the liquefaction resistance of this type of deposit involves correlation and analysis based on in-situ penetration resistance measured using the very large scale Becker Hammer system (Harder, 1988).

The correlations of Seed et al. (1985), and the (N1)60 data can be used to assess liquefaction susceptibility. Since geotechnical analyses are usually made using limited available data, the susceptibility zones should be delineated by use of geologic criteria. Geologic cross sections, tied to boreholes and/or trenches, should be constructed for correlation purposes. The units characterized by geotechnical analyses are correlated with surface and subsurface units and extrapolated for the mapping project.

Liquefaction opportunity is a measure, expressed in probabilistic terms, of the potential for ground shaking strong enough to generate liquefaction. Analyses of in-situ liquefaction resistance require assessment of liquefaction opportunity. The minimum level of seismic excitation to be used for such purposes with LQ-Zones (potential liquefaction zones defined by the State Geologist under the Seismic Hazards Mapping Act that require site-specific geotechnical investigation for liquefaction hazards) will be that level defined by M_w 7.5-weighted peak ground acceleration (PGA) for UBC SD (stiff soil) soil conditions with a 10% probability of exceedance over a 50-year period.

Liquefaction mapping criteria in areas where geotechnical data are insufficient: In areas of limited or no geotechnical data, susceptibility zones are identified by geologic criteria as follows:

- Areas containing soil deposits of late Holocene age (current river channels and their historic floodplains, marshes and estuaries), where the M7.5-weighted peak acceleration that has a 10% probability of being exceeded in 50 years is greater than or equal to 0.10 g and the water table is less than 40 feet below the ground surface; or

- Areas containing soil deposits of Holocene age (less than 11,000 years), where the M7.5-weighted peak acceleration that has a 10% probability of being exceeded in 50 years is greater than or equal to 0.20 g and the historic high water table is less than or equal to 30 feet below the ground surface; or

- Areas containing soil deposits of latest Pleistocene age (between 11,000 years and 15,000 years), where the M7.5-weighted peak acceleration that has a 10% probability of being exceeded in 50 years is greater than or equal to 0.30 g and the historic high water table is less than or equal to 20 feet below the ground surface.

Based on probabilistic mapping described earlier, only the easternmost portion of the County (Blythe region) has acceleration values below the criteria thresholds (Table 1-6).

Application of these criteria allows compilation of hazard maps that are useful for preliminary evaluations, general land-use planning and delineation of special studies zones where site-specific studies may be required before major development is approved (Youd, 1991). In developing a liquefaction hazard map for Riverside County, the Quaternary geology is taken from existing maps (Geologic Map for Riverside County, California), and described in detail within Chapter 2-Geologic Hazards of this Technical Background Report. Hydrologic data are compiled (Ground Water Contour Map for Riverside County, California; Plate 1-4), as described below.

1.6.2.1 Geographic Information System Coverage of Shallow Ground Water for Riverside County (Plate 1-4)

Coverage Description: Depth to Groundwater in Riverside County
Coverage distribution file name: gwcntrs.e00; gwwells.e00
Coverage Area: Riverside County
Source: Earth Consultants International
Accuracy: Only areas where groundwater exists within the upper 200 feet were mapped.

Groundwater was mapped using data from the Regional Water Quality board, Santa Ana Watershed Project Authority (SAWPA), and U.S. Geological Survey reports on groundwater within Riverside County. The groundwater is reported as the highest recorded elevation. Groundwater is only mapped in areas where sufficient data were available. There may be areas of perched water that have not been mapped throughout the county. Contours were created based on data collected from the various water districts through Santa Ana Watershed Project Authority. Reports located at the Regional Water Quality board were used to augment the data collected from the various water districts. All data were analyzed for highest historical recorded elevation. These data should be considered for regional analysis only.

The Western Municipal Water District (Mains, Steven E., *personal communication*, 1999) provided groundwater data from 56 agencies for over 2,300 wells. These data contain water levels from monitoring wells at selected service stations within Riverside and San Bernardino counties. The data include abandoned or destroyed wells. Many measuring point elevations are estimated from topographic maps and may be 5 to 10 feet in error. Also many agencies supply data using air lines that may have an accuracy of " several feet. Data were also obtained from the California Regional Water Quality Control Board, Santa Ana Region; Leaking Underground Storage Tank Information System (LUSTIS).

1.6.3 Liquefaction Hazard Zones in Riverside County

Based on the criteria described above and illustrated on the flow chart presented in Figure 1-10, a detailed Liquefaction Susceptibility Map for Riverside County was produced at a 1:250,000 scale (Plate 1-5). These data are summarized on the Generalized Liquefaction Susceptibility Map (Figure 1-11). Figure 1-11 includes the liquefaction potential zones described in Table 1-9.

Riverside County development policies should be implemented based on this liquefaction potential mapping (Table 1-9). Site-specific geotechnical liquefaction hazard investigations should be required for proposed construction projects in zones of moderate, high and very high liquefaction potential. The policy for construction projects involving critical facilities should extend to include all liquefaction ranks from "very low" to "very high". Based on relatively low potential for ground shaking, the region near Blythe (< 0.1 g, 10% probability of exceedance in 50 years) should be excluded from policies requiring hazard investigations for general construction projects. However, projects involving critical facilities should address liquefaction hazards if they are proposed within a potential liquefaction zone.

Table 1-9 SUPERCEDED APRIL 2004.

General Liquefaction Potential Zones for Riverside County

Rank	Ground Water Depth#	General+ Sediment Type	Recommended Policies*	
			General Construction	Critical Facilities
High	< 30 feet	very susceptible	study required	study required
Moderate	< 30 feet	susceptible	study required	study required
	30-50 feet	very susceptible	study required	study required
Low	> 30 feet	susceptible	none	study required
Very Low	30-50 feet	susceptible	none	study required
	50-100	very susceptible	none	study required
Extremely Low	50-100 feet	susceptible	none	study required
None	> 100 feet	susceptible	none	none
	no data	bedrock	none	none

*: Ground shaking potential in easternmost Riverside County is considered below the threshold for liquefaction, and site-specific investigations should not be required for general construction projects
#: Ground water depth is based on the historic high measurement
+: Very susceptible sediment type includes generally granular Holocene sediments; susceptible includes generally granular Pleistocene sediments.

	Very High	High		Moderate				Low			Very Low	
Depth to Groundwater	0-30'	0-30'	30-50'	0-30'	30-50'	50-100'	>100' or No data	30-50'	50-100'	>100' or No data	50-100'	>100' or No data
Holocene Sediments	Fine-grained Unconsolidated	Coarse-grained	Fine-grained		Coarse-grained	Fine-grained			Coarse-grained			
Pleistocene Sediments		Fine-grained		Coarse-grained	Fine-grained			Coarse-grained	Fine-grained		Coarse-grained	

Earth Consultants International

Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

Liquefaction Hazard Rating Criteria

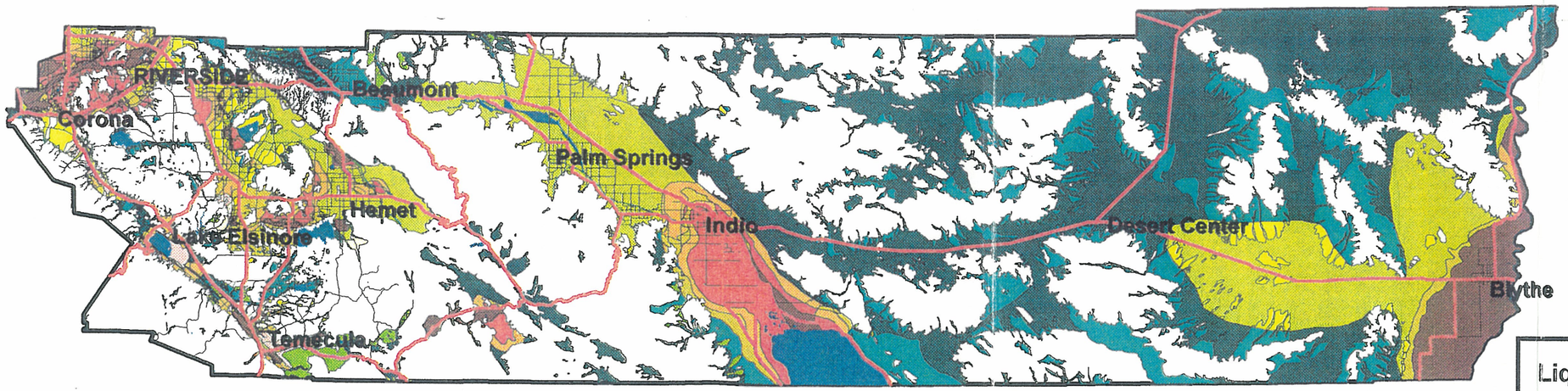
Figure 1-10

Figure 1-11:

Generalized Liquefaction Susceptibility Map Riverside County, California

(Summary of GIS Data, for additional detail see Plate 1-5 in-pocket)

Earth Consultants International



Liquefaction Susceptibility

Very High	101	Shallow Groundwater Susceptible Sediments
High	102	
Moderate	103	
Low	104	
Very Low	105	
Moderate	106	Deep Groundwater Susceptible Sediments
Low	107	
Very Low	108	
Moderate	109	No Groundwater Data Susceptible Sediments
Low	110	
Very Low	111	

Major Roads — Highways — Water Bodies — Lake, Pond, Sea

N W E S

Scale: 1:1,000,000

10 0 10 20 30

Miles

1.6.3.1 Geographic Information System Coverage of Liquefaction Hazards in Riverside County (Plate 1-5)

Coverage Description: Liquefaction Hazards in Riverside County
Coverage distribution file name: liquef.e00
Coverage Area: Riverside County
Source: Earth Consultants International
Scale: 1:250,000

Hazard mitigation policies for proposed projects in Riverside County based on the detailed liquefaction mapping shown on Plate 1-5 should be implemented as follows:

General Construction: special site-specific liquefaction hazard studies should be required in all areas mapped as "Shallow Ground Water, Susceptible Sediments" with the exception of the Blythe region.

Critical Facilities/Lifelines: special site-specific liquefaction hazard studies should be required in all areas of susceptible sediments, including the Blythe region.

1.6.4 Seismically-Induced Settlement

In some situations, strong ground shaking can cause the densification of soils, resulting in local or regional settlement of the ground surface. Local differential settlements damage structures. Regional settlements can damage pipelines by, for example, changing the gravity gradient on water and sewer lines and canals.

Whether seismically induced settlement will occur depends on the intensity and duration of ground shaking, and the relative density (the ratio between the in-place density and the maximum density) of the subsurface soils. Sediments in the County's alluvial valleys were deposited fairly rapidly, which may lead to conditions of low density sediments that can settle in an earthquake. Therefore, many of the valley regions that contain relatively recent sediments may be susceptible to some degree of seismic settlement. The areal extent of relatively young sediments with moderate to locally high potential for settlement may be correlated with areas of valley fill represented on subsidence susceptibility mapping described in Chapter 2-Soil and Slope Instability.

As demonstrated by past earthquakes, seismic settlement is primarily damaging in areas subject to differential settlement. These can include cut/fill transition lots build on hillsides, where a portion of the house is built over an area cut into the hillside while the remaining portion of the house projects over man made fill. During an earthquake, even slight settlement of the fill can lead to a differentially settled structure and significant repair costs. Therefore, cut and fill transition lots should be overexcavated and fill depths beneath structures should never vary by more than 100%.

Developments in areas subjected to seismically induced settlement should include specific subsurface geotechnical investigations that address the potential for seismically induced settlement on a site-specific basis. This hazard can be mitigated with proper site preparation that involves the densification of the subsurface soils, and with proper foundation design that can accommodate a limited degree of differential settlement due to seismic shaking.

1.6.5 Seismically-Induced Slope Instability

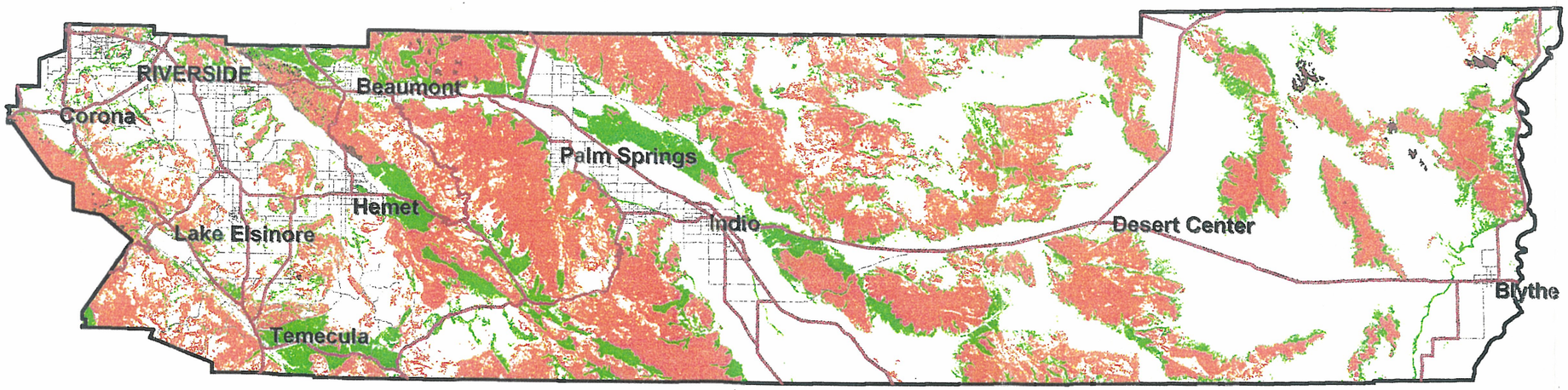
Seismically induced landsliding and rock falls can be expected to occur throughout the County in a major earthquake. Chapter 2 - Slope and Soil Instability Hazards of this Technical Background Report discusses slope stability and landsliding in the County in more detail, including the development of the Geographic Information System (GIS) coverage presented on the Landslide Susceptibility Zone Map for Riverside County. Development policies, based on the GIS mapping, include avoidance and mitigation of the hazard during construction. These mitigation measures will reduce the potential losses associated with this hazard. Figure 1-12 has been prepared to illustrate the regions of the County with existing landslides and slopes that are susceptible to instability during a significant earthquake.

Wilson and Keefer (1985) have reported that a ground acceleration of at least 0.10 g in steep terrain is necessary to induce earthquake-related rock falls, although exceeding this value does not guarantee that rock falls will occur. Since there are several faults capable of generating peak ground accelerations of over 0.10 g in Riverside County, there is a high potential for seismically induced rock falls and landslides to occur.

Figure 1-12:

Earthquake-Induced Slope Instability Map

(Summary of GIS Data, for additional detail see Plate 2-3 in-pocket)



N
W
E
S

Scale: 1:1,000,000

10 0 10 20 30

Miles

Earth Consultants International

- Existing Landslides
- High susceptiblity to seimically induced landslides and rockfalls.
- Low to locally moderate susceptibility to seimically induced landslides and rockfalls.

Highways

Major Roads

A separate Southern California Earthquake Center (SCEC) committee dealing with the issues of implementation of SP 117 (DMG, 1997) for landslide hazards has been formed and is working on a companion to the liquefaction hazards document discussed earlier. Factors controlling the stability of slopes include: 1) the slope height and inclination, 2) the engineering characteristics of the earth materials comprising the slope, and 3) the intensity of ground shaking. Engineered slopes should be designed to resist seismically induced failure. Slope design should be based on pseudo-static stability analyses using soil engineering parameters. These should be established on a site-specific basis from detailed geotechnical investigations that include subsurface soil sampling and laboratory testing. The stability analyses should factor in the intensity of ground shaking expected in the County.

1.6.6 Seiches

The County's water tanks, reservoirs, lakes and swimming pools are enclosed bodies of water that are subject to potentially damaging oscillations on the water surface, called ***seiches***. A seiche can result from a number of factors including wind-driven currents, tides, variation in atmospheric pressure and ground shaking associated with near or distant earthquakes. In southern California, the greatest threat of seiches comes from earthquakes.

Whether an earthquake will create seiches depends upon a number of earthquake-specific parameters, including period or length of the seismic waves, earthquake location, and the style of fault rupture (e.g., dip-slip or strike-slip). Whether a seiche will cause damage can depend upon the size, shape and location of the body of water, storage tank strength, integrity of dam construction, underlying soil type, proximity of human-built structures, and local relief (variations in elevation).

Amplitudes of seiche waves associated with earthquake ground motion have typically been less than 0.5 meters high; however, some have exceeded 2 meters. A seiche in Hebgen reservoir, caused by an earthquake in 1959 near Yellowstone National Park, repeatedly overtopped the dam, causing considerable damage to the dam and its spillway (Stermitz, 1964). The 1964 Alaska earthquake produced seiche waves 0.3 m high in the Grand Coulee Dam reservoir, and seiches of similar magnitude in fourteen bodies of water in the state of Washington (McGarr and Vorhis, 1968). California earthquakes have generated (non-damaging) seiches in Florida swimming pools!

Lakes: Due to their relatively large size, proximity to major faults, and development near their shores, in Riverside County, Lake Elsinore and the Salton Sea create especial hazard from seiches.

Dams: An important method to decrease seiche hazard behind dams is to increase the freeboard distance (top of dam to top of water). This can be accomplished by either building up the dam, or by reducing the allowable reservoir storage capacity. Other mitigation measures include:

- replacing dams;
- adding buttresses and berms;
- flattening slopes;
- increasing drainages; and
- grouting foundations.

It seems likely that the threat to dam stability is increased if a dam simultaneously experiences forces associated with strong seismic ground shaking and seiches. Thus, to increase dam safety, these two hazards need to be considered together.

Swimming Pools: Damage from swimming pool seiches is a common problem. During seismic ground shaking, seiches created in private and public pools can expell considerable water. This often damages homes downslope, and sliding glass doors near the pool.

Water Tanks: Seiches damaged storage tanks during the 1992 Landers-Big Bear earthquakes and the 1994 Northridge earthquake. As a result, the American Water Works Association (AWWA) Standards for Design of Steel Water Tanks (D-100) now provide new criteria for seismic design (Lund, 1994).

1.7 Vulnerability of the Built Environment to Earthquake Hazards

This section assesses the earthquake vulnerability of structures and facilities common in the County of Riverside, as well as the status of existing earthquake hazard mitigation programs, including code and ordinance adoption and enforcement. This analysis is based on past earthquake performance of similar types of buildings in the U.S. Beyond the scope of this study are the effects of design earthquakes on particular structures within the County of Riverside. However, utilizing a recent standardized methodology developed for the Federal Emergency Management Agency (FEMA), general estimates of losses are provided in Section 1.8 of this report.

Although it is not possible to prevent earthquakes from occurring, their destructive effects can be minimized. Comprehensive hazard mitigation programs that include the identification and mapping of hazards, prudent planning and enforcement of building codes, and expedient retrofitting and rehabilitation of weak structures can significantly reduce the scope of an earthquake disaster.

With these goals in mind, the State Legislature passed Senate Bill 547, addressing the identification and seismic upgrade of Unreinforced Masonry (URM) buildings. In addition, the law encourages identification and mitigation of seismic hazards associated with other types of potentially hazardous buildings, including pre-1971 concrete tilt-ups, soft-stories, mobile homes, and pre-1940 homes.

The County of Riverside's building stock is predominantly modern, and modern buildings do save lives. However, economic losses associated with structural and non-structural damage, loss of contents and repairs can be tremendous. For example, the losses associated with the Northridge earthquake approached $30 billion.

As discussed earlier, various geologic phenomena can be triggered by earthquakes to cause loss of life and property damage. Earthquakes can also cause localized, equally destructive hazards such as urban fires, dam failures, and toxic chemical releases. During the 1994 Northridge earthquake, many mobile homes shifted or fell off their foundations, which ruptured gas lines and started fires. This type of hazard is intensified by the relatively high density of homes within mobile home parks.

1.7.1 Potentially Hazardous Buildings and Structures

Most of the loss of life and injuries due to an earthquake are related to the collapse of hazardous buildings and structures. FEMA (1985) defines a hazardous building as "any inadequately earthquake resistant building, located in a seismically active area, that presents a potential for life loss or serious injury when a damaging

earthquake occurs". Building codes have generally been made more stringent following damaging earthquakes. However, pre-existing structures in the County of Riverside have generally not been upgraded to current building code standards, and may be hazardous during an earthquake. Structure built before the 1933 Long Beach earthquake are especially at risk.

Building damage is commonly classified as either structural or non-structural. ***Structural damage*** impairs the building's structural support. This includes any vertical and lateral force-resisting systems, such as frames, walls, and columns. ***Non-structural damage*** does not affect the integrity of the structural support system. Non-structural damage includes broken windows, collapsed or rotated chimneys, and fallen ceilings. During an earthquake, buildings get thrown from side to side, and up and down. Heavier buildings are subjected to higher forces than lightweight buildings, given the same acceleration. Damage occurs when structural members are overloaded, or differential movements between different parts of the structure strain the structural components. Larger earthquakes and longer shaking durations tend to damage structures more. The level of damage can be predicted only in general terms, since no two buildings undergo the exact same motions, even in the same earthquake. Past earthquakes have shown us, however, that some buildings are far more likely to fail than others.

Unreinforced masonry buildings (URMs, Figure 1-13) are prone to failure due to inadequate anchorage of the masonry walls to the roof and floor diaphragms, due to the limited strength and ductility of the building materials, and sometimes due to poor construction workmanship. Using a statistical analysis, the number of URMs in Riverside County is estimated at about 4,000 (HAZUS '99 Inventory). However, Riverside County identified only five in the unincorporated areas during a 1990 study (Kack Fung, personal communication, 2000). There are surely URMs in older regions of incorporated cities within the County, but these have not been identified. The five known URM owners were notified by mail to comply with the State guidelines, but no unique URM ordinance has been passed by Riverside County. In addition, no other potentially vulnerable buildings have been inventoried.

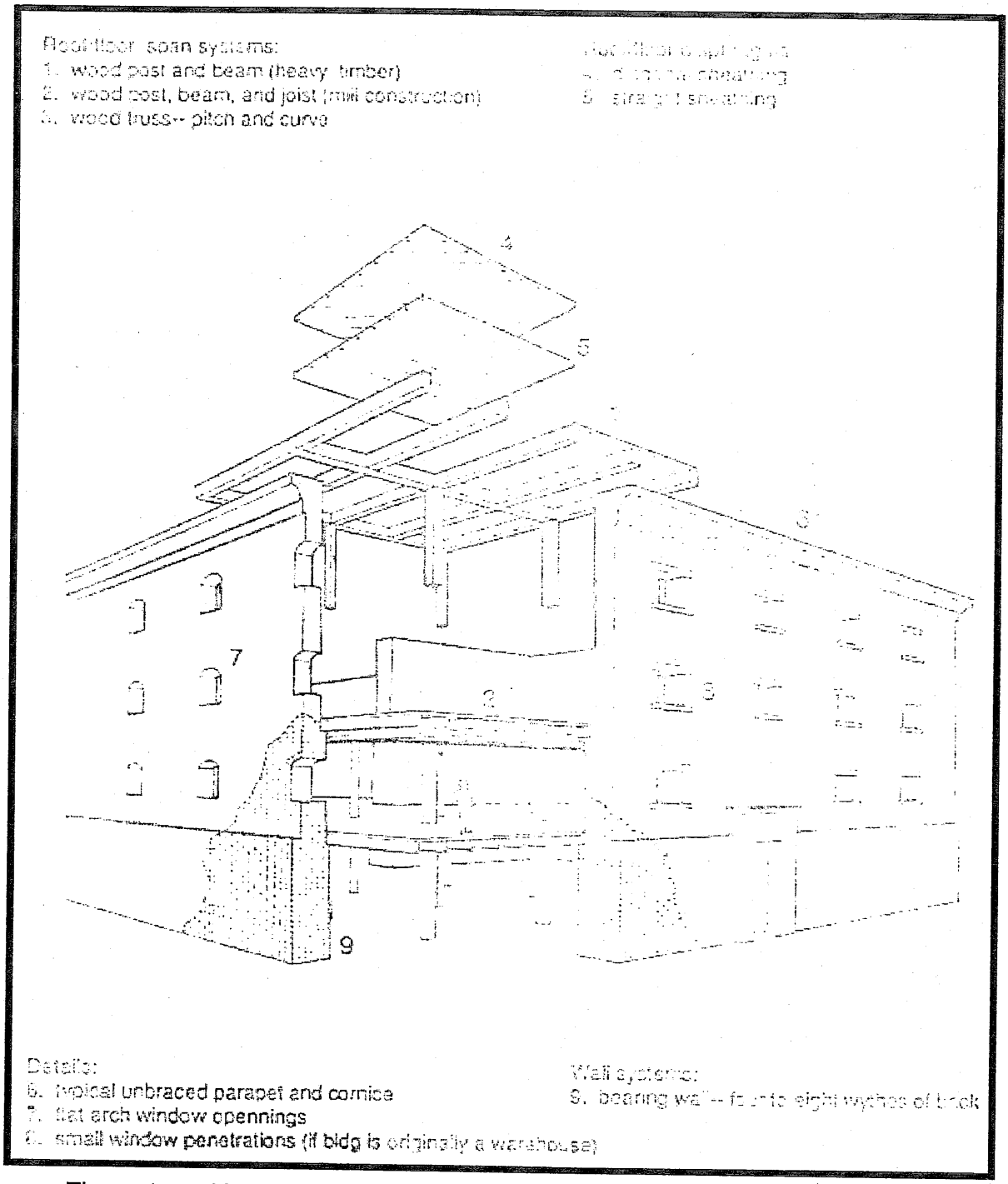


Figure 1-13: Unreinforced Masonry Building (URM). Prepared by the Applied Technology Council for the Federal Emergency Management Agency (1988), Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook: Earthquake Hazards Reduction Series 41, FEMA 154.

Unless URMs have been appropriately reinforced and strengthened, an earthquake may cause irreparable damage, and even collapse. Thus they pose a threat to life and property. There are many ways that damage may occur. Parapets and cornices that are not positively anchored to the roofs may fall out. Wall diaphragms are generally made of wood. These diaphragms are therefore very flexible, allowing large out-of-plane deflections at the wall transverse. This large drift can cause the masonry walls to collapse. Some tall URM buildings have thin walls that may buckle out-of-plane under severe lateral loads. If the wall is a non-load bearing wall, it may fail; collapse of a load-bearing wall will result in partial or total collapse of the structure. Deterioration of the mortar (often of lime and sand with little or no cement, having very little shear strength), and of the wood framing as a result of weather exposure may also contribute to the weakening and poor performance. Collapse of URMs generates much heavy debris.

Reinforced masonry buildings often perform well in moderate earthquakes if they are adequately reinforced and grouted, and if sufficient diaphragm anchorage exists. Poor construction workmanship or materials may lead to failure during a large earthquake. Other common building types are also known to perform poorly during moderate to strong earthquakes, although they have not been targeted for upgrading and strengthening. Of particular concern are ***soft-story buildings*** (those with a story, generally the first floor, lacking adequate strength or toughness due to few shear walls). Apartments above glass-fronted stores and buildings perched atop parking garages are common examples of soft-story buildings. No estimates of the number of soft-story buildings in Riverside County are currently available. Collapse of a soft story and "pancaking" of the remaining stories killed 16 people at the Northridge Meadows apartments during the 1994 Northridge earthquake (EERI, 1994). There are many other cases of soft-story collapses.

Structural damage to ***wood frame structures*** often results from inadequate connection between the superstructure and the foundation. These buildings may slide off their foundations, with consequent damage to plumbing and electrical connections. Unreinforced masonry chimneys may also collapse. These types of damage are generally not life threatening, although they may be costly to repair. Wood frame buildings with stud walls generally perform well in an earthquake, unless they have no foundation or have a weak foundation constructed of unreinforced masonry or poorly reinforced concrete. In these, damage is generally limited to cracking of the stucco, which dissipates much of the earthquake's induced energy. The collapse of wood frame structures, if it happens, generally does not generate heavy debris; but rather, the wood and plaster debris can be cut or broken into smaller pieces by hand-held equipment and removed by hand in order to reach victims (FEMA, 1985).

Partial or total collapse of buildings where the floors, walls and roofs fail as large intact units, such as large ***pre-cast concrete*** panels, cause the greatest loss of life and difficulty in victim rescue and extrication (FEMA, 1985). Thousands have died in collapses of these kinds of structures during earthquakes, such as in Mexico City (1985), Armenia (1988), Nicaragua (1972), El Salvador (1986), the Philippines (1990), and most recently Turkey (1999). Unfortunately, these lessons were not applied to California's parking structures. Many parking structures that failed spectacularly in Northridge (1994) consisted of pre-cast components (EERI, 1994). Many more such parking structures exist throughout the region. No estimates of the number in Riverside County are available.

Collapse of these types of structure leaves debris that requires heavy mechanical equipment to be removed. Location and extrication of victims trapped under the rubble is generally a slow and dangerous process. Extrication of trapped victims within the first 24 hours after the earthquake becomes critical for survival. In most instances, however, post-earthquake planning fails to quickly procure equipment needed to move heavy debris. The establishment of Heavy Urban Search and Rescue teams, as recommended by FEMA (1985), has improved victim extrication and survivability. Buildings that are more likely to fail and generate heavy debris need to be identified, so that appropriate mitigation and planning procedures are defined prior to an earthquake.

Tilt-up buildings have concrete wall panels, often cast on the ground, or fabricated off-site and trucked in, that are tilted upward into their final position. Connections and anchors have pulled out of walls during earthquakes, causing the floors or roofs to collapse. A high rate of failure was observed for this type of construction in the 1971 Sylmar, California earthquake. Tilt-up buildings may generate heavy debris.

Statistical estimates (HAZUS '99 Inventory) indicate about 1,500 ***pre-cast concrete frame*** buildings in Riverside County. Their seismic performance varies, and is dependent on adequate design and construction (Figure 1-14). Pre-cast frames are often weakened due to stresses incurred during transportation and accumulated stresses from shrinkage and creep. Corrosion of the metal connectors between prefabricated elements may also occur, weakening the structure. Multi-story concrete and reinforced masonry buildings with concrete floor slabs may collapse ("pancake") with the floor slabs falling, nearly intact, one on top of the other, becoming closely stacked. The floor slabs prevent access to, and extrication of, victims. These slabs weigh up to 250 tons and generally need to be cut into smaller pieces and removed by heavy cranes - a time-consuming process.

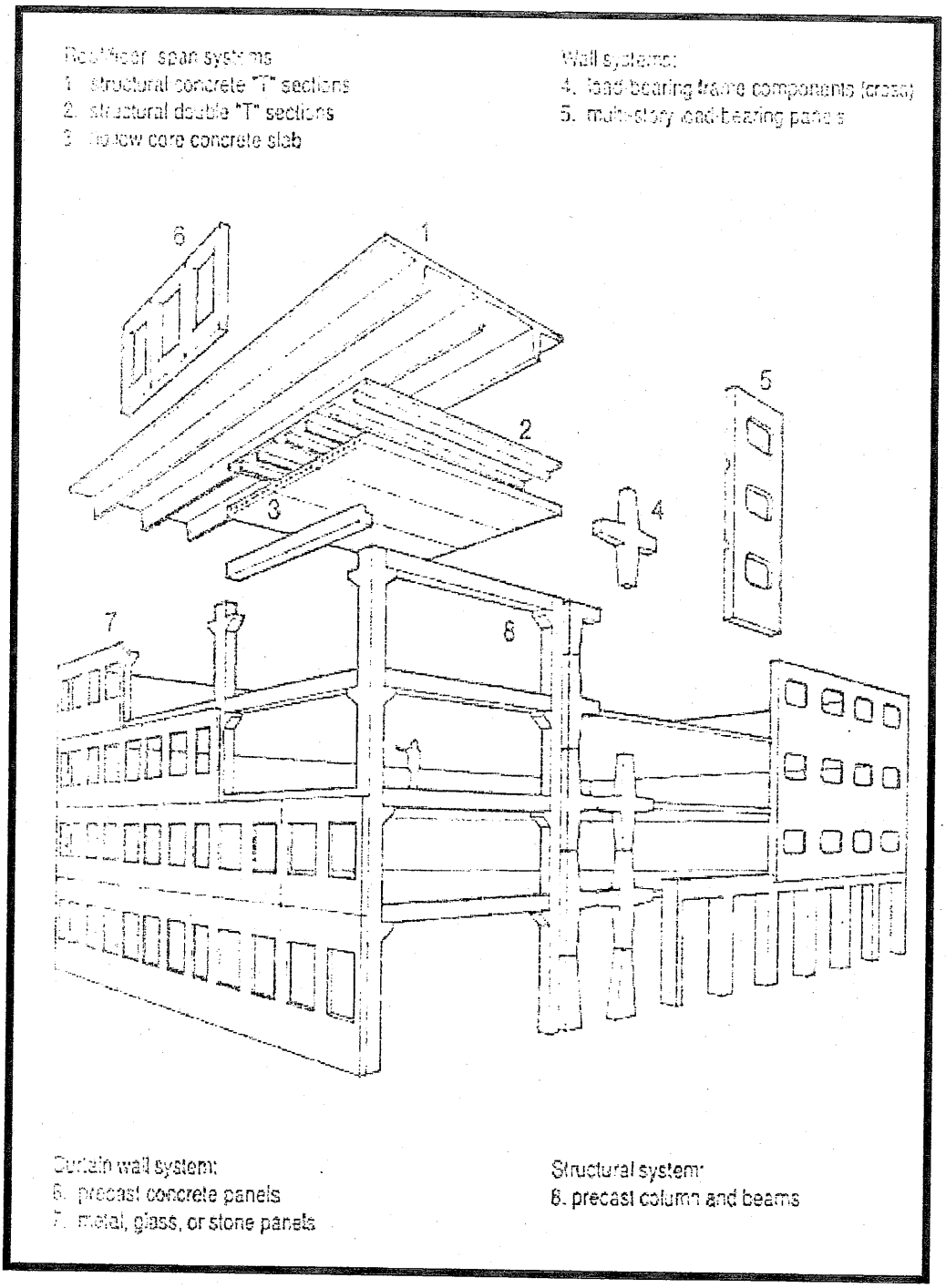


Figure 1-14: Precast concrete-frame construction. Prepared by the Applied Technology Council for the Federal Emergency Management Agency (1988), Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook: Earthquake Hazards Reduction Series 41, FEMA 154.

Reinforced concrete frame buildings, with or without reinforced infill walls, display low ductility. Earthquakes may cause shear failure (if there are large tie spacings in columns, or insufficient shear strength), column failure (due to inadequate rebar splices, inadequate reinforcing of beam-column joints, or insufficient tie anchorage), hinge deformation (due to lack of continuous beam reinforcement), and non-structural damage (due to the relatively low stiffness of the frame). A common type of failure observed following the M_w 6.7, 1994 Northridge earthquake was confined column collapse (EERI, 1994), where infilling between columns confined the length of the columns that could move laterally in the earthquake.

Multi-story steel buildings generally also have concrete floor slabs. However, these buildings are less likely to collapse than concrete structures. Common damage to these types of buildings is generally non-structural, including collapsed exterior curtain wall (cladding), and damage to interior partitions and equipment. Overall, modern steel buildings have been expected to perform well in earthquakes, but the 1994 Northridge earthquake broke many welds in these buildings, a previously unanticipated problem.

Older, pre-1945 steel frame structures may have unreinforced masonry such as bricks, clay tiles and terra cotta tiles as cladding or infilling. Cladding in newer buildings may be glass, infill panels or pre-cast panels that may fail and generate a band of debris around the building exterior (with considerable threat to pedestrians in the streets below). Structural damage may occur if the structural members are subject to plastic deformation which can cause permanent displacements. If some walls fail while others remain intact, torsion or soft-story problems may result.

Buildings are often a combination of steel, concrete, reinforced masonry and wood, with different structural systems on different floors or different sections of the building. Combination types that are potentially hazardous (and that have not been discussed above) include: concrete frame buildings without special reinforcing, precast concrete and precast-composite buildings, steel frame or concrete frame buildings with unreinforced masonry walls, reinforced concrete wall buildings with no special detailing or reinforcement, large capacity buildings with long-span roof structures (such as theaters and auditoriums), large unengineered wood-frame buildings, buildings with inadequately anchored exterior cladding and glazing, and buildings with poorly anchored parapets and appendages (FEMA, 1985). Additional types of potentially hazardous buildings may be recognized after future earthquakes.

A building's vertical and/or horizontal shape can also be important. Simple, regular and ***symmetric buildings*** generally perform better than non-symmetric buildings. During an earthquake, ***non-symmetric buildings*** tend to twist as well as shake. Wings on a building tend to act independently during an earthquake, resulting in differential movements and cracking. The geometry of the lateral load-resisting systems also matters. For example, buildings with one or two walls made mostly of glass, while the remaining walls are made of concrete or brick, are at risk. Also, asymmetry in the placement of bracing systems that provide a building with earthquake resistance can result in twisting or differential motions.

Site-related seismic hazards may include the potential for neighboring buildings to "pound", or for one building to collapse onto a neighbor. ***Pounding*** occurs when there is little clearance between adjacent buildings, and the buildings "pound" against each other as they deflect during an earthquake. The effects of pounding can be especially damaging if the floors of the buildings are at different elevations, so that, for example, the floor of one building hits a supporting column of the other. Damage to a supporting column can result in partial or total building collapse.

By inventory estimates, more than 70,000 ***mobile homes*** are located in the County of Riverside (HAZUS '99 Inventory). Mobile homes are prefabricated housing units that are placed on isolated piers, jackstands, or masonry block foundations (usually without any positive anchorage). Floors and roofs of mobile homes are usually plywood; outside surfaces are covered with sheet metal. Mobile homes typically do not perform well in earthquakes. Severe damage occurs when they fall off their supports, severing utility lines and piercing the floor with steep jackstands.

A community's first defense against dangerous buildings is to perform a building inventory, to locate, count and identify buildings by structural type and occupancy (usage). With an inventory, limited mitigation resources can be more effectively prioritized.

1.7.2 Essential Facilities

Critical facilities are those parts of a community's infrastructure that must remain operational after an earthquake, or facilities that pose unacceptable risks to public safety if severely damaged. Critical facilities include schools, hospitals, fire and police stations, emergency operation centers (EOC's) and communication centers. Figure 1-15 through 1-18 illustrate the locations of the County's hospitals, emergency response facilities (EOC's, fire and police stations), schools, and communication facilities in relation to ground shaking potential.

It is essential that critical facilities have no structural weaknesses that can lead to collapse. The Federal Emergency Management Agency (FEMA, 1985) has suggested the following seismic performance goals for health care facilities:

- The damage to the facilities should be limited to what might be reasonably expected after a destructive earthquake and should be repairable and not life-threatening.
- Patients, visitors, and medical, nursing, technical and support staff within and immediately outside the facility should be protected during an earthquake.
- Emergency utility systems in the facility should remain operational after an earthquake.
- Occupants should be able to evacuate the facility safely after an earthquake.
- Rescue and emergency workers should be able to enter the facility immediately after an earthquake and should encounter only minimum interference and danger.
- The facility should be available for its planned disaster response role after an earthquake.

High-loss facilities, if severely damaged, may result in a disaster far beyond the facilities themselves. Examples include nuclear power plants, dams and flood control structures, freeway interchanges, bridges, and industrial plants that use or store explosives, toxic materials or petroleum products. Figures 1-19 through 1-21 illustrate the locations of the County's dams, highway bridges and hazardous materials sites in relation to ground shaking potential.

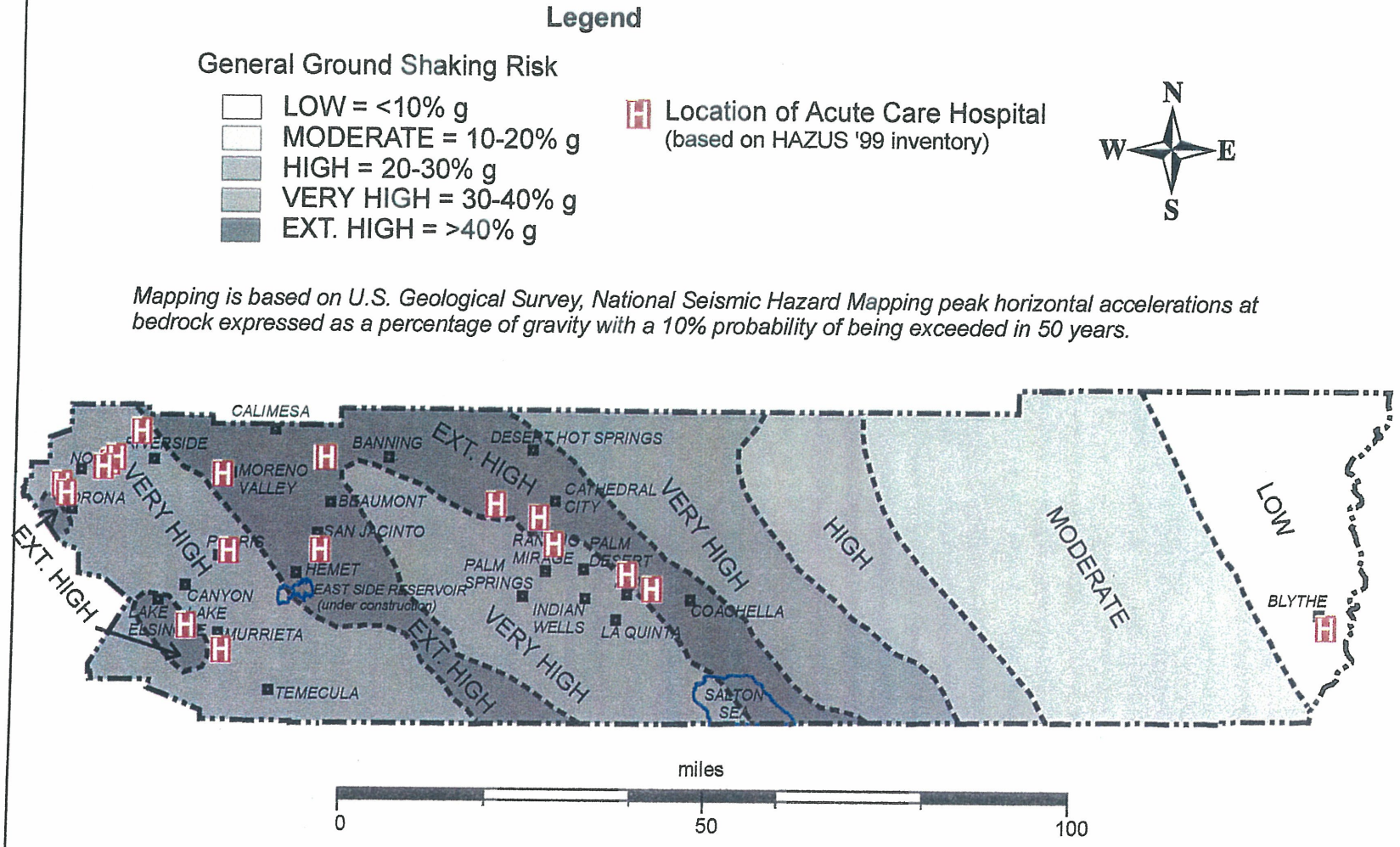


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Figure 1-15: Inventory of Hospital Locations in Relation to Ground Shaking Risk

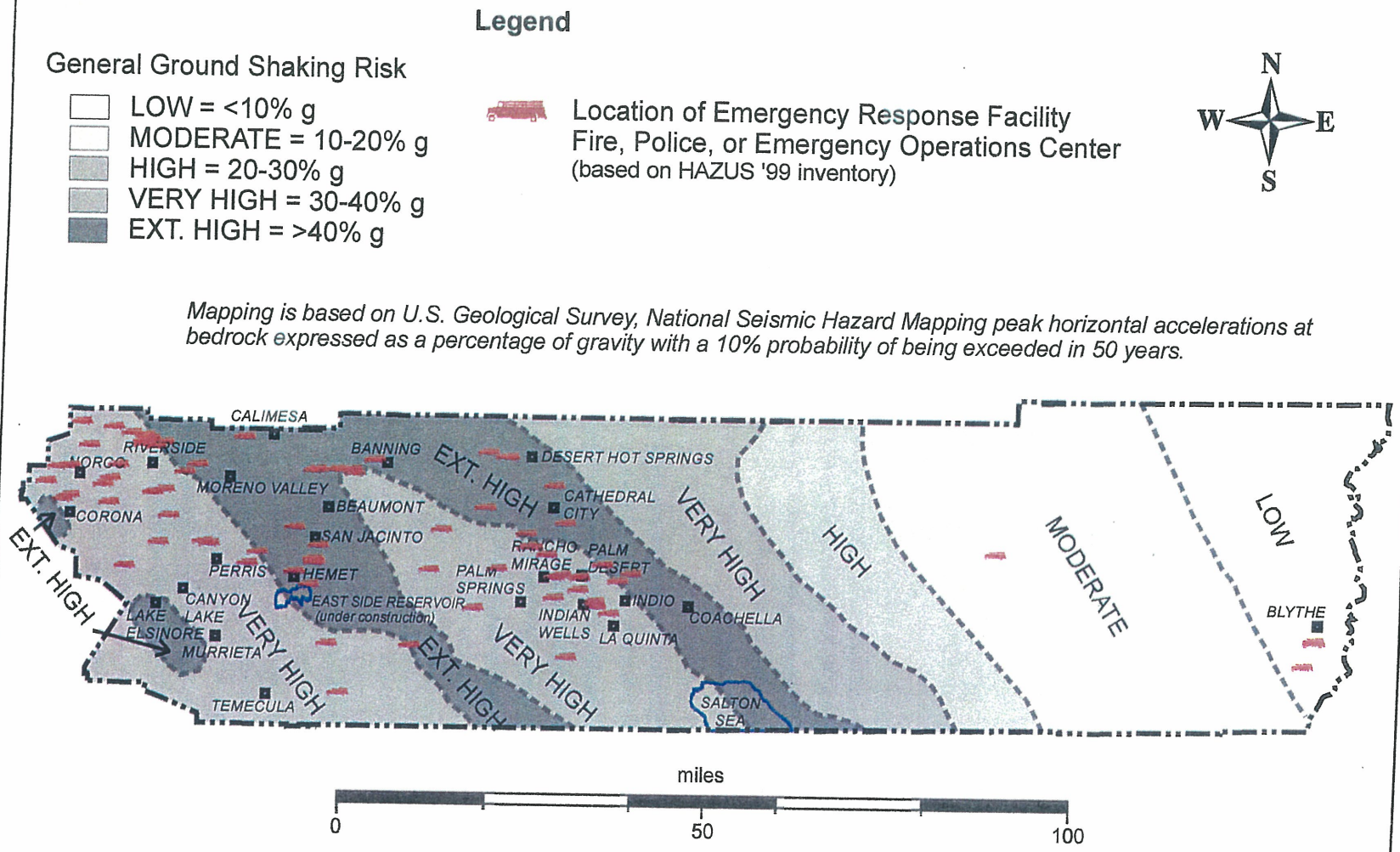

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Figure 1-16: Inventory of Emergency Response Facilities in Relation to Ground Shaking Risk

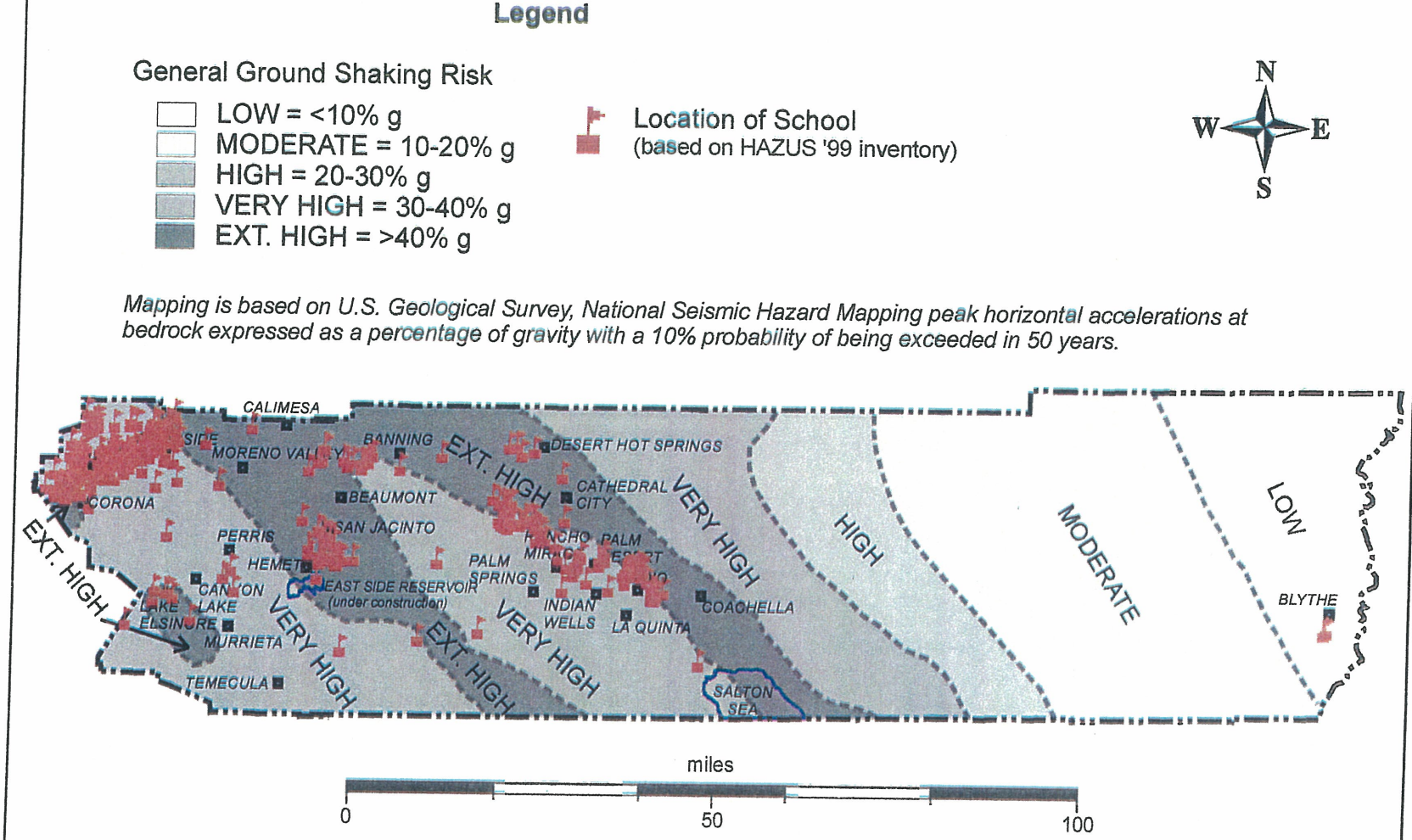

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Figure 1-17: Inventory of School Locations in Relation to Ground Shaking Risk

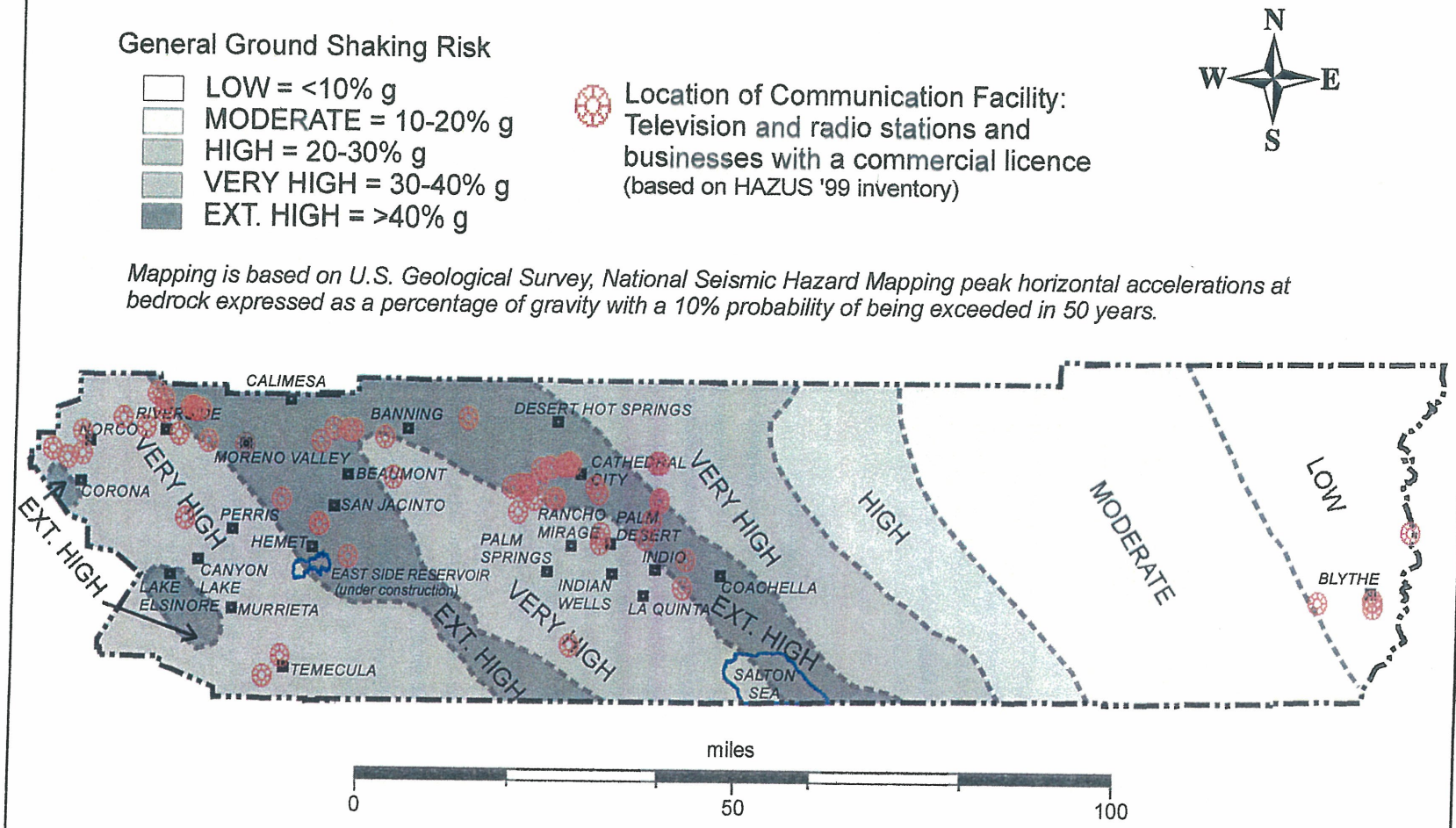

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Figure 1-18: Inventory of Communication Facilities in Relation to Ground Shaking Risk

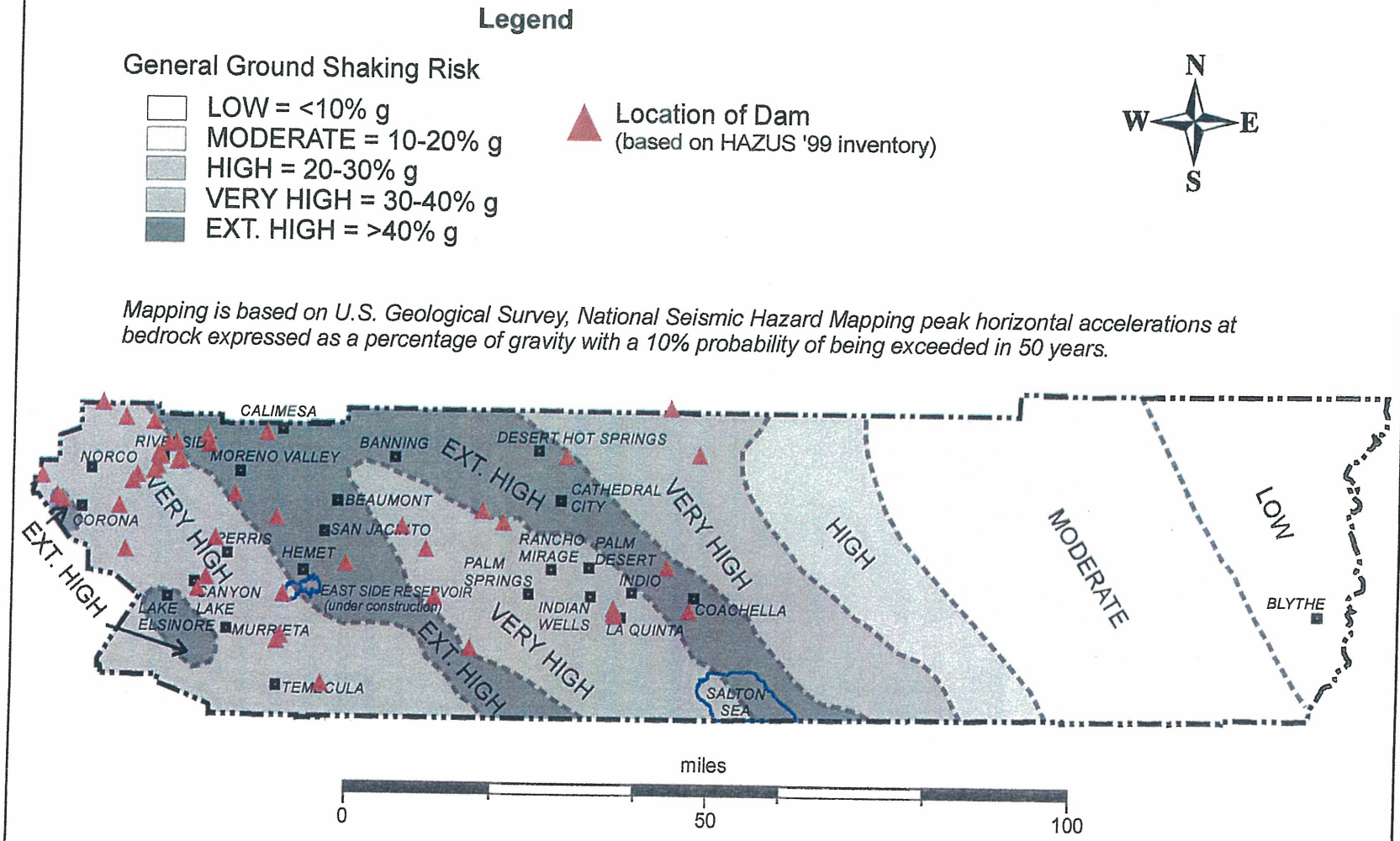

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Figure 1-19: Inventory of Dam Locations in Relation to Ground Shaking Risk

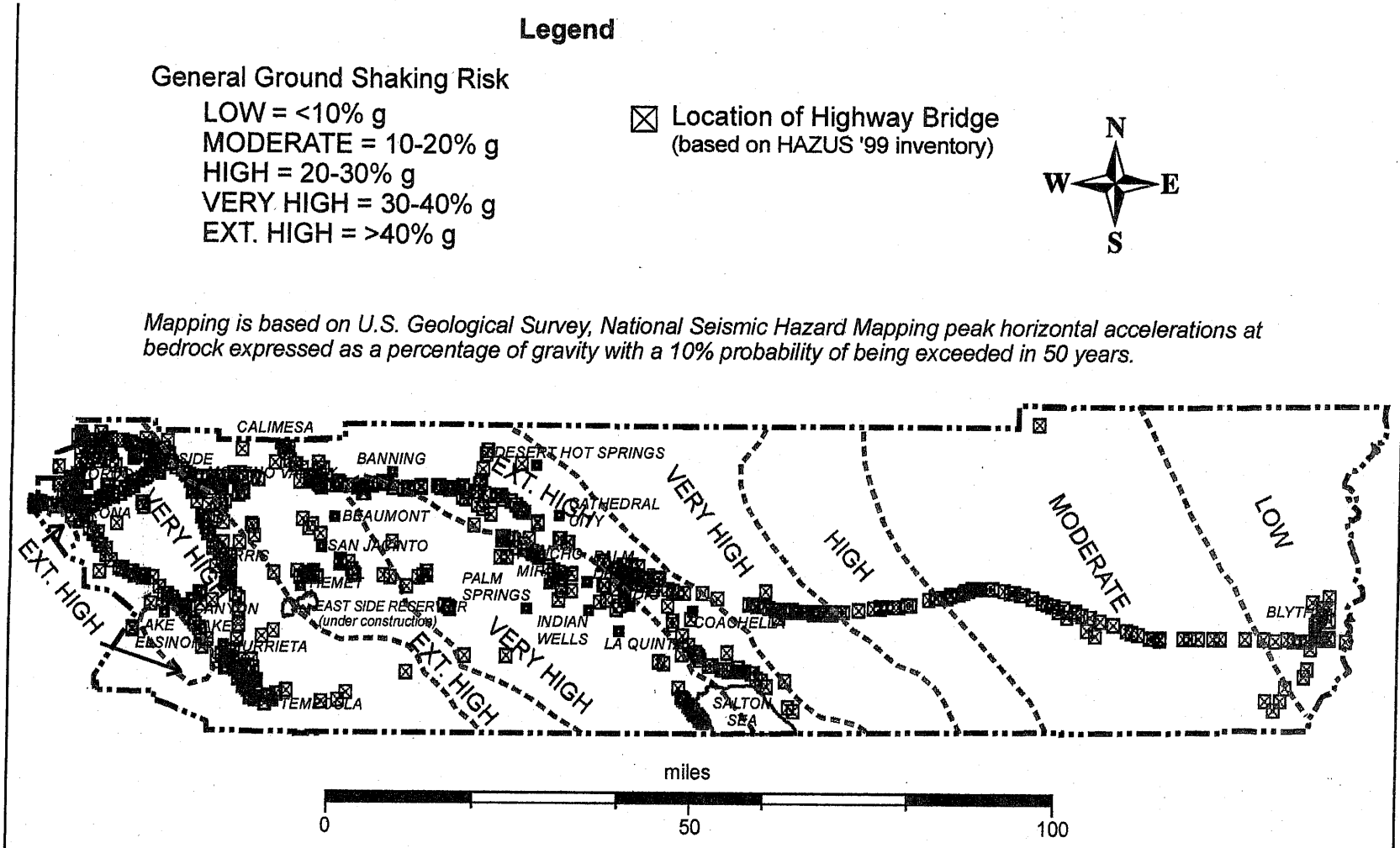

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Figure 1-20: Inventory of Highway Bridges in Relation to Ground Shaking Risk

Legend

General Ground Shaking Risk

- LOW = <10% g
- MODERATE = 10-20% g
- HIGH = 20-30% g
- VERY HIGH = 30-40% g
- EXT. HIGH = >40% g

Location of Hazardous Materials
(based on HAZUS '99 inventory)

N
W E
S

Mapping is based on U.S. Geological Survey, National Seismic Hazard Mapping peak horizontal accelerations at bedrock expressed as a percentage of gravity with a 10% probability of being exceeded in 50 years.

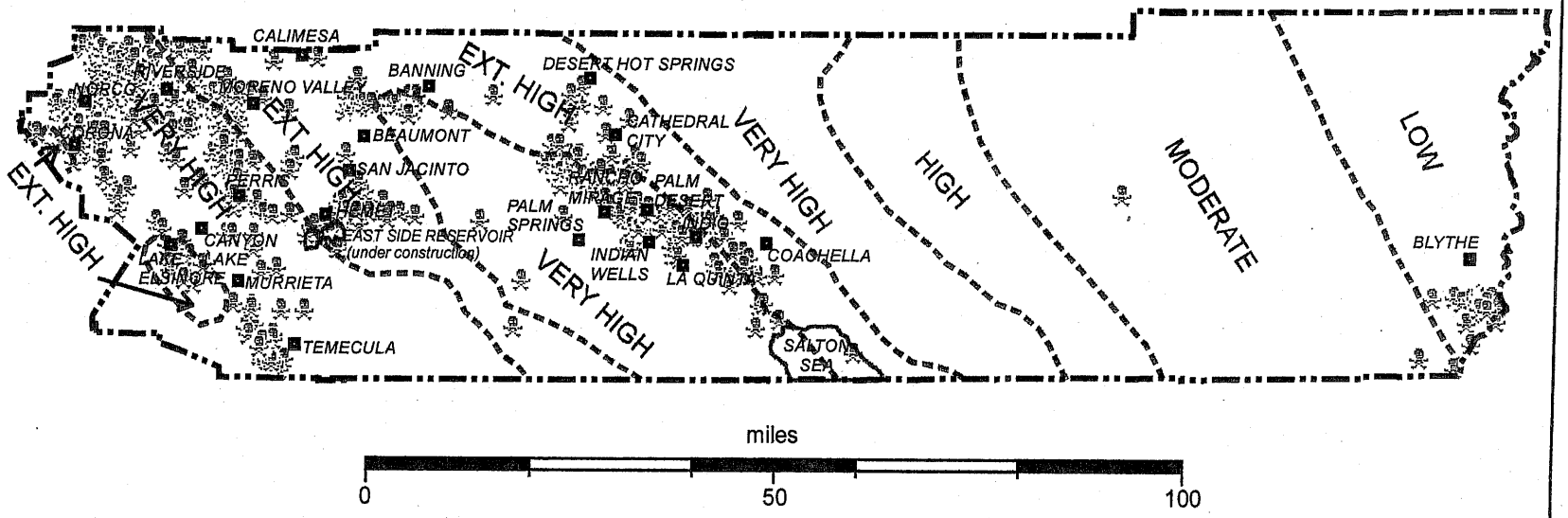

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Figure 1-21: Inventory of Hazardous Materials in Relation to Ground Shaking Risk

Dam Safety: Statutes governing dam safety are defined in Division 3 of the California State Water Code (California Department of Water Resources, 1986), which empowers the California Division of Dam Safety to monitor the structural safety of dams that are greater than 25 feet in dam height or 50 acre-feet in storage capacity.

Dams under this State jurisdiction are required to have inundation maps that show the potential flood limits in the remote possibility a dam is catastrophically breached. Dam inundation maps are prepared by dam owners primarily for contingency planning; it is stressed that they in no way reflect the structural integrity or safety of the dam in question. Dam owners are also required to prepare and submit emergency response plans to the State Office of Emergency Services, the lead State agency for the State dam inundation mapping program. Detailed dam inundation mapping and a discussion of dam vulnerability are presented in Chapter 3-Flood Hazards of this Technical Background Report. The County of Riverside is required by State law to have in place emergency procedures for the evacuation and control of populated areas within the limits of inundation below the dams. In addition, real estate disclosure upon sale or transfer of property in the inundation area is required under recent legislation (AB 1195 Chapter 65, June 9, 1998. Natural Hazard Disclosure Statement).

Most of the legislation regarding dam safety has developed as a result of dam failures, particularly the sudden, disastrous failure of the St. Francis Dam in 1928 (Babbitt, 1993); and damage to dams during earthquakes. During the 1971 San Fernando earthquake, for example, the Lower San Fernando Dam came within five feet of being breached, when the upstream slope slid into the reservoir and the crest settled 30 feet. This confirmed concerns that hydraulic fill dams could be severely damaged by earthquake-induced vibrations (Babbitt and Verigin, 1996).

High-occupancy facilities can potentially cause a large number of casualties or crowd-control problems. This category includes high-rise buildings, large assembly facilities, and large multifamily residential complexes.

Dependent-care facilities house populations with special evacuation considerations, such as preschools and schools, rehabilitation centers, prisons, group care homes, and nursing and convalescent homes.

Economic facilities are those that should remain operational to avoid severe economic impacts, such as banks, archiving and vital record keeping facilities, airports and ports, and large industrial and commercial centers.

1.7.3 Lifelines

Critical facilities, designed to remain functional during and immediately after an earthquake, may provide only limited services if lifelines are disrupted. Our understanding of the seismic hazards to new and existing lifeline facilities relies on several workshops and publications dedicated to the subject, including research completed as a result of the 1989 Loma Prieta earthquake. The issue of seismic hazard mitigation for lifelines is very complex, given the diversity of lifeline facilities. The general comments on the effect of strong ground motion to buildings apply to structures involved in lifeline service, such as the control tower in an airport, or the buildings that house the computers and telephone circuits that are central to communication lifelines. When properly designed, manufactured and laid out, buried pipelines are generally not damaged by strong ground motions, but can be severely disrupted in areas of surface rupture, liquefaction, or landslides. Freeway interchanges and bridges have been damaged by strong ground motions; certain bridge designs have been prioritized in retrofitting programs because of their poor past performance in regions of seismic activity.

A hazard analysis should focus on four lifeline categories: (1) water and sewer facilities, (2) transportation facilities, (3) electric power facilities, and (4) gas and liquid fuel lines. Retrofit and upgrading programs for lifelines generally require careful planning to ensure that the public is not inconvenienced by irregular or discontinued service. To implement an effective mitigation program, potential problem spots must be identified and prioritized in the extensive systems of cable and pipe used to distribute electrical energy, gas, telephone communications, and water, or to collect sewer and storm drain water.

Figures 1-22 through 1-24 illustrate the County's inventory of airports, highways, and rail facilities, as well as available data on water, oil and natural gas pipelines, in relation to the general ground shaking risk.

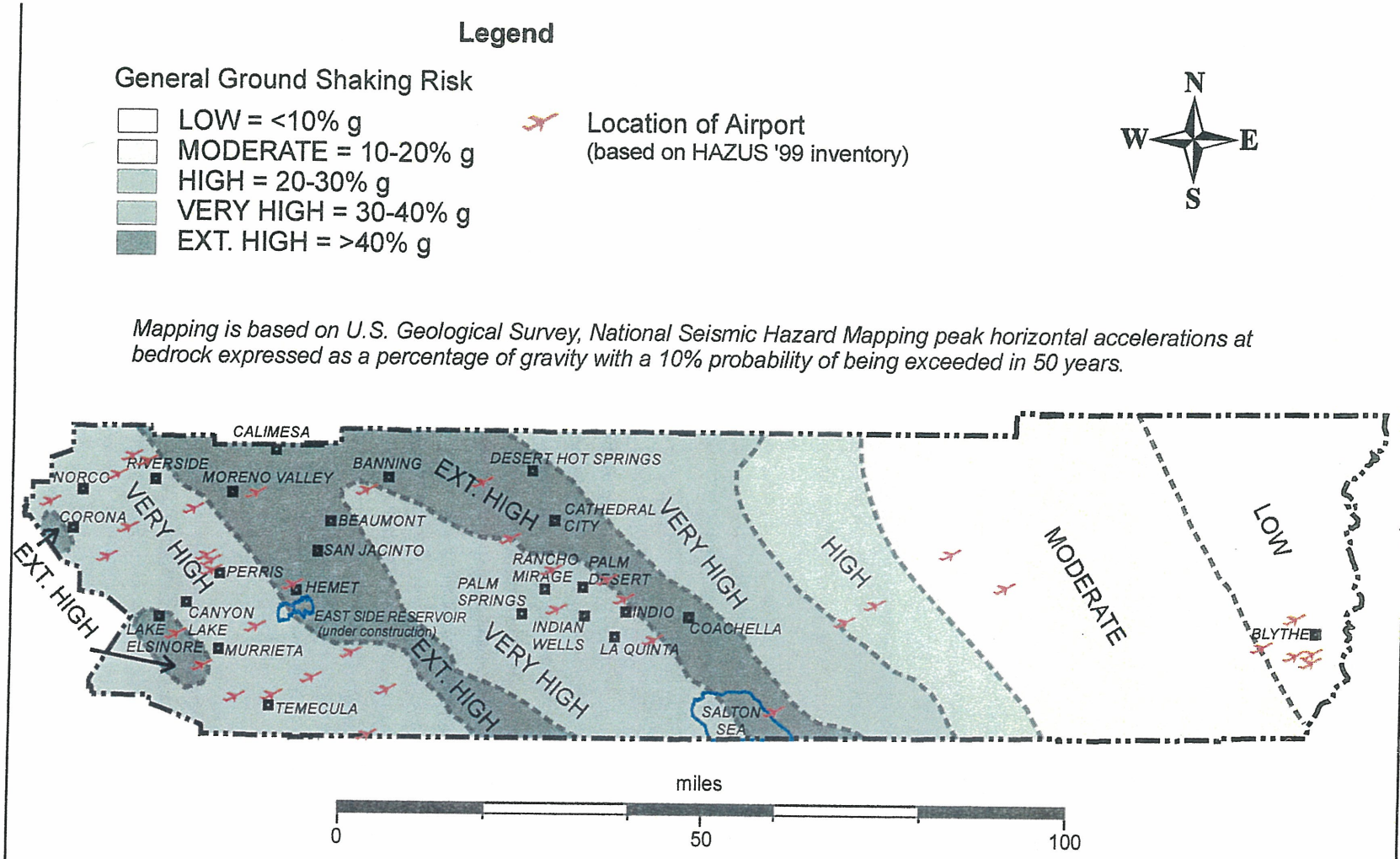

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Figure 1-22: Inventory of Airport Locations in Relation to Ground Shaking Risk

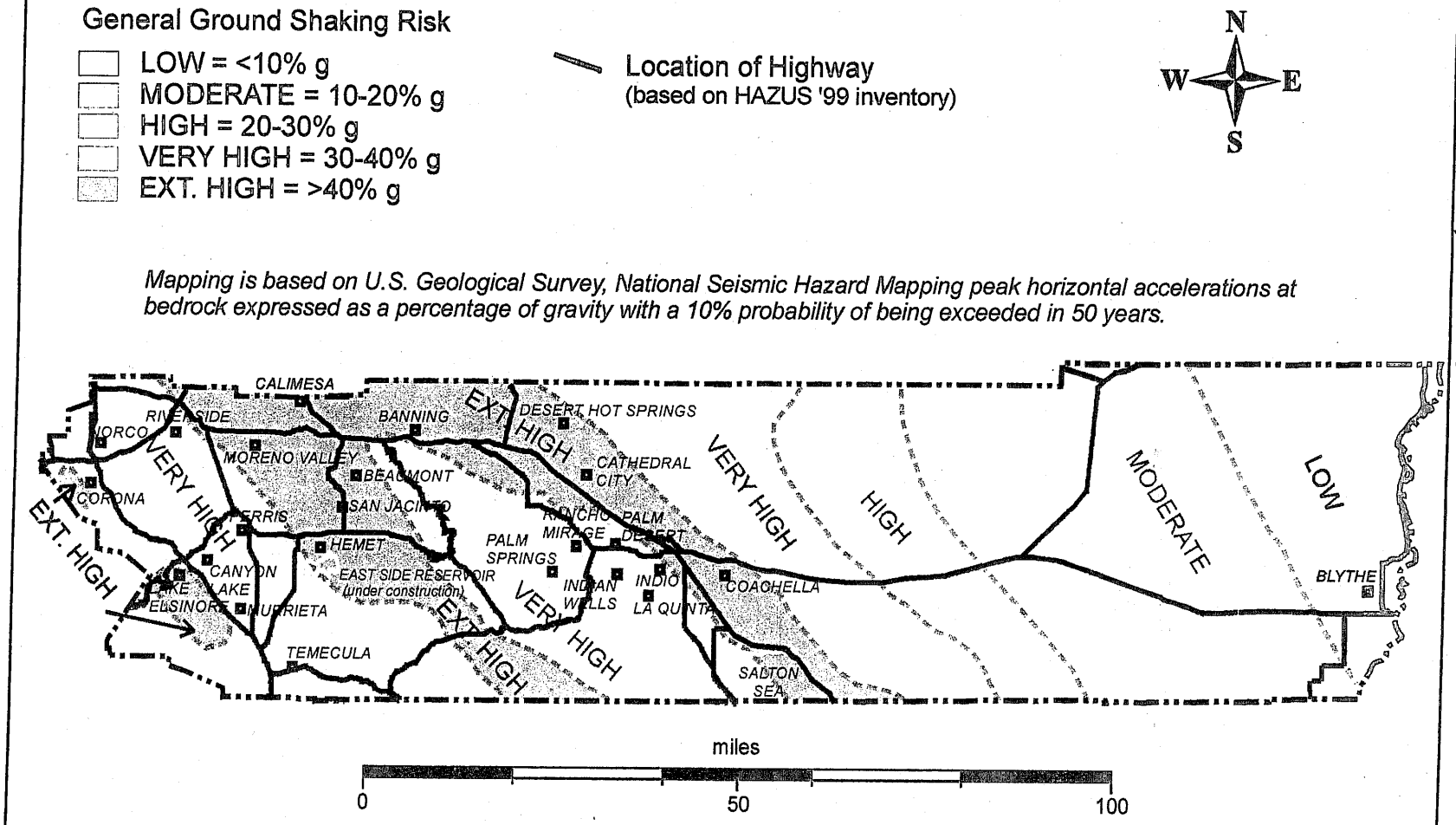

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Figure 1-23: Inventory of Highways in Relation to Ground Shaking Risk

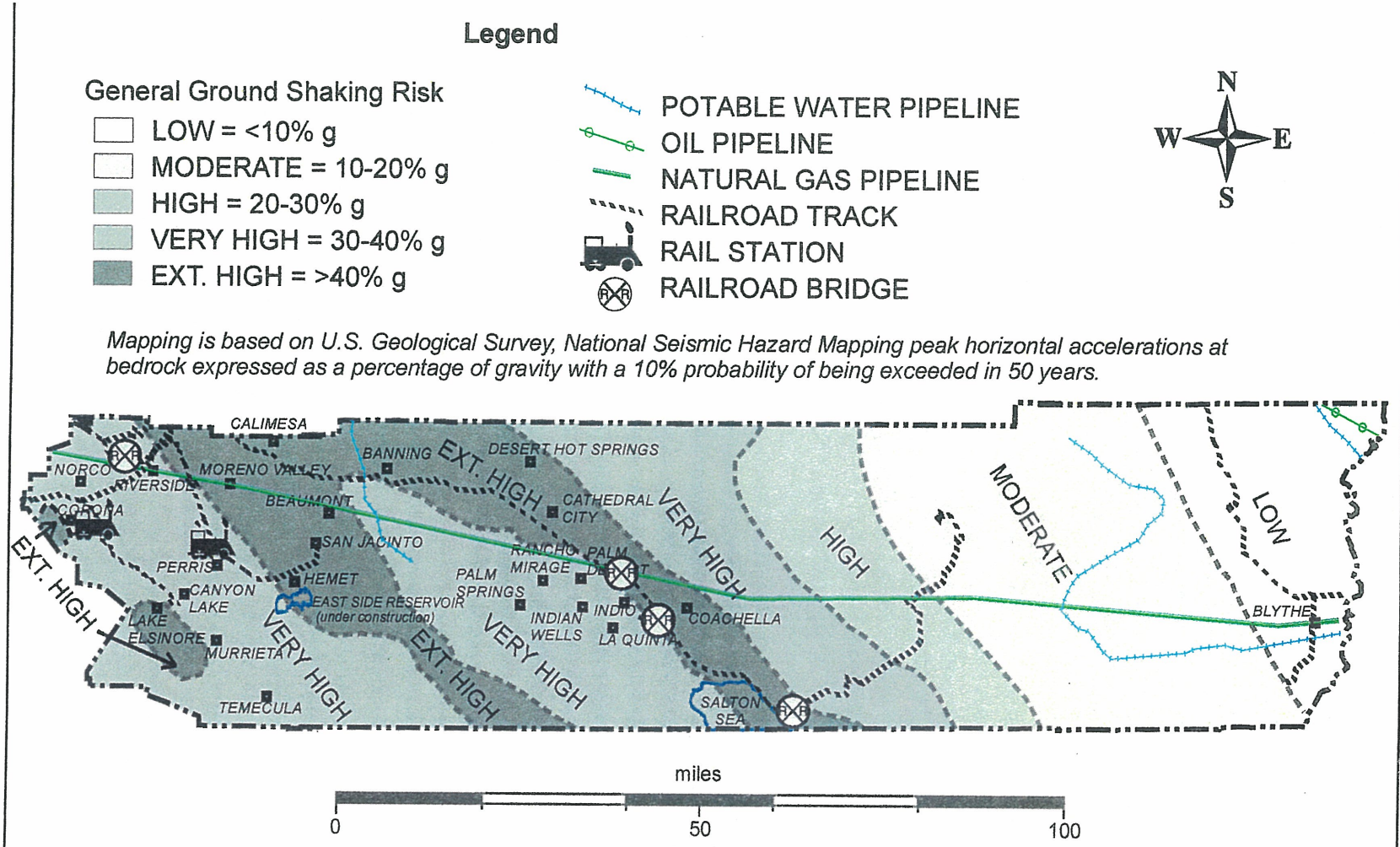

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Figure 1-24: Inventory of Rail Facilities, and Water, Oil, and Natural Gas Pipelines in Relation to Ground Shaking Risk

1.8 HAZUS Earthquake Scenario Loss Estimations for Riverside County

HAZUS™ is a standardized methodology for earthquake loss estimation based on a geographic information system (GIS). A project of the National Institute of Building Sciences, funded by the Federal Emergency Management Agency (FEMA), it is a powerful advance in mitigation strategies. The HAZUS project developed guidelines and procedures to make standardized earthquake loss estimates at a regional scale. With standardization, estimates can be compared from region to region. HAZUS is designed for use by state, regional and local governments in planning for earthquake loss mitigation, emergency preparedness, response and recovery. HAZUS addresses nearly all aspects of the built environment, and many different types of losses. The methodology has been tested against the experience of several past earthquakes, and against the judgment of experts. Subject to several limitations noted below, HAZUS can producing result that are valid for the intended purposes.

Loss estimation is an invaluable tool, but must be used with discretion. A loss estimation analyzes casualties, damage and economic loss in great detail. It produces seemingly precise numbers that can be easily misinterpreted. A loss estimation's results, for example, may cite 4,054 left homeless by a scenario earthquake. This is best interpreted by its magnitude. That is, 4,000 homeless is clearly more manageable than 40,000 homeless; and an event that leaves 400,000 homeless would overwhelm a community's resources. However, a loss estimation that predicts 7,000 homeless should probably be considered equivalent to the 4,054 result. Because HAZUS results make use of a great number of parameters and data of varying accuracy and completeness, it is not possible to assign quantitative error bars. Although the numbers should not be taken at face value, they are not rounded or edited because detailed evaluation of individual components of the disaster can help mitigation agencies ensure that they have considered all the important options.

The more community-specific the data that is input to HAZUS, the more reliable the loss estimation. HAZUS provides defaults for all required information. These are based on best-available scientific, engineering, census and economic knowledge. The loss estimations in this report have been tailored to Riverside County by using the maps of soil type, liquefaction and landslide susceptibility done as part of this study. Loss estimations can be further refined with new census data, and an inventory of the buildings, lifelines and infrastructure specific to Riverside County.

Uncertainties are inherent is any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effect upon buildings and facilities, and in part from the approximations and simplifications necessary for comprehensive analyses.

Users should be aware of the following specific limitations:

- HAZUS is driven by statistics, and thus is most accurate when applied to a region, or a class of buildings or facilities. It is least accurate when considering a particular site, building or facility.
- Losses estimated for lifelines may be less than losses estimated for the general building stock.
- Losses from smaller (less than M_w 6.0) damaging earthquakes may be overestimated.
- Pilot and calibration studies have not yet provided an adequate test concerning the possible extent and effects of landsliding.
- The indirect economic loss module is new and experimental. While output from pilot studies has generally been credible, this module requires further testing.

1.8.1 Methodology and Terminology Used in Earthquake Loss Estimation

The flow chart in Figure 1-25 presents the modules (components) of a HAZUS analysis. HAZUS input and output are based on 1990 census tract boundaries. The census tracts that best cover the County of Riverside were chosen for this analysis, and are illustrated in Figure 1-26.

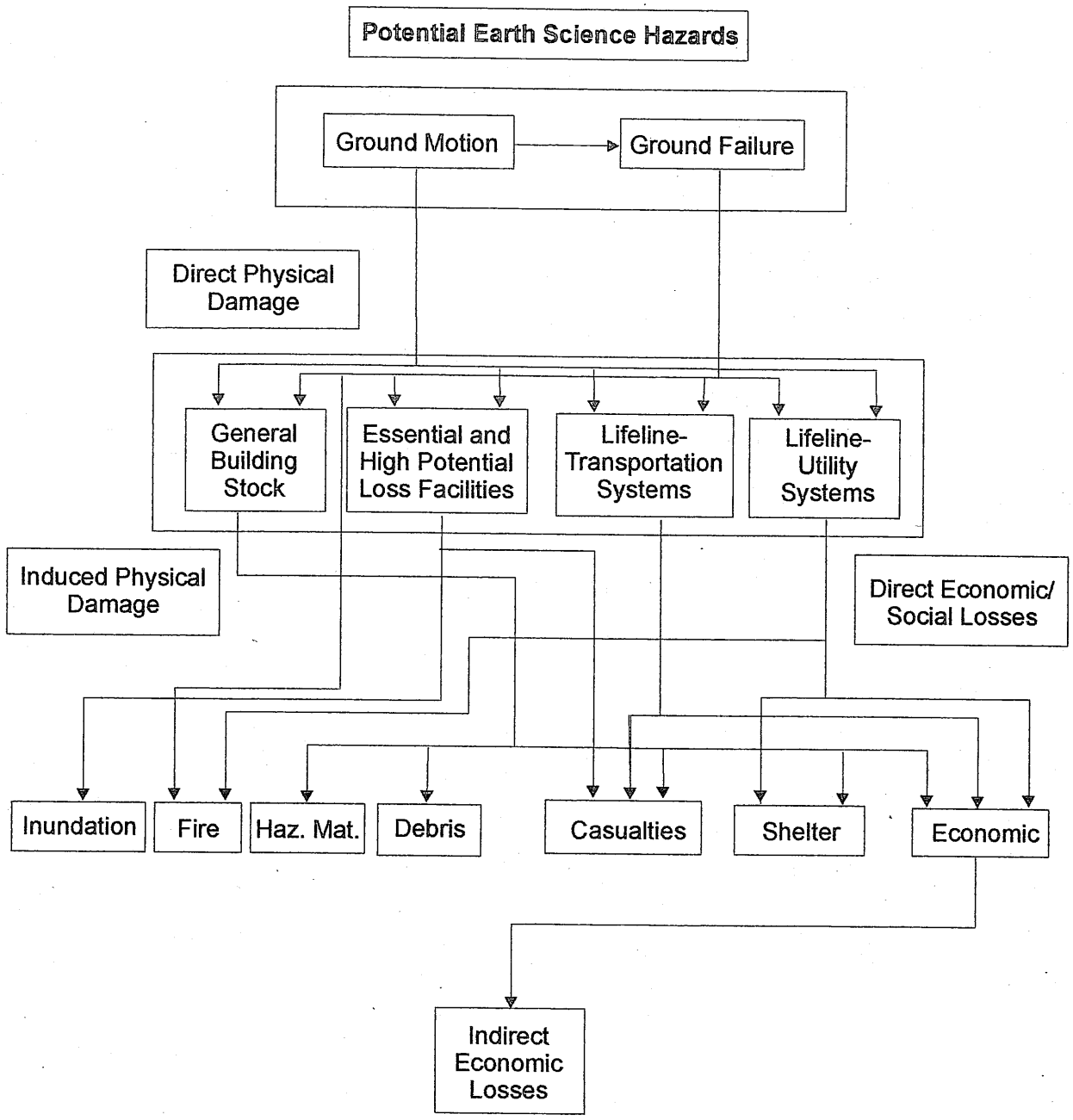

Figure 1-25: Flow Chart Illustrating HAZUS Methodology

Essential Facilities provide services to the community and should be functional after an earthquake. Essential facilities include hospitals, police stations, fire stations and schools. The essential facility HAZUS module determines the expected loss of functionality for these critical facilities. The damage state probabilities for essential facilities are determined on a site-specific basis (i.e., at each facility). Economic losses associated with these facilities are computed as part of the analysis of the general building stock. Data required for the analysis include occupancy classes (current building use) and building structural type, or a combination of essential facilities building type, design level and construction quality factor. In addition, the number of beds for each hospital and the number of fire trucks at each fire station are required. The fire truck information is used as input for the fire following earthquake analysis.

General Building Stock Type and Classification: HAZUS provides damage data for buildings based on these structural types:

Concrete
Mobile Home
Precast Concrete
Reinforced Masonry Bearing Walls
Steel
Unreinforced Masonry Bearing Walls
Wood Frame

and based on these occupancy (usage) classifications:

Residential
Commercial
Industrial
Agriculture
Religion
Government
Education

Building Damage Classification: Loss estimation for the general building stock are averaged for each census tract. Building damage classifications range from slight to complete. Examples for wood frame (the County's most numerous building type) and mobile homes (one of the County's most vulnerable building types) are provided below:

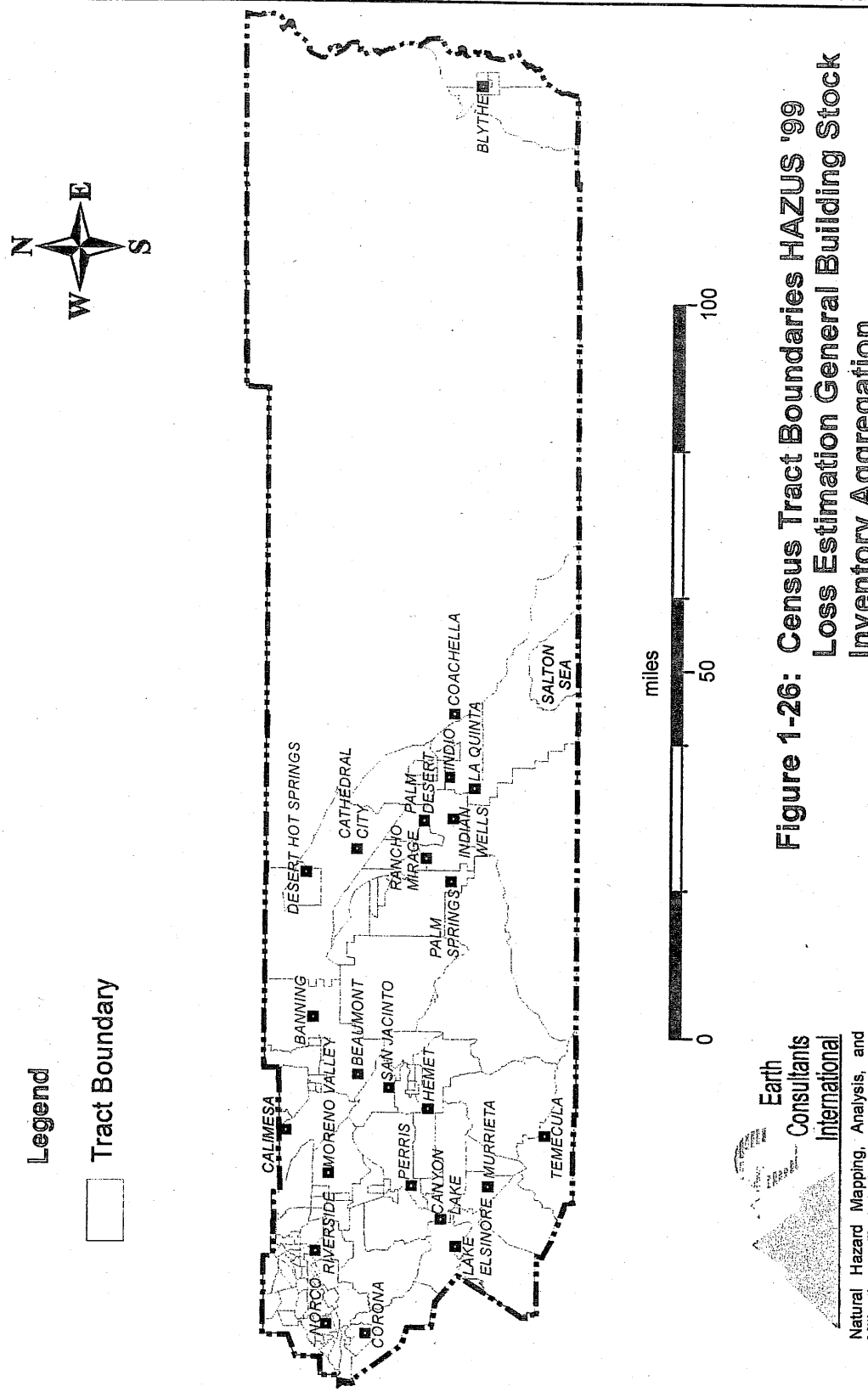

Figure 1-26: Census Tract Boundaries HAZUS '99 Loss Estimation General Building Stock Inventory Aggregation

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Wood, Light Frame:

- *Slight Structural Damage:* Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
- *Moderate Structural Damage:* Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
- *Extensive Structural Damage*: Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of "room-over-garage" or other "soft-story" configurations; small foundations cracks.
- *Complete Structural Damage:* Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse due to cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks. Approximately 5% of the total area with complete structural damage is expected to be collapsed.

Mobile Homes:

- *Slight Structural Damage*: Damage to some porches, stairs or other attached components.
- *Moderate Structural Damage:* Major movement of the mobile home over its supports resulting in some damage to metal siding and stairs and requiring resetting of the mobile home on its supports.
- *Extensive Structural Damage:* Mobile home has fallen partially off its supports, often severing utility lines.
- *Complete Structural Damage:* Mobile home has totally fallen off its supports, usually severing utility lines, with steep jackstands penetrating through the floor. Approximately 5% of the total area of buildings with complete structural damage is expected to be collapsed.

Incorporation of Historic Building Code Design Functions: Estimates of building damage are provided for "High", "Moderate" and "Low" seismic design criteria. Buildings of newer construction (e.g., post-1973) are best designated "High". Buildings built after 1940, but before 1973, are best represented by "Moderate". If built before about 1940 (i.e., before significant seismic codes were implemented), "Low" is most appropriate. The vast majority of buildings in the

County of Riverside fit "High" seismic design criteria.

Fires Following Earthquakes: Fires following earthquakes can cause severe losses. These losses can outweigh the losses from direct damage, such as collapse of buildings and disruption of lifelines. Many factors affect the severity of the fires following an earthquake, including but not limited to: ignition sources, types and density of fuel, weather conditions, functionality of water systems, and the ability of fire fighters to suppress the fires.

A complete fire-following-earthquake model requires extensive input about the readiness of local fire departments and the types and availability (functionality) of water systems. The fire following earthquake model presented here is simplified. With better understanding of fires that will be garnered after future earthquakes, forecasting capability will undoubtedly improve.

An estimated that about 70% of all fire ignitions start within minutes of the earthquake. The remaining ignitions start from an hour to a day after the earthquake. A typical cause of later ignitions is restoration of electric power. When power is restored, short circuits that occurred due to the earthquake become energized and can ignite fires. Similarly, when power is restored, items which have overturned, fallen onto range tops, etc., can ignite. If no one is present at this time, fire department response can be required.

Debris Generation: HAZUS estimates two types of debris. The first is debris that falls in large pieces, such as steel members or reinforced concrete elements. These require special treatment to break into smaller pieces before they are hauled away. The second type of debris is smaller and more easily moved with bulldozers and other machinery and tools. This type includes brick, wood, glass, building contents and other materials.

Estimating Casualties: Casualties are estimated based on the assumption that there is a strong correlation between building damage (both structural and non-structural) and the number and severity of casualties. In smaller earthquakes, non-structural damage will most likely control the casualty estimates. In severe earthquakes where there will be a large number of collapses and partial collapses, there will be a proportionately larger number of fatalities. Data regarding earthquake-related injuries are not of the best quality, nor are they available for all building types. Available data often have insufficient information about the type of structure in which the casualties occurred and the casualty-generating mechanism.

HAZUS casualty estimates are based on the classification scale in Table 1-10.

Table 1-10 HAZUS Injury Classification Scale

Injury Severity Level	Injury Description
Severity 1	Injuries requiring basic medical aid without requiring hospitalization
Severity 2	Injuries requiring a greater degree of medical care and hospitalization, but not expected to progress to a life threatening status
Severity 3	Injuries which pose an immediate life-threatening condition if not treated adequately and expeditiously. The majority of these injuries are the result of structural collapse and subsequent entrapment or impairment of the occupants.
Severity 4	Instantaneously killed or mortally injured

HAZUS can produce casualty estimates for three times of day:

- Earthquake striking at 2:00 a.m. (population at home)
- Earthquake striking at 2:00 p.m. (population at work/school)
- Earthquake striking at 5:00 p.m. (commute time).

Displaced Households/Shelter Requirements: Earthquakes can cause loss of function or habitability of buildings which contain housing. Displaced households may need alternative short-term shelter, provided by family, friends, temporary rentals, or public shelters established by relief organizations such as the Red Cross or Salvation Army. Long-term alternative housing may require import of mobile homes, occupancy of vacant units, net emigration from the impacted area, or, eventually, the repair or reconstruction of new public and private housing. The number of people seeking short-term public shelter is of most concern to emergency response organizations. The longer-term impacts on the housing stock are of great concern to local governments, such as cities and counties.

Economic Losses: HAZUS estimates structural and nonstructural repair costs caused by building damage and the associated loss of building contents and business inventory. Building damage can cause additional losses by restricting the building's ability to function properly. Thus, business interruption and rental income losses are estimated. HAZUS divides building losses into two categories: (1) direct building losses and (2) business interruption losses. Direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are associated with inability to operate a business because of the damage sustained during the earthquake. Business

interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

Earthquakes may produce indirect economic losses in sectors that do not sustain direct damage. All businesses are forward-linked (if they rely on regional customers to purchase their output) or backward-linked (if they rely on regional suppliers to provide their inputs) and are thus potentially vulnerable to interruptions in their operation. Note that indirect losses are not confined to immediate customers or suppliers of damaged enterprises. All of the successive rounds of customers of customers and suppliers of suppliers are affected. In this way, even limited physical earthquake damage causes a chain reaction, or ripple effect, that is transmitted throughout the regional economy.

1.8.2 HAZUS Scenario Earthquakes

Eight specific earthquakes, called scenario events, were chosen for HAZUS loss estimation (Table 1-11). These include the maximum probable earthquake (MPE) and the maximum credible earthquake (MCE) for Riverside County, as defined in Section 1.1.2. The earthquake chosen to represent MPE ground shaking is a magnitude 6.9 earthquake on the San Jacinto Valley segment of the San Jacinto fault. The MCE is a M_w 7.9 earthquake rupturing the entire southern San Andreas fault.

Table 1-11: HAZUS Scenario Earthquakes for Riverside County

Event		Maximum Magnitude (Mw)	Chance of Occurring in 30 Years	Comments
Fault	Segment			
San Andreas	Southern	7.9	22%	Worst-case scenario event for Riverside County. Involves rupture of the entire San Andreas from Cajon Pass to the Salton Sea. This event is considered the Maximum Credible Earthquake (MCE) for Riverside County.
San Andreas	San Bernardino	7.3	28%	Very high intensity ground shaking throughout the San Bernardino Valley, including north central Riverside County.
San Andreas	Coachella	7.1	22%	Very high intensity ground shaking throughout the Coachella Valley, impacting desert resort communities and agriculture.
San Jacinto	San Jacinto Valley	6.9	43%	Highest probability of occurrence of any southern California fault. Brought closer to failure as a result of stress field changes caused by the 1992 Landers earthquake. This event is considered the Maximum Probable Earthquake (MPE) for Riverside County.
San Jacinto	Anza Segment	7.2	17%	This event would be very destructive within the communities of Hemet and San Jacinto.
Elsinore	Temecula Segment	6.8	16%	Has not produced any significant earthquakes in historic time.
Elsinore	Glen Ivy Segment	6.8	16%	Would be very destructive in the communities of Lake Elsinore, Murrieta, and Temecula.
Whittier	Whittier	6.8	5%	Has not broken in over 1600 years (WGCEP, 1995). Would cause significant landsliding and lifeline damage in the Chino Hills - Corona area.

1.8.3 Inventory Data used in the HAZUS Loss Estimations

The HAZUS inventory includes census tract data provided in the 1990 national census, as well as Dun and Bradstreet valuations for real estate compiled in 1994. The general building stock and population inventory data conform to census tract boundaries. Essential facilities and lifeline inventory are located by latitude and longitude. The HAZUS inventory data were developed at a national level and where specific data are lacking, statistical estimations were utilized. While the inventory is the best available for Riverside County, collecting inventory data at a local level would improve the loss estimations.

The County is 7,301 square miles and contains 124 census tracts (see Figure 1-26). There are over 402,000 households, with a total population of 1,170,400 people.

There are an estimated 402,000 buildings in the region with a total building replacement value (excluding contents) of $61,138 million dollars (1994 dollars). About 98% of the buildings (and 82% of the building value) are associated with residential housing. Figure 1-27 presents the relative distribution of value with respect to the occupancies.

The replacement value of the transportation system is estimated to be $17,551 million dollars (1994 dollars).

Wood frame building construction is estimated to comprise 66% of the building inventory. The remaining 34% is distributed among the other general building types.

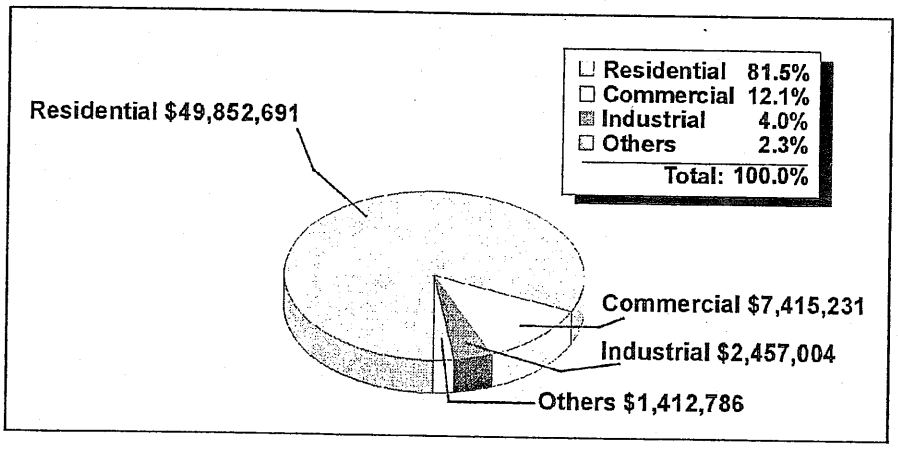


Figure 1-27: County of Riverside Building Inventory by Occupancy Type

Critical Facility Inventory:

HAZUS breaks critical facilities into two groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites. For essential facilities, HAZUS tallies 18 hospitals in the region (total bed capacity of 2,682), 380 schools, 52 fire stations, 45 police stations and 12 emergency operation facilities. With respect to HPL facilities, there are 46 dams in the HAZUS inventory. Of these, 23 are classified as 'high hazard' by HAZUS. The inventory also identifies 1,978 hazardous material sites, but does not include them in the analysis.

Transportation and Utility Lifeline Inventory:

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. The seven transportation systems include highways, railways, light rail, bus, ports, ferry and airports. There are six utility systems that include potable water, wastewater, natural gas, crude and refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1-12 and 1-13.

Table 1-12: Transportation System Lifeline Inventory

System	Component	# locations/# Segments	Replacement value (millions of dollars)
Highway	Major Roads	70	11,439
	Bridges	1,306	4,054
		Subtotal	15,493
Railways	Rail Tracks	169	822
	Bridges	4	20
	Facilities	2	6
		Subtotal	848
Bus	Facilities	6	6
Airport	Facilities	39	252
	Runways	34	952
		Subtotal	1,204
		Total	**17,551**

Table 1-13: Utility System Lifeline Inventory

System	Component	#Locations/ #Segments	Replacement value (millions of dollars)
Potable Water	Pipelines	3	na
	Facilities	0	na
Waste Water	Pipelines	0	na
	Facilities	1	na
Natural Gas	Pipelines	2	na
	Facilities	0	na
Oil Systems	Pipelines	1	na
Electrical Power	Facilities	0	na
Communication	Facilities	85	na
When data are not available for this inventory, HAZUS applies a statistical estimate based on population exposure (J. Bouabid, *personal communication*, 2000).			

1.8.4 Estimated Losses Associated with Scenario Earthquakes

HAZUS loss estimations for Riverside County were run for the eight scenario earthquakes listed in Table 1-11. Relative representations of the loss estimates are presented in Figure 1-28 for all eight scenario events. Projected losses associated with two events (the MCE and MPE) are described in additional detail in the following sections.

Summaries of building damage, casualties, shelter requirements, and economic losses in Riverside County associated with the eight scenario earthquakes are provided in Tables 1-14 through 1-17, below:

Number of buildings damaged, casualties and economic losses, respectively, associated with selected scenario earthquakes.

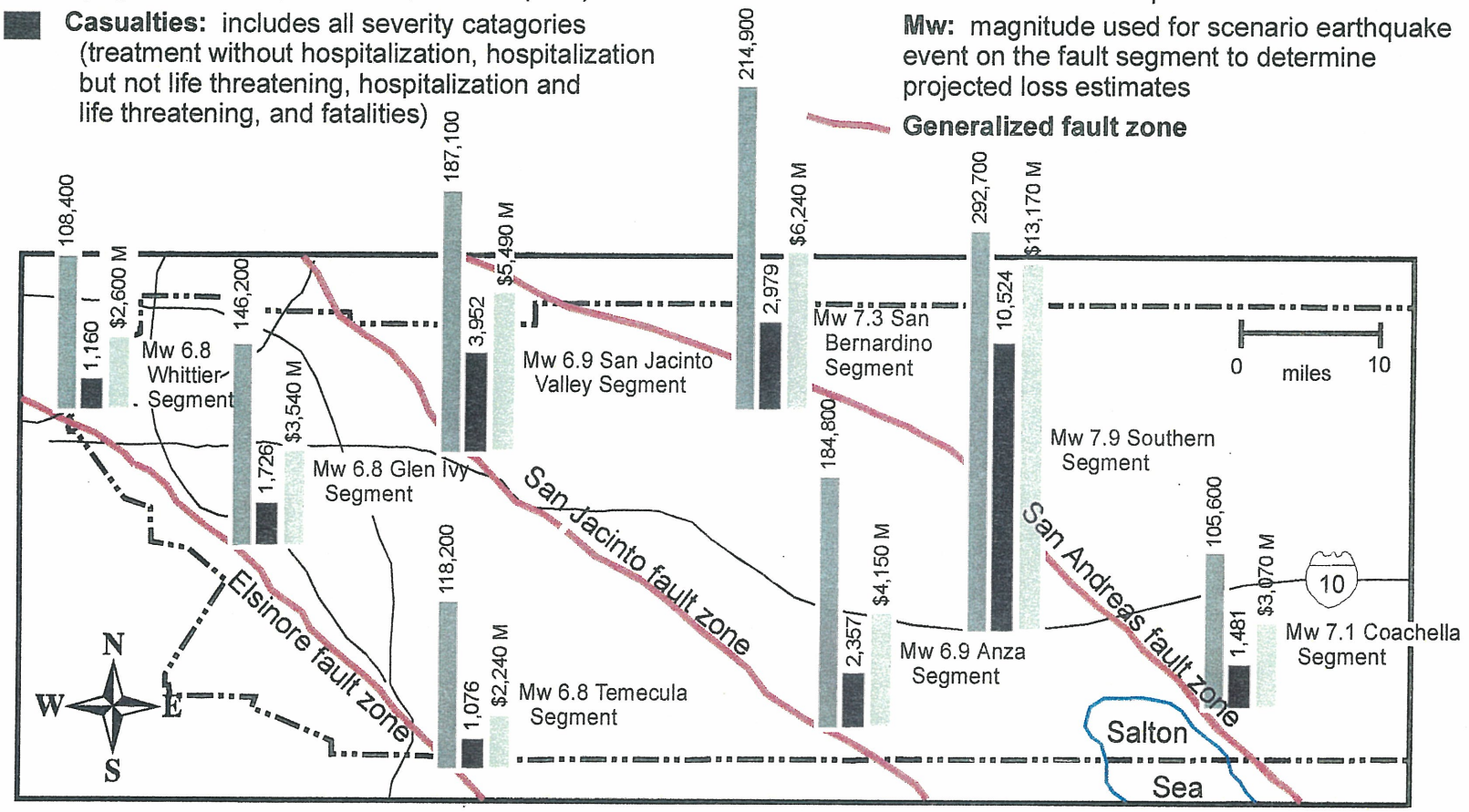
Building Damage: includes all damage levels (slight, moderate, extensive, and complete)

Casualties: includes all severity catagories (treatment without hospitalization, hospitalization but not life threatening, hospitalization and life threatening, and fatalities)

Economic Losses: includes property damage and business interuption

Mw: magnitude used for scenario earthquake event on the fault segment to determine projected loss estimates

Generalized fault zone



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Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

Figure 1-28: Relative Projected Loss Estimations for Scenario Earthquakes

Table 1-14: Number of Buildings Damaged

Scenario Event	Building Damage				Total
	Slight	Moderate	Extensive	Complete	
San Andreas-Southern Segment M_w 7.9 ***(MCE)***	112,100	92,700	50,900	37,000	292,700
San Andreas-San Bernardino Segment M_w 7.3	109,400	69,200	26,600	9,600	214,900
San Andreas-Coachella Segment M_w 7.1	52,700	35,200	13,100	4,600	105,600
San Jacinto-San Jacinto Valley Segment M_w 6.9 ***(MPE)***	92,800	57,300	26,600	10,500	187,100
San Jacinto-Anza Segment M_w 7.2	97,100	57,400	22,800	7,400	184,800
Elsinore-Temecula Segment M_w 6.8	69,300	36,100	10,600	2,200	118,200
Elsinore-Glen Ivy Segment M_w 6.8	82,000	46,600	14,300	3,300	146,200
Elsinore-Whittier M_w 6.8	65,100	33,100	8,400	1,700	108,400

Table 1-15: Estimated Casualties

Scenario Event	Casualty Severity*				Total
	1	2	3	4	
San Andreas-Southern Segment M_w 7.9 ***(MCE)***	8,159	1,499	302	127	10,524
San Andreas-San Bernardino Segment M_w 7.3	2,455	410	83	31	2,979
San Andreas-Coachella Segment M_w 7.1	1,216	207	42	16	1,481
San Jacinto-San Jacinto Valley Segment M_w 6.9 ***(MPE)***	2,916	503	71	39	3,952
San Jacinto-Anza Segment M_w 7.2	1,974	325	37	21	2,357
Elsinore-Temecula Segment M_w 6.8	911	139	17	9	1,076
Elsinore-Glen Ivy Segment M_w 6.8	1,453	231	25	17	1,726
Elsinore-Whittier M_w 6.8	974	153	20	13	1,160

*: Severity Definitions
Severity 1: Medical treatment without hospitalization.
Severity 2: Hospitalization but not life threatening.
Severity 3: Hospitalization and life threatening.
Severity 4: Fatalities.

Table 1-16: Estimated Shelter Requirements

Scenario Event	Estimates*	
	Displaced Households (no. of households)	Short Term Shelter (no. of people)
San Andreas-Southern Segment M_W 7.9 ***(MCE)***	8,159	1,499
San Andreas-San Bernardino Segment M_W 7.3	2,455	410
San Andreas-Coachella Segment M_W 7.1	1,216	207
San Jacinto-S.J. Valley Segment M_W 6.9 ***(MPE)***	2,916	503
San Jacinto-Anza Segment M_W 7.2	1,974	325
Elsinore-Temecula Segment M_W 6.8	911	139
Elsinore-Glen Ivy Segment M_W 6.8	1,453	231
Elsinore-Whittier M_W 6.8	974	153

*: HAZUS estimates 2.4 persons displaced per household, but typically not all require shelter (most apparently leave the area or stay with others). HAZUS uses past earthquake experiences and demographics (income) to estimate the number of persons requiring short-term shelter.

Table 1-17: Estimated Economic Losses

Scenario Event	Economic Losses (millions)		
	Property Damage	Business Interruption	Total
San Andreas-Southern Segment M_W 7.9 ***(MCE)***	$10,150	$3,020	$13,170
San Andreas-San Bernardino Segment M_W 7.3	$4,180	$1,440	$6,240
San Andreas-Coachella Segment M_W 7.1	$2,340	$720	$3,070
San Jacinto-S.J. Valley Segment M_W 6.9 ***(MPE)***	$4,280	$1,220	$5,500
San Jacinto-Anza Segment M_W 7.2	$3,280	$870	$4,150
Elsinore-Temecula Segment M_W 6.8	$1,800	$450	$2,240
Elsinore-Glen Ivy Segment M_W 6.8	$2,820	$730	$3,540
Elsinore-Whittier M_W 6.8	$2,060	$550	$2,600

1.8.5 Estimated Losses Associated with a M_w 6.9 San Jacinto Fault Earthquake (MPE)

This event was chosen as the MPE because it has the greatest probability of occurrence (43%, Table 1-11) within the lifetimes of structures in the County of Riverside (30 years). The event would involve a rupture of the San Jacinto Valley segment of the San Jacinto fault. The relatively high probability is related to the San Jacinto's high slip rate (±12 mm/year), as well as the increase in stress along the fault caused by the 1992 Landers earthquake. HAZUS estimates as many as 39 fatalities, about 3,500 injuries and total economic loss of $5.5 billion (equivalent to 9% of the total replacement value of the region's buildings).

Building Damage

HAZUS estimates that over 94,000 buildings will be at least moderately damaged. This is about 23% of the total number of buildings in the region. An estimated 10,485 buildings will be completely destroyed. The definition of 'damage states' are described above. Table 1-18 below summarizes the expected damage by general occupancy for Riverside County buildings, while Table 1-19 summarizes the expected damage by general building type.

Table 1-18: Expected Building Damage by Occupancy
M_w 6.9 San Jacinto Fault Earthquake

Occupancy Type	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Residential	210,420	97.90	91,537	98.67	56,074	97.92	26,124	98.20	10,295	98.2
Commercial	2,980	1.39	833	0.90	799	1.40	325	1.22	137	1.31
Industrial	823	0.38	241	0.26	268	0.47	108	0.41	36	0.34
Agriculture	264	0.38	62	0.00	45	0.08	20	0.08	10	0.10
Religion	222	0.10	67	0.00	52	0.09	18	0.07	3	0.03
Government	73	0.03	4	0.00	5	0.01	2	0.01	0	0.00
Education	162	0.08	29	0.03	21	0.04	7	0.03	4	0.04
Total	**214,944**		**92,773**		**57,264**		**26,604**		**10,485**	

Table 1-19: Expected Building Damage by Building Type (all design levels) M_w 6.9 San Jacinto Fault Earthquake

Occupancy Type	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	988	0.5	313	0.3	267	0.5	146	0.4	47	0.5
Mobile Homes	18,481	8.6	13,256	14.3	21,418	37.4	15,279	59.3	6,218	57.4
Precast Concrete	889	0.4	204	0.2	246	0.4	132	0.6	61	0.5
Reinforced Masonry	15,030	7.0	3,842	4.1	4,295	7.5	2,778	10.7	1,125	10.4
Steel	10,409	4.8	4,586	4.9	6,500	11.4	3,976	15.2	1,595	14.9
URM	1,008	0.5	589	0.6	794	1.4	661	6.8	708	2.5
Wood	168,139	78.2	69,983	75.4	23,744	41.5	3,632	7.0	731	13.7

Essential Facility Damage

Before the earthquake, there are 18 hospitals with 2,682 hospital beds available for use. HAZUS estimates that 51% of these beds are available on the day of the earthquake, as well as by patients already in the hospital. After one week, 64% of the beds will be back in service. By 30 days, 81% will be operational.

Table 1-20: Expected Damage to Essential Facilities as a Result of a Mw 6.9 Earthquake on the San Jacinto Fault

Classification	Total	Number of Facilities With		
		At Least Moderate Damage	Complete Damage	Functionality > 50% at day 1
Hospitals	18	17	0	10
Schools	380	378	0	146
EOCs	12	11	0	6
Police Stations	45	43	0	30
Fire Stations	52	52	0	16

Transportation and Utility Lifeline Damage

Table 1-21, below, provides damage estimates based on available inventory.

Table 1-21: Expected Damage to the Transportation Systems as a Result of a M_w 6.9 Earthquake on the San Jacinto Fault

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Bridges	1,306	89	18	1,254	1,299
Railways	Bridges	4	0	0	4	4
	Facilities	2	0	0	2	2
Bus	Facilities	6	1	0	6	6
Airport	Facilities	39	7	0	39	39
	Runways	34	1	0	34	34

HAZUS performs a simplified system performance analysis for electric power (Table 1-22).

Table 1-22: Expected Electric Power System Performance as a Result of a M_w 6.9 Earthquake on the San Jacinto Fault

System	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Electric Power	402,426	93,996	17,668	825	0	0

Fire Following Earthquake

HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this MPE scenario, 124 ignitions will burn about 0.03% of the region's total area, displace about 360 people and burn about $19.0 million of building value.

Debris Generation

HAZUS estimates that 4.5 million tons of debris will be generated. Brick/Wood comprises 36% of the total, with the remainder Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 180,984 truckloads (@25 tons/truck) to remove the debris generated by the MPE.

Shelter Requirement

HAZUS estimates 9,345 households will be displaced due to the earthquake. Of these, 6,964 people will seek temporary shelter in public shelters.

Casualties

Table 1-23 provides a summary of the casualties estimated for this MPE.

Table 1-23: Casualty Estimates as a Result of a M_w 6.9 Earthquake on the San Jacinto Fault

		Level 1	Level 2	Level 3	Level 4
2 AM (maximum residential occupancy)	**Residential**	2,898	498	38	38
	Non-Residential	16	3	0	0
	Commute	2	3	4	1
	Total	2,916	503	42	39
2 PM (maximum educational, industrial and commercial)	**Residential**	1,119	193	14	14
	Non-Residential	866	157	20	20
	Commute	8	13	20	4
	Total	1,993	363	54	38
5 PM (peak commute time)	**Residential**	1,328	229	17	17
	Non-Residential	264	48	6	6
	Commute	20	33	48	10
	Total	1,613	309	71	32

Building-Related Economic Losses

Total building-related losses were $5.5 billion dollars, and 22% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up over 68% of the total loss. Table 1-24, below, provides a summary of the losses associated with building damage.

Table 1-24: Building-Related Economic Loss Estimates (millions of dollars) as a Result of a M_w 6.9 Earthquake on the San Jacinto Fault

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss	Structural	615.3	158.3	48.1	31.0	**852.7**
	Non-Structural	2,061.2	368.2	107.2	81.1	**2,617.7**
	Content	519.1	167.0	73.8	35.1	**794.9**
	Inventory	N/A	3.6	11.7	0.9	**16.2**
	Subtotal	3,195.6	697.1	240.8	148.1	**4,281.6**
Business Interruption Loss	Wage	16.6	190.3	10.4	8.8	**226.0**
	Income	7.1	208.6	6.2	2.4	**224.4**
	Rental	160.2	67.2	4.9	4.6	**236.9**
	Relocation	378.7	105.1	12.8	39.3	**535.9**
	Subtotal	562.7	571.2	34.4	55.1	**1,223.3**
	Total	3,758.3	1,268.3	275.1	203.2	**5,504.9**

1.8.6 Estimated Losses Associated with a M_w 7.9 Southern San Andreas Earthquake

This event represents the Maximum Credible Earthquake (MCE) for Riverside County. The earthquake would rupture the San Andreas fault from Cajon Pass, north of the County, to the Salton Sea. It is an event that likely occurs only once every several hundred years, but should it occur tomorrow, HAZUS estimates that Riverside County would suffer about 120 deaths, nearly 9,800 injuries, and economic losses of $13.6 billion, about 22% of the total replacement value of the region's buildings.

Building Damage:

HAZUS estimates that over 181,000 buildings will be at least moderately damaged. This is over 45% of the buildings in the County. An estimated 37,013 buildings will be destroyed. Table 1-25 below summarizes the expected damage by building occupancy, while Table 1-26 summarizes expected damage by building type.

Table 1-25: Expected Building Damage by Occupancy
M_w 7.9 San Andreas Fault Earthquake

Occupancy Type	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Residential	107,383	98.18	110,856	98.89	90,754	97.89	49,686	97.66	35,937	97.1
Commercial	1,259	1.15	817	0.73	1,331	1.44	856	1.68	799	2.16
Industrial	399	0.36	233	0.21	375	0.40	224	0.44	179	0.48
Agriculture	128	0.12	80	0.00	94	0.10	43	0.08	41	0.11
Religion	104	0.10	73	0.00	97	0.10	41	0.08	36	0.10
Government	25	0.02	4	0.00	11	0.01	5	0.01	3	0.01
Education	78	0.07	32	0.03	49	0.05	20	0.04	18	0.05
Total	109,376		112,095		92,711		50,875		37,013	

Table 1-26: Expected Building Damage by Building Type (all design levels)
M_w 7.9 San Andreas Fault Earthquake

Occupancy Type	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	420	0.4	321	0.3	430	0.5	309	0.8	281	0.6
Mobile Hms.	2,123	1.9	6,125	5.5	18,971	20.5	25,484	59.3	21,949	50.1
Precast Concrete	415	0.4	204	0.2	370	0.4	276	0.7	267	0.5
Reinforced Masonry	7,546	6.9	4,360	3.9	6,240	6.7	4,932	10.8	3,992	9.7
Steel	3,387	3.1	3,485	3.1	7,807	8.4	7,310	13.7	5,077	14.4
URM	140	0.1	233	0.2	568	0.6	834	5.4	1,985	1.6
Wood	95,345	87.2	97,367	86.9	58,325	62.9	11,730	9.4	3,462	23.1

Essential Facility Damage:

Before the earthquake, the region had 2,682 hospital beds available for use. HAZUS estimates that only 20% of these beds are available on the day of the earthquake, as well as by patients already in the hospital. After one week, 34% of the beds will be back in service. Even after 30 days, only 57% will be operational.

Table 1-27: Expected Damage to Essential Facilities as a Result of a M_w 7.9 Earthquake on the San Andreas Fault

Classification	Total	Number of Facilities With		
		At Least Moderate Damage	Complete Damage	Functionality > 50% at day 1
Hospitals	18	18	0	2
Schools	380	380	0	3
EOCs	12	12	0	1
Police Stations	45	45	0	8
Fire Stations	52	52	0	4

Transportation and Utility Lifeline Damage:

Table 1-28, below, provides damage estimates based on available inventory.

Table 1-28: Expected Damage to the Transportation Systems as a Result of a M_w 7.9 Earthquake on the San Andreas Fault

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Bridges	1,306	392	124	936	1,096
Railways	Bridges	4	1	0	4	4
	Facilities	2	0	0	2	2
Bus	Facilities	6	3	0	5	6
Airport	Facilities	39	14	1	36	39
	Runways	34	1	1	34	34

HAZUS performs a simplified system performance analysis for electric power (Table 1-29).

Table 1-29: Expected Electric Power System Performance as a Result of a M_w 7.9 Earthquake on the San Andreas Fault

System	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Electric Power	402,426	210,867	121,080	50,577	4,470	0

Fire Following Earthquake

HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this MCE scenario, HAZUS estimates 124 ignitions that will burn about 0.06% of the region's total area, displace about 830 people, and burn about $51.0 million dollars of building value.

Debris Generation

HAZUS estimates 11.9 million tons of debris will be generated. Brick/Wood comprises 36%, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 474,338 truckloads (@25 tons/truck) to remove the debris generated by the MCE for Riverside County.

Shelter Requirement

HAZUS estimates 27,027 households will be displaced. Of these, 20,079 people will seek temporary shelter in public shelters.

Casualties

Table 1-30 provides a summary of the casualties estimated for this earthquake

Table 1-30: Casualty Estimates as a Result of a M_w 7.9 Earthquake on the San Andreas Fault

		Level 1	Level 2	Level 3	Level 4
2 AM (maximum residential occupancy)	Residential	8,102	1,479	122	122
	Non-Residential	51	10	1	1
	Commute	7	11	17	3
	Total	8,159	1,499	141	127
2 PM (maximum educational, industrial and commercial)	Residential	2,960	540	43	43
	Non-Residential	2,676	508	67	67
	Commute	36	56	85	17
	Total	5,672	1,104	195	127
5 PM (peak commute time)	Residential	3,515	642	52	52
	Non-Residential	841	160	21	21
	Commute	98	149	229	46
	Total	4,454	950	302	118

Building-Related Economic Losses

Total building-related losses were $13.2 billion dollars, and 25% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up over 67% of the total loss. Table 1-31, below, provides a summary of the losses associated with building damage.

Table 1-31: Building-Related Economic Loss Estimates (millions of dollars) as a Result of a Mw 7.9 Earthquake on the San Andreas Fault

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss	Structural	1,532.3	433.1	104.0	71.3	2,140.7
	Non-Structural	5,085.1	975.7	195.6	180.6	6,436.9
	Content	1,032.4	335.8	116.0	60.6	1,544.7
	Inventory	N/A	6.9	18.3	1.7	26.9
	Subtotal	7,649.8	1,751.5	433.9	314.2	10,149.3
Business Interruption Loss	Wage	69.6	566.5	21.4	18.5	676.0
	Income	29.5	742.3	12.8	5.6	790.3
	Rental	459.9	171.5	9.5	10.3	651.1
	Relocation	934.1	253.2	23.3	86.7	1,297.4
	Subtotal	1,493.1	1,733.5	67	121.1	3,021
	Total	**9,142.9**	**3,485.0**	**500.9**	**435.3**	**13,170**

1.9 Reducing Earthquake Hazards in the County of Riverside

This section identifies and discusses the opportunities available for seismic upgrading of existing development and capital facilities, including potentially hazardous buildings and other critical facilities. Many of the issues and opportunities available to the County apply to new development, redevelopment and infilling. Issues involving rehabilitation and strengthening of existing development are decidedly more complex, given the inherent economic and societal impacts.

To prioritize rehabilitation and strengthening projects, the County must consider where its resources are best spent to reduce earthquake hazards in the existing development, and how mitigation programs can be implemented to avoid undue hardship in the community. Certainly, potentially hazardous buildings, critical facilities, and high-risk lifeline utilities will have high priority.

Only the County can set its priorities. This hazard evaluation helps define the scope of the problem.

Recent California earthquakes, with their relatively low loss of life, have demonstrated that the best mitigation technique is our ongoing improvement of building codes as we incorporate lessons from damaging earthquakes, worldwide. Our most recent building codes (1997, adopted by the County of Riverside Department of Building and Safety in July 1999), are a prime example. However, while hazard is reduced by new building codes, it is simultaneously increased by population growth, which leads to development in vulnerable areas, and by the aging of the existing building stock.

It must be stressed that building codes are designed to protect lives, not structures. Under recent building code improvements, buildings will still be damaged, but are far less likely to fail catastrophically.

It also needs to be emphasized that all development choices have some hazards associated with them. Most can and have been mitigated by engineered solutions. The recognition that these solutions require maintenance to function properly has been an expensive lesson to many. The recognition that engineered solutions have a finite design life has yet to be appreciated because of the relative youth of the County's development. This is an expense that will be passed on to future generations. Minimizing engineered mitigation, and maximizing land use planning, is the most environmentally balanced - and in the long-term, the most economical - route to a sustainable, safe community.

1.9.1 1997 Uniform Building Code Impacts on the County of Riverside

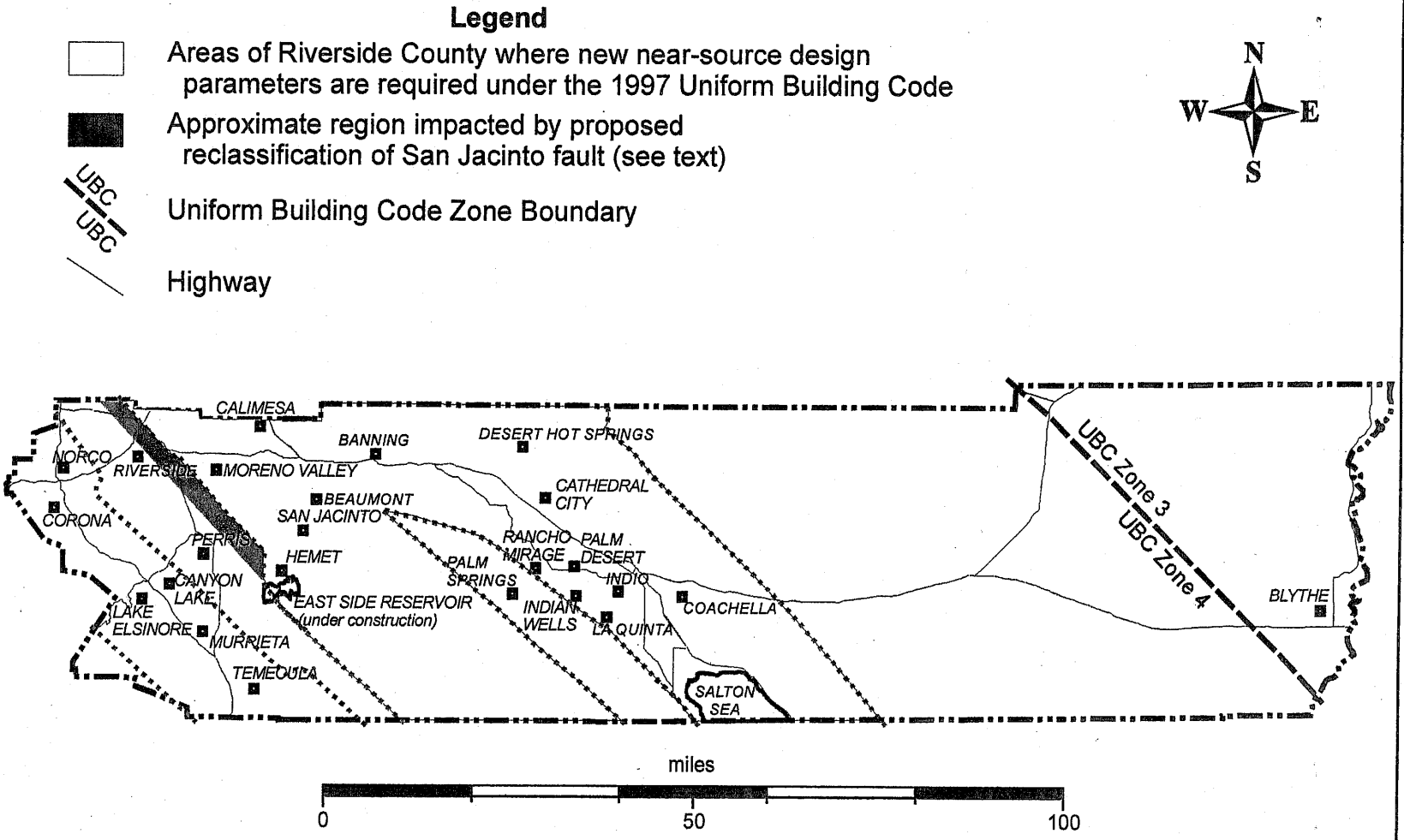
Changes in the 1997 UBC represent the most significant increases in ground shaking criteria in the last 30 years. Two changes have special significance for the County of Riverside. The first change is a revision in soil types and amplification factors. The second change incorporates the proximity of earthquake sources in UBC seismic zone 4. Zone 4 is the highest hazard zone and includes most of the County of Riverside. The eastern portion of the County (Blythe Region; Figure 1-29) is Zone 3, so the 1997 near-source seismic provisions of the UBC do not apply. The Riverside County Department of Building and Safety defines the UBC seismic zones in the County as follows:

"The townships T2SR16E, T3SR17E, T4SR18E, T5SR19E, T6SR20E, T7SR21E, T8SR22E are inclusive to the UBC SEISMIC ZONE-4 and the townships lying East of listed above may be considered in the SEISMIC ZONE-3."

Buildings of short predominant period of ground shaking (low-rises) must now also consider soil effects. In the past, only long-period structures (high-rises) were influenced by UBC requirements. The new ground shaking basis for code design is more complicated, because of the wide range of soil types and the close proximity of seismic sources. For the County of Riverside, these code changes are warranted. The new soil effects are based on observations made as a result of the Mexico City and Loma Prieta earthquakes, and affect all new buildings in western and central Riverside County. Most of the western and central portions of the County are affected by the new, near-source design factors (see Figure 1-29). An Atlas, "Maps of Known Near-Source Zones in California and Adjacent Portions of Nevada" was prepared by the California Division of Mines and Geology and published by the International Conference of Building Officials for use with the 1997 UBC (ICBO, 1998). The 1997 UBC contains detailed descriptions of the incorporation of the new near-source and soil parameters; only a summary is provided below:

Soil Types and Soil Amplification Factors: The seismic design response spectra are defined in terms of two seismic coefficients Ca and Cv. These coefficients are functions of the following parameters:

- Seismic Zone (e.g. UBC Zone 0, 1, 2, 3, or 4)
- Soil Type, and
- Near Source Factors (UBC Zone 4 only)



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Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

Figure 1-29: Near Source Zone Regions Impacting Riverside County and UBC Zone Boundary

The UBC outlines six soils types, using the average soil properties in the top 100 feet of soil, sediment and rock. Based on geologic mapping prepared for this study, "Engineering Geologic Map of Riverside County", which is described in detail in Chapter 2-Geologic Hazards, we have prepared Figure 1-30 to illustrate the areal distribution of the UBC soil types. The engineering parameters associated with the UBC soil types are outlined, below in Table 1-32.

Table 1-32: 1997 Uniform Building Code Soil Profile Types

Soil Profile Type	Soil Profile Name/Generic Description	Average Soil Properties for the Upper 100 Feet		
		Shear Wave Velocity (feet/second)	Standard Penetration Test (blows/foot)	Undrained Shear Strength (psf)
S_A	Hard Rock	>5,000		
S_B	Rock	2,500 to 5,000		
S_C	Very dense soil and soft rock	1,200 to 2,500	>50	>2,000
S_D	Stiff soil profile	600 to 1,200	15 to 50	1,000 to 2,000
S_E	Soft soil profile	<600	<15	<1,000
S_F	Soil requiring site-specific evaluation.			

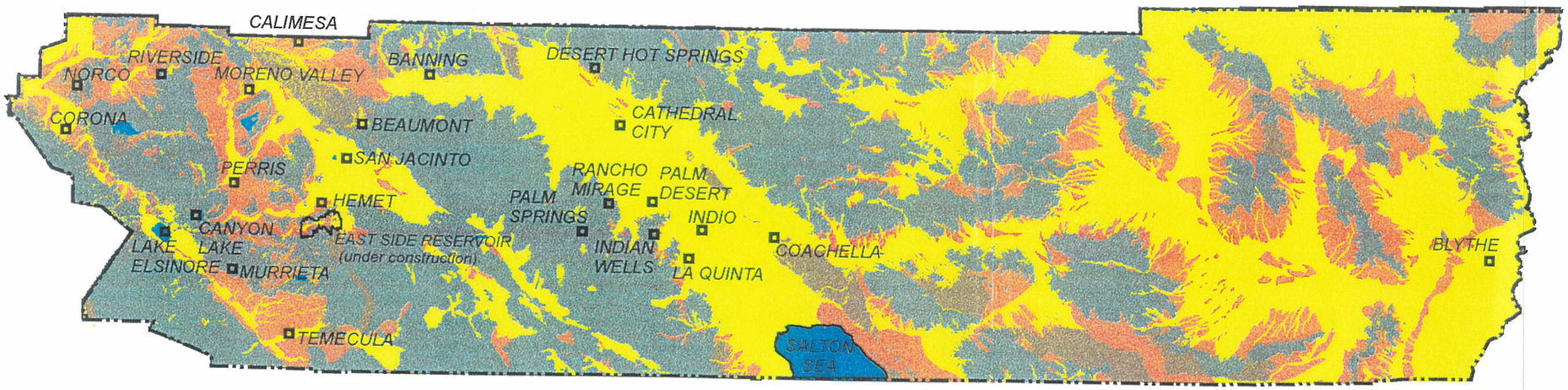
The detailed Geographic Information System (GIS) engineering geology coverage for Riverside County was converted to the basic UBC soil profiles illustrated on Figure 1-30 based on the following assumptions:

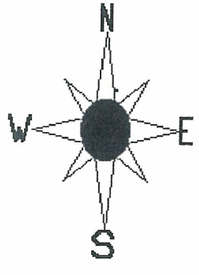
- S_A: Does not generally exist in California.
- S_B: Includes all igneous and metamorphic bedrock types.
- S_C: Includes all pre-Quaternary rock types, as well as Pleistocene soils described as "indurated"
- S_D: Generally Pleistocene soils, or soils described as "moderately consolidated"
- S_E: Generally Holocene soils, or soils described as "unconsolidated" or "weakly consolidated"

Figure 1-30:

General Uniform Building Code Soil Types

The soil types illustrated herein are based on regional mapping and should not substitute for site-specific evaluation. This map is intended to be used with the 1997 Uniform Building Code, Tables 16-S and 16-T.





Scale: 1:1,000,000

10 0 10 20 30

Miles

Earth Consultants International

Soil Profile Type	Soil Profile Name/Generic Description	Average Soil Properties for the Upper 100 Feet		
		Shear Wave Velocity (feet/second)	Standard Penetration Test (blows/foot)	Undrained Shear Strength (psf)
S_A	Hard Rock	>5,000		
S_B	Rock	2,500 to 5,000		
S_C	Very dense soil and soft rock	1,200 to 2,500	>50	>2,000
S_D	Stiff soil profile	600 to 1,200	15 to 50	1,000 to 2,000
S_E	Soft soil profile	<600	<15	<1,000
S_F	Soil requiring site-specific evaluation.			

Near Source Factors: Most of the western and central portions of the County of Riverside (see Figure 1-29) are subject to near source design factors based on the proximity of three major fault systems (Elsinore, San Jacinto, and San Andreas), as well as some smaller fault systems (Chino-Central Avenue, Burnt Mountain, and Eureka Peak). These parameters, new to the 1997 Uniform Building Code (UBC), address the proximity of potential earthquake sources (faults). In earlier versions of the UBC, these factors were present for the design of seismically isolated (base-isolation) structures, but were not applied to other structures until now. Ground shaking that was far more intense than expected occurred near the fault ruptures at Northridge in 1994 and at Kobe, Japan in 1995. The 1997 UBC also includes a near-source factor that accounts for directivity of fault rupture. The direction of fault rupture played a significant role in distribution of ground shaking at Northridge and Kobe. For Northridge, much of the earthquake energy was released into the sparsely populated mountains north of the San Fernando Valley, while at Kobe, the rupture directed energy into the City and contributed to extensive damage. Since the rupture direction of a given source cannot be predicted, the UBC requires about a 20% general increase in estimated ground shaking to account for directivity.

Seismic Source Type: Near source factors include a classification of seismic sources based on slip rate and maximum magnitude potential. These parameters are used to classify three seismic source types (A, B and C), in Table 1-33, below.

Table 1-33: 1997 Uniform Building Code Seismic Source Types

Seismic Source Type	Seismic Source Description	Seismic Source Definition	
		Maximum Moment Magnitude, M	Slip Rate, SR (mm/yr)
A	Faults that are capable of producing large magnitude events and which have a high rate of seismicity.	$M_w \geq 7.0$ and	$SR \geq 5$
B	All faults other than Types A and C.		
C	Faults which are not capable of producing large magnitude earthquakes and which have a relatively low rate of seismic activity.	$M_w < 6.5$	$SR \leq 2$

Type A faults are active and capable of producing large magnitude events. Most segments of the San Andreas and associated faults are classified as Type A, including those in the County of Riverside. The Type A slip rate (>5 mm/yr) and magnitude (Mw 7.0 or greater) are common only to faults near boundaries of tectonic plates (Pacific and North American). Type C seismic sources are considered to be sufficiently inactive and not capable of producing large magnitude events such that potential ground shaking effects can be ignored. Type B sources include all faults that are neither Type A nor C, thus Type B includes most of the active faults in California. The San Andreas fault and most of the San Jacinto fault in Riverside County are Type A faults. The 1997 UBC requires that the locations and characteristics of these faults be established based on reputable sources such as the California Division of Mines and Geology (DMG) and the U.S. Geological Survey (USGS). The fault parameters used by the DMG (ICBO, 1998) in classifying seismic source zones in the County of Riverside, and the UBC "Type" assigned to the fault segments as a result, are summarized in Table 1-34, below.

Table 1-34: 1997 Uniform Building Code Near-Source Zones and Classifications of Faults in Riverside County

Source	Maximum Magnitude (M_w)	Slip Rate (mm/year)	Type
San Andreas - San Bernardino Segment	7.3	24	A
San Andreas - Southern Segment	7.4	24	A
San Jacinto - San Jacinto Valley Segment	***6.9***	***12***	***B***
San Jacinto - Anza Segment	7.2	12	A
Elsinore - Temecula Segment	6.8	5	B
Elsinore - Glen Ivy Segment	6.8	5	B
Elsinore - Whittier Segment	6.8	2.5	B
Chino - Central Avenue Fault	6.7	1	B
Burnt Mountain Fault	6.4	0.6	B
Eureka Peak Fault	6.5	0.6	B

The whole San Jacinto fault should be considered a seismic source Type A. The UBC source zone classification of the San Jacinto Valley segment of the San Jacinto fault as a type B fault is based on its maximum magnitude of 6.9. The UBC has a minimum M_w 7.0 for Type A. However, of any southern California fault, this fault segment has the highest probability of generating a large earthquake in the next 30 years (43%; WGCEP, 1995). It also has a high slip rate (±12 mm/year). Further, there are always uncertainties in identifying fault segments boundaries (and thus maximum magnitudes). For all these reasons, we recommend reclassifying the San Jacinto fault as a Type A. This reclassification would extend the near source zone an additional 5 kilometers as shown on Figure 1-29, and affect the near source factors for the area (Tables 16-S and 16-T; UBC, 1997). Reclassification would mitigate the potential for building damage in portions of the cities of Riverside, Moreno Valley and Perris.

To establish near-source factors for any proposed project in the County of Riverside, the first step is to identify and locate known active faults in the region. The International Conference of Building Officials (ICBO) has provided an Atlas of the location of known faults for California to accompany the 1997 UBC.

The rules for measuring distance from a fault are provided by the 1997 UBC. The criteria for determining distance to vertical faults, such as the San Andreas, are relatively straightforward. The distance to thrust faults (which meet the surface at a low angle) and blind thrust faults (which are shallow dipping but buried) is assumed as 0 for anywhere above the dipping fault plane to a depth of 10 kilometers. This greatly increases the areal extent of high ground shaking parameters, but is warranted based on observations of ground shaking at Northridge.

Summary: Seismic building codes are now undergoing their most significant changes since their inception. These improvements are a result of experience in recent earthquakes, as well as extensive research under the National Earthquake Hazard Reduction Program (NEHRP). Inclusion of soil and near-field effects in the 1997 UBC represents meaningful and important change. Seismic codes will continue to improve under the International Building Code, which is to replace the UBC beginning in the year 2000.

1.9.2 Retrofit and Strengthening of Existing Structures

The new building codes mitigate hazard in new construction. The retrofit and strengthening of existing structures requires the adoption of ordinances. The

County of Riverside is required by state law to adopt an ordinance aimed at retrofitting unreinforced masonry buildings (URMs). Although retrofit buildings may still incur severe damage during an earthquake, the mitigation results in a substantial reduction of casualties by preventing collapse.

Past earthquakes have shown that many other types of structures other than URMs are potentially hazardous. Structures built before the code incorporated lessons from the 1971 Sylmar earthquake are particularly susceptible to damage. These include pre-cast tilt-up concrete buildings, soft-story structures, unreinforced concrete buildings, as well as pre-1940 single-family structures. Other potentially hazardous buildings include irregular-shaped structures and mobile homes.

The County should consider a program to inventory its building stock. Buildings can be identified and inventoried following the recommendations set forth in publications such as "Rapid Visual Screening of Buildings for Potential Seismic Hazards: Handbook and Supporting Documentation" and " A Handbook for Seismic Evaluation of Existing Buildings and Supporting Documentation", both prepared by the Applied Technology Council in Redwood County, California, and supplied by the Federal Emergency Management Agency (FEMA publications 154 and 155, and 175 and 178, respectively).

Often, and understandably, communities seek to cut inventory costs by looking only for hazardous structures. However, it quickly becomes more cost-effective to perform a complete inventory than to return to the same databases and neighborhoods for new partial inventories, as additional hazardous building features are recognized by the engineering community. Knowing the total building stock allows more accurate loss estimations and more able prioritizing of limited resources.

The societal and economic implications of rehabilitating existing buildings are discussed in many publications, including "Establishing Programs and Priorities for the Seismic Rehabilitation of Buildings - A Handbook and Supporting Report", "Typical Costs for Seismic Rehabilitation of Existing Buildings: Summary and Supporting Documentation," (FEMA Publications 174 and 173, and 156 and 157, respectively). Another appropriate source is the publication prepared by Building Technology, Inc. entitled "Financial Incentives for Seismic Rehabilitation of Hazardous Buildings - An Agenda for Action (Report and Appendices).

The building inventory phase of a seismic hazard mitigation program should incorporate GIS technology. The data base should include information such as the location, the date and type of construction, construction materials and type of structural framing system, structural conditions, number of floors, floor area,

occupancy and relevant characteristics of the occupants (such as whether the building houses predominantly senior citizens, dependent care or handicapped residents), and information on other building characteristics that may pose a threat to life. In proper format, this information may be input into the HAZUS database and mitigation improvements could be tracked by running updated loss estimation calculations.

Once buildings are identified as potentially hazardous, a second, more thorough analysis may be conducted. This may be carried out by local officials, such as the County's building department, or building owners may be required to submit a review by a certified structural engineer. The review would assess the structural and non-structural elements and general condition of the building, and the building's construction documents (if available). Nonstructural elements should include the architectural, electrical and mechanical systems of the structure. Cornices, parapets, chimneys and other overhanging projections should be considered, as these may pose a significant threat to passers by, and to individuals who, in fear, may leave the building during shaking. State of repair of buildings should also be noted, including cracks, rot, corrosion, and lack of maintenance, as these conditions may decrease the seismic strength of a structure. Occupancy should be noted as this factor is very useful in prioritizing the buildings to be abated for seismic hazards.

For multi-story buildings, high occupancy structures, and critical facilities, the analysis should include an evaluation of the site-specific seismic environment (e.g., response spectra, estimates of strong ground motion duration, etc.), and an assessment of the building's loads and anticipated deformation levels. The resulting data should be weighted against acceptable levels of damage and risk chosen by the County for that particular structure. Once these guidelines are established, available mitigation techniques (including demolition, strengthening and retrofitting, etc.) can be evaluated, weighted, and implemented.

The County of Riverside should set a list of priorities to establish and conduct strengthening of hazardous buildings, once identified. Currently, there are no Federal or State mandated criteria established to determined the required structural seismic resistance capacity of structures. Retrofitting to meet the most current UBC standards may be cost-prohibitive, and therefore, not feasible. The County may develop its own criteria, following a comprehensive development and review process that involves experienced structural engineers, building officials, insurance representatives, and legal authorities. Selection of the criteria may follow review of the seismic performance of similar buildings that had been retrofit prior to an earthquake. For example, upgrading potentially hazardous buildings to 1973 standards may prove inefficient if past examples show that similar buildings retrofit

to 1973 construction codes performed poorly and had to be demolished anyway. Many issues must be addressed, including justification for strengthening a building to a performance level less than the current code requirements, the potential liabilities and limitations on liability, and the acceptable damage to the structure after strengthening (FEMA, 1985).

Programs to encourage mitigation of potentially hazardous buildings can be voluntary or mandatory. Voluntary programs have been implemented with various degrees of success in California. Incentives to engender support among building owners include tax waivers, tax credits, and waivers from certain zoning restrictions. Other cities have mandated review by a structural engineer when a building is undergoing substantial improvements.

1.10 Earthquake Safety

An excellent guide for citizens to minimize earthquake hazard in their daily lives was put together by the U.S. Geological Survey in Pasadena. The 1995 guide, *Putting Down Roots in Earthquake Country,* is available on the Internet:

http://www.scecdc.scec.org/eqcountry.html

The sections below contain excerpts from *Putting Down Roots in Earthquake Country.*

1.10.1 Anatomy of a Safe Building

Buildings are built to withstand the downward pull of gravity. Earthquakes push on a building in all directions--up and down, but most of all, sideways. A safe building is one that can withstand the sideways push.

A safe building is built on a firm foundation. The foundation should be solid with a continuous perimeter. The house should be securely fastened to the foundation--so it cannot be pushed off--by drilling bolts through the mudsill and into the concrete of the foundation.

A safe building securely connects the building components together. Mortar in brick and masonry dissolves under even moderate shaking and should not be a structural element. A house with a crawl space (not a slab foundation) needs bracing of the cripple walls that surround the crawl space to resist the sideways push. The opening of a garage door supports nothing and other walls must compensate if that is the first floor of a multistory building.

A safe building is built of strong materials. Damaged concrete and rotten wood undermine the integrity of the building.

A safe building protects the plumbing. Broken water pipes will cause water damage and broken gas pipes are a great fire hazard. Pipes need some but not too much room to sway.

Most houses in southern California are not as safe as they could be. The following presents some common structural problems and how to recognize them. To fix them, you will need to obtain more information. Refer to the recommended resources in Section 1.10.5 and consult with a professional contractor or engineer.

- INADEQUATE FOUNDATIONS: Go into your crawl space and look at your

foundation. If the foundation is damaged or built in the "pier and post" style, consult a contractor or engineer about replacing it with a continuous perimeter foundation. Look for bolts in the mudsills. They should be no more than 6 feet apart in single story and 4 feet apart in multi-story buildings. Adding bolts to unsecured houses is one of the most important steps toward earthquake safety. This can be done by a contractor or by someone moderately adept at home maintenance.

- UNBRACED CRIPPLE WALLS: Go into your crawl space and look for panels of plywood or diagonal wood sheathing connecting the studs of the cripple walls. You or a contractor can strengthen the cripple walls relatively inexpensively.

- SOFT FIRST STORIES: Look for large openings in the lower floor, such as a garage door or a hillside house built on stilts. Consult a professional to determine if your building is adequately braced.

1.10.2 Protecting the Contents of Your Home

Earthquake safety is more than keeping our buildings from falling down. We must secure the contents of our buildings to reduce the risk to both our lives and our pocketbooks.

Four people died in the Northridge earthquake because of damage to building contents, such as toppling bookcases. Many billions of dollars were lost due to nonstructural damage.

Nonstructural safety is up to you. The hazard hunt showed potential problem areas of your home. Here we show you just what you can do to secure possessions inside your home. You should secure anything 1) heavy enough to hurt you if it falls on you, or 2) fragile and/or expensive enough to be a significant loss if it falls.

Most hardware stores now carry earthquake safety kits or the raw materials for you to make your own earthquake fasteners.

- SECURING TABLETOP OBJECTS: TVs, stereos, computers, lamps, and chinaware are heavy and costly to replace. They can be secured with buckles and safety straps attached to the tabletop (which allow easier movement of the unit when needed) or with hook and loop fasteners glued to both table and unit. Glass and pottery objects can be secured with nondrying putty or microcrystalline wax, available at many stores.

- IN YOUR KITCHEN: Unsecured cabinet doors fly open during earthquakes, allowing glassware and china to crash to the floor. Many types of latches are available to prevent this--child-proof latches, hook and eye latches, or positive catch latches designed for boats. Gas appliances should have flexible connectors to reduce the risk of fire.

- OBJECTS FROM ABOVE: Ceiling lights and fans can be very heavy and present a significant safety hazard. These should be additionally supported with a cable bolted to the ceiling joist. The cable should have enough slack to allow it to sway. Framed pictures, especially glass-covered, should be hung from closed hooks so that they can't bounce off. Only soft art such as tapestries should be placed over beds or sofas.

- PROTECTING YOURSELF FROM BROKEN GLASS: Window glass can shatter during earthquakes and presents a significant hazard. Windows made from safety glass or covered with a strong mylar film are much safer. Be sure you use safety film and not just a solar filter.

- ANCHORING YOUR FURNITURE: Secure the tops of all, top-heavy furniture such as bookcases and file cabinets to the wall. Be sure to anchor to the stud, and not just to plasterboard. Flexible fasteners such as nylon straps allow tall objects to sway without falling over, reducing the strain on the studs.

Below is a checklist of items that frequently cause injury or are damaged in earthquakes:

THE HAZARD HUNT CHECKLIST

TABLETOP OBJECTS

- Televisions
- Stereo systems
- Art objects
- Glassware & vases
- Computers
- Monitors
- Speakers

IN YOUR KITCHEN

- Unlatched cupboards
- Microwave ovens
- Gas appliances

OBJECTS FROM ABOVE

- Hanging lights
- Ceiling fans
- Picture frames
- Hanging mirrors

GLASS

- Sliding glass doors
- Windows

TALL FURNITURE

- Tall bookcases
- File cabinets
- Armoires
- China cabinets

1.10.3 Personal Safety During an Earthquake

The previous sections have concentrated on making your environment safer before the next earthquake. What should you do during an earthquake? The next big earthquake will be less traumatic if you:

1) prepare an earthquake plan and practice it;
2) know what to do during a big earthquake; and
3) store supplies to make life more comfortable after the earthquake (see Section 1.10.4, After the Earthquake).

1.10.3.1 PREPARE A PLAN

How rational do you think you will be during the violent shaking of a major earthquake? Before the next earthquake, get together with your family or housemates to plan now what you will do during and after that event.

1) Teach everyone to "duck, cover, and hold."

2) Identify safe spots in every room, such as sturdy desks and tables, and interior walls.

3) Teach everyone who could be home alone how to turn off the gas--but only if they smell or hear a leak.

4) Establish an out-of-area contact person who can be called by all family members to relay information. In an emergency, out-of-area calls are often easier to place than local calls.

5) Store supplies and prepare a personal earthquake bag.

Practice your plan often before the next earthquake, so habit can overcome fear. Also work with your neighbors to prepare a neighborhood plan. You may have elderly or disabled neighbors who could need your help. The support of friends and neighbors could reduce the stress for everyone.

1.10.3.2 DUCK, COVER, AND HOLD

During an earthquake, duck or drop to the floor, take cover under a sturdy desk or table, and hold onto it so that it doesn't move away from you. Wait there until the shaking stops.

The area near the exterior walls of a building is the most dangerous place to be. Windows, facades, and architectural details are the first parts of the building to collapse. To stay away from this danger zone, stay inside if you are inside and outside if you are outside.

Do not try to run outside or to another room--severe shaking will make it difficult to move. Duck, cover, and hold--wherever you are. Doorways are no safer than elsewhere in the home. If your building actually begins to collapse, you are safest under a sturdy piece of furniture that can shield you from falling debris.

If you are

- *Indoors:* Duck, cover, and hold. If you are not near a desk or table, drop to the floor against an interior wall and protect your head and neck with your arms. Avoid exterior walls, windows, hanging objects, mirrors, and tall furniture.

- *In a high-rise:* Duck, cover, and hold. Avoid windows and other hazards. Do not use elevators. Do not be surprised if sprinkler

systems or fire alarm activate.

- *Outdoors:* Move to a clear area if you can safely do so; avoid power lines, trees, signs, buildings, vehicles, and other hazards.
- *Driving:* Pull over to the side of the road, stop, and set the parking brake. Avoid overpasses, bridges, power lines, signs, and other hazards. Stay inside the vehicle until the shaking is over. If a power line falls on the car, stay inside until a trained person removes the wire.
- *In a kitchen:* Get away from the stove, refrigerator, and cabinets with heavy objects, leaving the kitchen if necessary. Get under a table. Duck, cover, and hold.
- *In a stadium or theater:* Stay at your seat and protect your head and neck with your arms. Don't try to leave until the shaking is over. Then walk out slowly watching for anything that could fall in the aftershocks.
- *In a mall:* Move away from display shelves. Look for sturdy furniture or an interior wall. Duck, cover, and hold.

1.10.4 After the Earthquake

Once the earthquake is over, then we will have to live with its aftermath--the risk of fire, the potential lack of utilities and basic services, and the certainty of aftershocks.

1.10.4.1 FIRE PREVENTION

Earthquakes cause fires. They break gas mains, causing fires, and break water mains, impeding the fighting of fires.

Some tips for reducing the risk:

- Brace your water heater to prevent gas leaks.
- Be sure your gas appliances have flexible attachments.
- Keep a wrench near the gas main and train family members who may be home alone how to use it.

- Shut off gas only if you smell gas or hear a leak.
- If you lose power, use flashlights instead of candles.
- The flame could cause an explosion if gas is leaking, or aftershocks could knock over the candle.
- Keep a fire extinguisher braced securely to the wall, and know how to use it.

1.10.4.2 WHAT YOU WILL NEED

Maintain personal earthquake bags. Keep them where they can be reached even if your building is badly damaged. Take them with you if you evacuate. These should include:

- Medications and medical consent forms for dependents
- Emergency cash
- Copies of vital documents such as insurance policies
- Spare eyeglasses and shoes
- Snack foods, high in water and sugar
- Working flashlights, radio, and extra batteries
- Lightsticks
- Personal hygiene supplies
- Comfort items such as games, crayons, writing materials, outgrown teddy-bears (children regress under stress)
- Electrical, water, transportation, and other vital systems can be disrupted for several days after a large earthquake.
- Emergency response agencies and hospitals could be overwhelmed and unable to provide you with immediate assistance.
- Be prepared to be on your own for 72 hours or more.
- Knowing first aid and having supplies will make life more comfortable and help you keep your sanity after the next earthquake.

Maintain a 72-hour to 1-week supply of the following items:

- Drinking water (minimum one gallon per person, per day)
- First aid kit and book
- Food that is nutritious and liked by family members
- Charcoal or gas grill for outdoor cooking
- Cooking utensils, including a manual can opener
- Extra food for pets, pet restraints
- Working flashlights with extra batteries and lightsticks
- Portable radio and extra batteries

- Plastic bags for tarps, waste, rain ponchos, and other uses
- Sturdy shoes and comfortable clothing

1.10.5 Recommended Resources

The following references provide additional information for earthquake mitigation and preparedness:

Many publications are available from the Governor's Office of Emergency Services (OES) or the Federal Emergency Management Agency (FEMA).

- Before, During, After, OES
- A Guide to Repairing and Strengthening Your Home Before the Next Earthquake, OES & FEMA
- Protecting Your Home and Business from Nonstructural Earthquake Damage, OES & FEMA
- An Ounce of Prevention: Strengthening Your Wood Frame House for Earthquake Safety, OES
- Tremor Troop: Earthquakes, A Teachers Package for K-6, produced by the National Science Teachers Association with support from FEMA

available from the American Red Cross:

- Are You Ready for An Earthquake?
- Your Family Disaster Plan
- Your Family Disaster Supplies Kit

AVAILABLE FROM PUBLISHERS AND BOOKSTORES:

Sieh, Kerry E. and LeVay, Simon, Earth in Turmoil : Earthquakes, Volcanoes, and Their Impact on Humankind (New York, NY: W H Freeman & Co; August 1999)

Bolt, Bruce A., Earthquakes. (New York, NY: W. H. Freeman, Fourth Edition 1999)

Calhoun, Fryar, Earthquake Survival Guide. (Berkeley, CA: Magnet Press, 1991)

Gere, James M., and Haresh C. Shah, Terra Non Firma: Understanding and Preparing for Earthquakes. (New York, NY: W. H. Freeman, 1984)

Iacopi, R., Earthquake Country. (Menlo Park, CA: Lane Publishing Co., 1978, 6th edition)

Kimball, Virginia, Earthquake Ready. (Santa Monica, CA: Roundtable Publishing, 1988)

Lafferty, Libby, Earthquake Preparedness. (La Cañada, CA: Lafferty & Associates, Inc., 1986)

Leach, Joel, Earthquake Prepared. (Northridge, CA: Studio 4 Productions, 1993)
Richter, C. F., Elementary Seismology (San Francisco, CA: W. H. Freeman, 1958)
Sharp, R., Field Guide: Geology of Southern California. (Dubuque, Iowa: Kendall/Hunt Publishing Co., 1994, 3rd edition)
Yanev, Peter, Peace of Mind in Earthquake Country. (San Francisco, CA: Chronicle Books, 1991)

VIDEOS:

An Ounce of Prevention: Strengthening Your Wood Frame House for Earthquake Safety, prepared by OES and available through Blockbuster Video.

AGENCIES:

The following agencies can supply information and materials concerning earthquake safety and preparedness:

Governor's Office of Emergency Services, Southern Region (Los Alamitos), 11200 Lexington Drive, Bldg.283, Los Alamitos, CA 90720-5002, (562) 795-2900, (562) 795-2877 FAX, Greg Renick (562) 795-2941, http://www.oes.ca.gov/

Federal Emergency Management Agency, 500 C Street, SW, Washington, D.C. 20472, http://www.fema.gov/

American Red Cross, Riverside County Chapter, PO Box 2646, Riverside, CA 92516-2646, Phone: 909-328-0013, Fax: 909-328-1222, http://www.redcross.org/

The following agencies can supply information and materials about geology and earthquake hazards:

California Department of Conservation, Division of Mines and Geology, P.O. Box 2980, Sacramento, CA 95812-2980, (916) 445-5716, http://www.consrv.ca.gov/dmg/

U.S. Geological Survey, Earth Science Information Center, 345 Middlefield Road, Menlo Park, CA 94025, (415)329-4390, http://quake.wr.usgs.gov/

Southern California Earthquake Center, University of Southern California, University Park, Los Angeles, California 90089-0742, 213/740-1560, http://www.scec.org/

1.11 Summary of Findings and Recommended Programs

Since it is not possible to prevent earthquakes, local governments, emergency relief organizations, and individuals must take action to reduce the effects of earthquakes. An effective seismic hazard reduction program should include the identification and mapping of geologic and seismic hazards, the improvement and enforcement of building and fire codes, and the expedient retrofitting and rehabilitation of weak structures. Individuals should also exercise prudent planning to provide for themselves and their families in the aftermath of an earthquake.

Aftershocks to major earthquakes will also be large enough to cause damage, and must be part of post-disaster planning.

Major Earthquake Sources in Riverside County

The earthquake effects that pose the greatest hazard are strong ground shaking, liquefaction and surface fault rupture. The faults that pose the greatest threat to Riverside County are described in more detail below:

San Andreas Fault Zone: The San Andreas fault is the "Master Fault", controlling the seismic hazard for Southern California. It bisects Riverside County. Paleoseismology studies indicate that San Andreas fault segments in the County have ruptured simultaneously at least twice (1680 AD and 1450 AD), generating a M_w 7.9, maximum credible earthquake each time. The segments can also rupture individually.

- *The San Bernardino Mountains segment* ruptures about every 146 years and has a 28% probability of rupturing before 2024. This segment can produce a magnitude 7.3 earthquake, with ground accelerations as high as 0.53 g throughout the County.

- *The Coachella Valley segment* has not produced large, surface-rupturing earthquakes in historic times, yet it continues to store strain energy. Paleoseismic studies suggest that the last surface-rupturing earthquake on this segment occurred around A.D. 1680. The segment has a 22% probability of rupturing before the year 2024 and can produce a magnitude 7.1 earthquake.

The **San Jacinto Fault Zone** has a high level of historical seismic activity, with at least ten moderate (M_w 6 - 7) earthquakes between 1890 and 1986. Fatalities in Riverside County resulted from San Jacinto earthquakes in 1899 and 1918. The San Bernardino, San Jacinto Valley and Anza segments of the San Jacinto fault have a 37%, 43%, and 17%

probability, respectively, of rupturing before 2024. Peak ground accelerations could reach 0.53 g.

In Riverside County, the **Elsinore Fault Zone** consists of the Temecula, Glen Ivy, Whittier and Chino segments. Maximum credible earthquakes of M_w 6.7 to 6.8 could occur on these segments, generating peak ground accelerations of about 0.48 g for Riverside County. WGCEP (1995) estimates probabilities of 5% to 16% for these events to occur in the 1994 to 2024 time period.

Riverside County Seismicity

Several historic earthquakes in Riverside County have resulted in up to Modified Mercalli Intensity VIII (severe) ground shaking. Most recently MMI VI was reported in the southern Coachella Valley region of Riverside County for the October 1999 M_w 7.1 Hector Mine earthquake. Several fatalities occurred due to the San Jacinto fault earthquakes in 1899 and 1918.

The two most seismically active faults in California are located in Riverside County (the San Jacinto and San Andreas faults). As a result, more than 45,000 earthquakes (M>1.0, 1931-1999) have been located in Riverside County. About 90% of the earthquake epicenters in Riverside County occur along the three major fault zones: San Andreas, San Jacinto, and Elsinore fault zones.

As part of this study, seismic data were imported into a geographic information system (GIS) coverage for Riverside County. The data utilized were seismicity catalogs dating from 1931 to 1999. Data tables linked to each event includes magnitude, depth, and year.

Existing Legislation

Earthquake Fault Zone Mapping for Riverside County: **The Alquist-Priolo Earthquake Fault Zoning Act** was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. Surface rupture is the most easily avoided seismic hazard. Earthquake Fault Zone mapping has been completed by the State Geologist for the 45 quadrangles in Riverside County.

Alquist-Priolo Earthquake Fault Zones have been designated by the California Division of Mines and Geology for the Elsinore, San Jacinto and San Andreas fault zones in Riverside County. The County of Riverside (1991) has applied special studies zone criteria for additional fault systems in the County.

Within these zones, State and Riverside County law requires that proposed tracts of four or more dwelling units investigate the potential for and setback from ground rupture hazards. Before a project can be permitted, a geologic investigation must demonstrate that proposed buildings will not be constructed across active faults. This is typically accomplished by excavation of a trench across the site. An evaluation and written report must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (generally 50 feet).

The County of Riverside must regulate most development projects within the earthquake fault zones. Projects include all land divisions and most structures for human occupancy. Single family wood-frame and steel-frame dwellings up to two stories not part of a development of four units or more are exempt. However, local agencies can be more restrictive than State law requires.

Since the fault zones in Riverside County have high rates of displacement (>5 mm/yr), and given that new offshoot faults are being ongoingly discovered, all proposed structures should be required to investigate the potential for and setback from ground rupture.

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides. However, no seismic hazard mapping pursuant to the 1990 State law has been completed in the County of Riverside, and none are planned to be released for the County through 2000 (DMG, 2000).

Real Estate Disclosure Requirements: Effective June 1, 1998, the Natural Hazards Disclosure Act requires that sellers of real property and their agents provide prospective buyers with a "Natural Hazard Disclosure Statement" when the property being sold lies within one or more State-mapped hazard areas. If a property is located in a Seismic Hazard Zone as shown on a map issued by the State Geologist, the seller or the seller's agent must disclose this fact to potential buyers.

Geographic Information System Coverage of Faults

Detailed GIS coverage for faults and earthquake fault special studies zones are provided as part of this study. More than 4,300 faults and fault segments are included in the GIS database. Data tables linked to the faults include the fault name, length, age and other pertinent information.

Earthquake Analyses for Riverside County

There are two primary approaches to analyzing the effects of particular earthquakes. Design earthquake scenarios consider the rupture of a specified fault. Probabilistic seismic hazard assessment, considers the potential ground motions from earthquakes on many faults and the relative likelihood of each.

A maximum probable earthquake (MPE) is the largest earthquake a fault is expected to generate within a specific time period, usually 30 or 100 years. MPEs are most likely to occur within the life span of most development, and therefore, are commonly used in assessing seismic risk. . Riverside County's MPE, with a 43% probability of occurrence in 30 years, is a M_w 6.9 rupture of the San Jacinto Valley segment of the San Jacinto fault.

The maximum credible earthquake (MCE) is also often considered in planning and engineering decisions. An MCE is the worst-case scenario, the largest earthquake a fault is believed capable of generating. For Riverside County, the MCE is a M_w 7 .9 based on rupture of the entire southern segment of the San Andreas fault from Cajon Pass to the Salton Sea. The MCE exposes most of the County to very high intensity ground shaking that could last more than 1 minute. Horizontal ground displacements of 25 feet may occur, and losses could be extensive.

Seven other probable earthquake events are likely to occur during the design life of most buildings. These involve earthquakes generated by various segments of the Elsinore, San Jacinto and San Andreas faults. The probable earthquake events will cause damage to vulnerable structures, and may result in localized ground failures. Because of the County's mostly modern building stock, life-safety is not terribly threatened, but the estimated economic losses are substantial.

Probabilistic ground motion values for the County of Riverside are among the highest in southern California, due to the County's proximity to major fault systems with high earthquake recurrence rates. With the exception of the Blythe region, the incorporated cities of Riverside County are exposed to very high and extremely high values that exceed 50% of the force of gravity with a 10% chance of occurring in 50 years. Communities along the San Jacinto fault (Moreno Valley, San Jacinto and Hemet) have a greater risk of ground shaking than those along the San Andreas, because San Jacinto earthquakes have a higher probability of occurrence.

Short-Term Earthquake Alerts Based on Foreshock Probabilities

Half of the major earthquakes on strike-slip faults in California are preceded by immediate foreshocks (smaller earthquakes within 3 days and 10 kilometers of the mainshock). In 1991, for the southern San Andreas fault, a working group of scientists developed a notification system based on patterns of foreshock occurrences, and the likelihood that an anomalous earthquake might be a foreshock to a larger event.

This system could be adapted by the County of Riverside to respond to short-term increases in hazard from the San Andreas fault. Certainly, thoughtfulness and care must be exercised to construct a system that will enhance public safety without promoting rumors or fear. Also, the system must not be a substitute for long-term mitigation efforts. Such potential difficulties do not reduce the usefulness of short-term, pre-event response plans.

Over time, new data and additional research should allow similar systems to be developed for other major southern California faults.

Secondary Earthquake Hazards

Liquefaction is a process by which water-saturated materials lose strength and may fail during strong ground shaking.

Pursuant to the 1990 Seismic Hazard Mapping Act (SHMA), the California Department of Conservation, Division of Mines and Geology (DMG) provides seismic hazard zone maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures. The DMG has not completed any SHMA mapping for Riverside County, nor is any planned through 2000 (DMG, 2000). However, this study provides seismic hazard mapping and information that meets the requirements of the Seismic Hazards Mapping Act, and local agencies should require site specific geotechnical hazard investigations based on this mapping.

In Riverside County, site-specific geotechnical liquefaction hazard investigations should be required for proposed construction projects in zones of moderate, high and very high liquefaction potential. The policy for construction projects involving critical facilities should extend to include all liquefaction ranks from "very low" to "very high".

Geographic Information System Coverage of Liquefaction Hazards in Riverside County

Hazard mitigation policies for proposed projects in Riverside County based on the detailed GIS liquefaction coverage should be implemented as follows: General Construction: special site-specific liquefaction hazard studies should be required in all areas mapped as "Shallow Ground Water, Susceptible Sediments" with the exception of the Blythe region; and Critical Facilities-Lifelines: special site-specific liquefaction hazard studies should be required in all areas of susceptible sediments, including the Blythe region.

Seismically Induced Settlement

In some situations, strong ground shaking can densify soils and cause local or regional ground settlement. Seismic settlement is primarily damaging in areas subject to differential settlement, such as cut/fill transition lots on hillsides. Even slight settlement of the fill can cause significant repair costs. Cut and fill transition lots be overexcavated and fill depths beneath structures should never vary by more than 100%.

Seismically Induced Slope Instability

Landslides and rock falls can be expected throughout the County in a major earthquake. Factors controlling the stability of slopes include: 1) the slope height and inclination, 2) the engineering characteristics of the earth materials comprising the slope, and 3) the intensity of ground shaking. Engineered slopes should be designed to resist seismically induced failure, based on pseudo-static stability analyses after detailed geotechnical investigations. Stability analyses must factor in the intensity of expected ground shaking.

Vulnerability of the Built Environment to Earthquake Hazards

Comprehensive hazard mitigation programs that include the identification and mapping of hazards, prudent planning and enforcement of building codes, and expedient retrofitting and rehabilitation of weak structures can significantly reduce the scope of an earthquake disaster.

Senate Bill 547 addresses the identification and seismic upgrade of Unreinforced Masonry (URM) buildings. The law encourages identification and mitigation of seismic hazards associated with other types of potentially hazardous buildings, including: pre-1971 concrete tilt-ups, soft-stories, mobile homes, and pre-1940 homes

So far, only five URMs have been identified in the unincorporated regions during a 1990 study. The building owners were notified by mail to comply with the State guidelines. No unique URM ordinance has been passed by Riverside County and no other potentially vulnerable buildings have been inventoried. Statistical estimates expect that about 4000 URMs exist in the County.

The Seismic Hazard Maps developed for this study do not show areas that automatically should be excluded from development. Instead, they show areas where the potential for damage from the mapped hazard is great enough so as to make it geologic investigations prudent. It is far less costly to incorporate hazard mitigation into a structure before it is built than to later add mitigating features.

Potentially Hazardous Buildings and Structures

Most of the loss of life and injuries that occur during an earthquake are related to the collapse of hazardous buildings and structures. Building codes have generally been made more stringent following damaging earthquakes. However, structures in the County of Riverside built prior to improved building codes, have generally not been upgraded to current building code standards, and may, therefore, be hazardous during an earthquake.

Based on observations from past earthquakes, **unreinforced masonry buildings** (URMs) are prone to failure.

Several other common building types are also known to perform poorly, although they have not been targeted for upgrading and strengthening. Of these, of particular concern are **soft-story buildings** (those with a story, generally the first floor, lacking adequate strength or toughness, due to few shear walls, i.e., buildings where the first floor is the garage) and older concrete buildings. No good estimates exist concerning their numbers in Riverside County.

Wood frame buildings with stud walls can perform well in an earthquake, depending on the quality and construction of their foundations.

Pre-cast concrete frame buildings vary in their performance during earthquakes. Inventory estimates indicate about 1,500 pre-cast concrete frame buildings in Riverside County. Partial or total collapse of buildings where the floors, walls and roofs fail as large intact units, such as large pre-cast concrete panels, cause the greatest concern in terms of life loss because they slow down victim rescue. Speedy extrication of trapped victims is critical for victim survival. Establishment of Heavy Urban Search and Rescue teams as recommended by FEMA (1985) has improved victim extrication and survivability, but much more advance planning is needed.

During the 1994 Northridge earthquake, many **mobile homes** shifted or fell off their foundations, rupturing gas lines and starting fires. This hazard is intensified by the relatively high density of homes within mobile home parks. Inventory estimates indicate that more than 70,000 mobile homes are located in the County of Riverside.

Critical facilities are those parts of a community's infrastructure that must remain operational after an earthquake (e.g. hospitals, fire and police stations, emergency operation centers (EOC's) and communication centers), or facilities that pose unacceptable risks if severely damaged (e.g. public schools). There are an estimated 380 schools, 18 hospitals, 100 fire and police stations and 12 EOCs in Riverside County.

High-loss facilities, if severely damaged, may result in a disaster far beyond the facilities themselves. Examples include nuclear power plants, dams and flood control structures, freeway interchanges, bridges, and industrial plants that use or store explosives, toxic materials or petroleum products. Statistical estimates predict 46 dams and 1,978 hazardous waste sites in the County.

Dam Safety

Dams under State jurisdiction (e.g. over 50 feet in height or 50 acre-feet in storage capacity) are required to have inundation maps that show the potential flood limits in the remote possibility a dam is catastrophically breached. Dam inundation maps are prepared by dam owners. The County of Riverside is required by State law to have emergency procedures for the evacuation and control of populated areas within the limits of inundation. In addition, real estate disclosure upon sale or transfer of property in the inundation area is required under recent legislation (AB 1195 Chapter 65, June 9, 1998. Natural Hazard Disclosure Statement). Chapter 3-Flood Hazards of this Technical Background Report provides GIS coverages of potential inundation areas and an assessment of dam vulnerability.

HAZUS Earthquake Scenario Loss Estimations for Riverside County

HAZUS (Hazard U.S.) is designed to produce loss estimates for use by State, regional and local governments in planning for earthquake loss mitigation, emergency preparedness and response and recovery. HAZUS loss estimations are based on best available knowledge and data. The estimations were improved by the mapping of soil type, liquefaction and landslide susceptibility provided as part of this study. They can be further improved by inventories of buildings and infrastructure in Riverside County.

Loss estimation is a valuable mitigation tool. The numbers of casualties and losses provided by HAZUS are best interpreted as order of magnitude values.

Eight scenario earthquakes were chosen for HAZUS loss estimation. Additional details are provided for the two events that represent the maximum probable earthquake (MPE) and the maximum credible earthquake (MCE) for Riverside County.

Estimated Losses Associated with a M_w 6.9 San Jacinto Fault Earthquake (MPE)

A rupture of the San Jacinto Valley segment of the San Jacinto fault has the greatest probability of occurrence (43%) within the lifetimes of structures in the County of Riverside (30 years). HAZUS estimates:

- *Building Damage:* 94 thousand buildings at least moderately damaged (23% of the total number of buildings) in the region; 10,485 buildings will be completely destroyed.
- *Essential Facility Damage:* On the day of the earthquake, 51% of hospital beds are available. After one week, 64% will be back in service. By 30 days, 81% will be operational.
- *Electrical System Performance*: 93,996 out of 402,426 households (23%) will be without service the day of the earthquake.
- *Fire Following Earthquake:* Fires will displace about 360 people and burn about $19.0 million of building value.
- *Debris Generation:* 4,525 thousand tons of debris will be generated, and will require 180,984 truckloads (@25 tons/truck) to be removed.
- Shelter Requirement: 9,345 households to be displaced. 6,964 people will seek temporary shelter in public shelters.
- *Casualties:* A 2:00 am earthquake (maximum residential occupancy) creates the greatest number of casualties (3,500). A 5:00 pm (peak commute time) event causes 2,025 casualties.
- *Economic Loss:* Estimated total economic loss is $5.5 billion dollars, which is equivalent to 9% of the total replacement value of the region's buildings.

Estimated Losses Associated with a M_w 7.9 Southern San Andreas Fault Earthquake (MCE)

This event represents the Maximum Credible Earthquake (MCE) for Riverside County. It is an event that likely occurs only once every several hundred years, but should it occur tomorrow, HAZUS estimates:

- *Building Damage:* 181 thousand buildings (45% of total) will be at least moderately damaged; and 37,013 buildings will be completely destroyed.
- *Essential Facility Damage:* On the day of the earthquake, only 20% of hospital beds are available. After one week, 34% of the beds will be back in service. Even after 30 days, only 57% will be operational.
- *Electrical System Performance:* 210,687 out of 402,426 households (52%) will be without service the day of the earthquake.
- *Fire Following Earthquake:* Fires will displace about 830 people and burn about $51.0 million of building value.
- *Debris Generation:* 11,858 thousand tons of debris will be generated, and will require 474,338 truckloads (@25 tons/truck) for removal.
- *Shelter Requirement:* 27,027 households will be displaced. Of these, 20,079 people will seek temporary shelter in public shelters.
- *Casualties:* A 2:00 am occurrence (maximum residential occupancy) creates the greatest number of casualties (9,926). A 5:00 pm (peak commute time) event causes 5,824 casualties.
- *Economic Loss:* Total economic loss is $13.6 billion dollars, which is equivalent to 22% of the total replacement value of the region's buildings.

Reducing Earthquake Hazards in the County of Riverside

The County must prioritize rehabilitation and strengthening projects in existing development to best allocate resources for earthquake hazards reduction. The proposed mitigation programs should be implemented to avoid undue hardship in the community.

Our most recent building codes (1997), adopted by Riverside County in July 1999, are a prime example of incorporating earthquake lessons further reduce earthquake hazard. However, hazard increases with population growth (that encourages building in vulnerable areas) and with the aging of the existing building stock.

It must be stressed that building codes are designed to protect lives, not structures. Under recent building code improvements, buildings will still be damaged, but are far less likely to fail catastrophically.

It also needs to be emphasized that all development choices have some hazards associated with them. Most can and have been mitigated by engineered solutions. The recognition that these solutions require maintenance to function properly has been an expensive lesson to many. The recognition that engineered solutions have a finite design life has yet to be appreciated because of the relative youth of the County's development. This is an expense that will be passed on to future generations. Minimizing engineered mitigation, and maximizing land use planning, is the most environmentally balanced - and

in the long-term, the most economical - route to a sustainable, safe community.

1997 Uniform Building Code Impacts on the County of Riverside

Two significant changes are incorporated into the 1997 Uniform Building Code (UBC) that affect the County of Riverside: revision of soil types and amplification factors; and incorporation of the proximity of earthquake sources in UBC seismic zone 4, which includes most of the County of Riverside. Due to the presence of the three major fault systems (Elsinore, San Jacinto and San Andreas), most of the western and central portions of the County are affected by the new near-source design factors. For Riverside County, the changes are warranted.

Seismic Source Type: Near source factors include a classification of seismic sources based on slip rate and maximum magnitude potential. The San Andreas fault and most of the San Jacinto fault in Riverside County are considered Type A faults.

The UBC source zone classification labels the San Jacinto Valley segment of the San Jacinto fault a Type B fault, but for several important reasons, it should be considered a seismic source Type A. This reclassification would extend the near source zone an additional 5 kilometers, and affect the near source factors for the area. Reclassification would mitigate the potential for building damage in portions of the cities of Riverside, Moreno Valley and Perris.

Seismic codes are now undergoing their most significant changes to date. Seismic codes will continue to improve under the International Building Code, which is to replace the UBC beginning in the year 2000.

Retrofit and Strengthening of Existing Structures

The new building codes address new construction. Retrofit and strengthening of existing structures requires the adoption of ordinances. The County of Riverside is required by State law to adopt an ordinance aimed at retrofitting unreinforced masonry buildings (URMs). Although retrofit buildings may still incur severe damage during an earthquake, the mitigation results in a substantial reduction of casualties by preventing collapse.

Other potentially hazardous buildings include irregular-shaped structures and mobile homes, soft-story structures, unreinforced concrete buildings, as well as pre-1940 single-family structures.

Building inventory is needed in Riverside County. The building inventory phase of a

seismic hazard mitigation program should employ GIS technology. In proper format, this information may also be input into HAZUS to run updated loss estimations.

The mitigation program established by the County could be voluntary or mandatory. Voluntary programs to encourage mitigation of potentially hazardous buildings have been implemented with varying degrees of success in California, using various incentives. Some cities mandate a review by a structural engineer when a building is undergoing substantial improvements. Additional options are described in the Policy section (Chapter 5) of this Technical Background Report.

CHAPTER 2: SLOPE AND SOIL INSTABILITY HAZARDS

2.1 Physiographic and Geologic Setting

The County of Riverside covers approximately 7,000 square miles of the geologically complex southern California region, from the Colorado River at the Arizona border to within ten miles of the Pacific Ocean. Riverside County spans portions of several major geologic provinces (Figure 2-1):

- ***Peninsular Ranges:*** The western portion of Riverside County and most of its population are in the Peninsular Range province. This province is dominated by right-lateral strike-slip faulting associated with the San Jacinto and Elsinore faults. However, all types of faulting may be found in this block. Temecula, Murrieta and many agricultural areas of southwestern Riverside County lie in the broad structural depression called the Elsinore Trough, formed and bounded by active faults of the Elsinore fault system. The Santa Ana and San Jacinto Mountains are part of the Peninsular Ranges, and were built by movement along earthquake faults.

- ***Salton Trough:*** The desert communities and farmland of the Coachella Valley in central Riverside County are located within the Salton Trough province. Here, the plates are separating and spreading centers exist. The spreading centers continue to the south, into the Gulf of California. At present, the Salton Trough is cut off from the Gulf of California by an accumulation of sediment at the mouth of the Colorado River. The Trough is filled with sediment three miles thick, derived primarily from the Colorado River. Periodically during the last 10,000 years, the Trough has been inundated with water. The most recent inundation formed the Salton Sea in 1905.

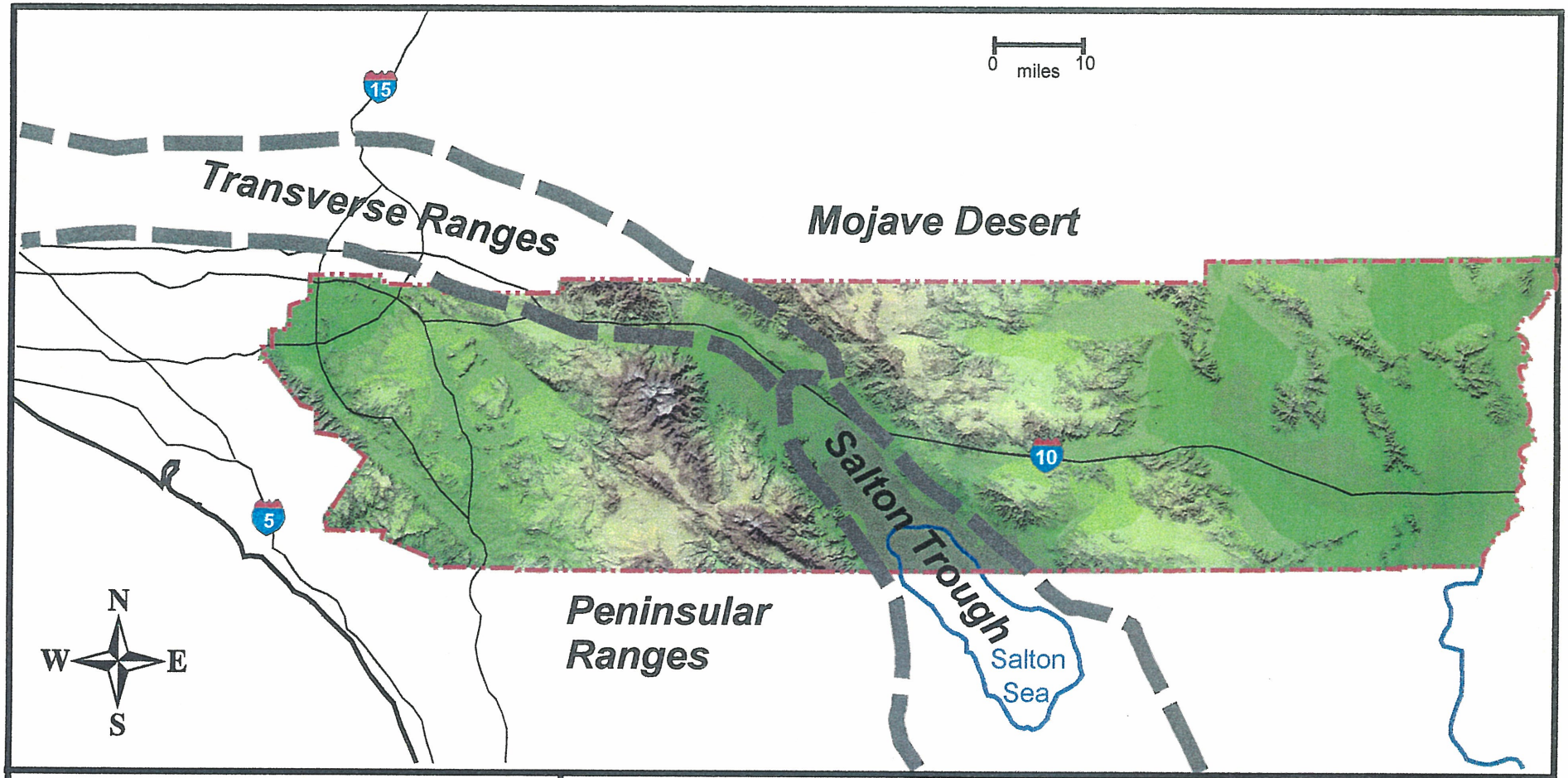
- ***Transverse Ranges:*** Throughout most of the western U. S. are northwest-trending geologic features, a consequence of current plate motions. The trend of the Transverse Range province is a startling exception. These mountains run west to east from west of Santa Barbara to east of San Bernardino. The easternmost San Bernardino Mountains lie in north-central Riverside County. Many of southern California's recent damaging earthquakes occurred on faults that have built the Transverse Ranges, including: the 1971 Sylmar M_w 6.7, the 1991 Sierra Madre M_w 5.8, and the 1994 Northridge M_w 6.7. Although most of this province is located north and west of Riverside County, populated areas such as Riverside, Norco and Corona are at risk from Transverse Range earthquakes occurring on the nearby Cucamonga or Sierra Madre fault systems, about 20 to 25 miles to the north.

- ***Mojave Desert:*** The Mojave Desert province consists of the eastern half of the County, and includes the Blythe area. Compared to the rest of Riverside County, this province has a moderate to low rate of seismicity and very few mapped faults. However, just north of the County, there are numerous active right-lateral strike-slip faults in the Mojave Desert province. These have recently produced the 1992 Landers M_w 7.3 and the 1999 Hector Mine M_w 7.1 earthquakes.

The bedrock exposures of Riverside County consist predominantly of igneous and metamorphic rock with some sedimentary units. These vary from hard rock underlying steep slopes in the San Jacinto Mountains to the weathered granitic rocks of Joshua Tree National Park and hillsides near the city of Riverside.

Alluvial (river) valleys between these mountain ranges contain sediments with significant variation in thickness. Some valleys are filled with a few hundred feet of Pleistocene and Holocene sediments (i.e., the sediments were deposited in the last 2.5 million years). Others, such as the Coachella, San Jacinto and Elsinore Valleys, contain several thousand feet to several miles of sediment. The thickest sediments have been deposited in basins that are being pulled apart by the movement of tectonic plates.

Generally, the hazards of subsidence and hydroconsolidation (soil collapse) are prevalent in valleys, while mass wasting (such as landslides and rockfall) threatens the mountainous regions (Figure 2-2).



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Map of Geologic Provinces of the Riverside County Area

Figure 2 - 1

Figure 2-2:

Engineering Geologic Materials Map Riverside County California

(Summary of GIS Data, for additional detail see Plate 2-1 in-pocket)

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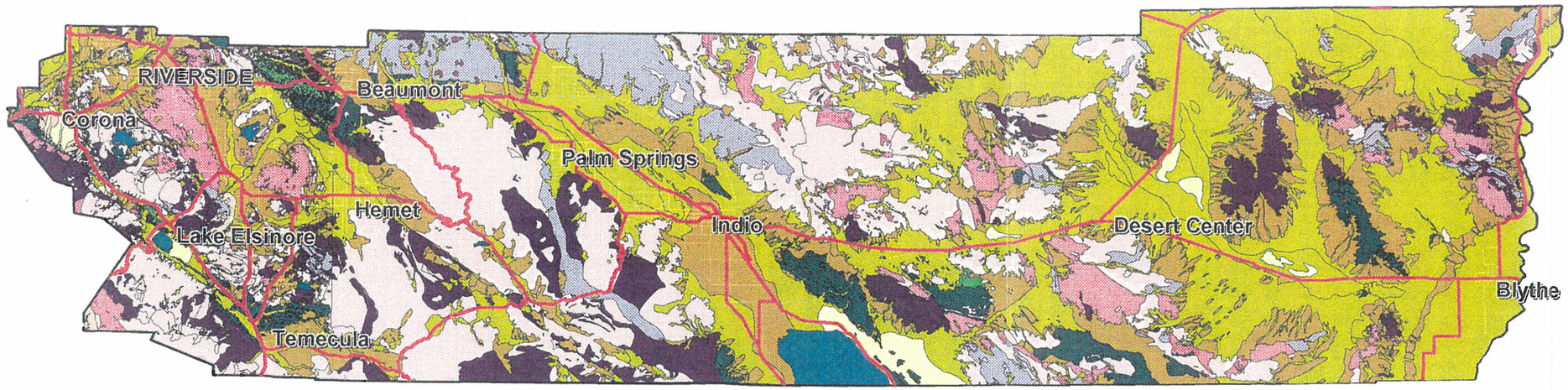

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Scale: 1:1,000,000

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Miles

Explanation for the Engineering Geologic Materials Map of Riverside County, California

Surficial Materials

- Holocene-age, fine-grained unconsolidated sediments, including stream-, gravity-, lake-, and wind-deposited sediments. Deposits in this category include stream channel, alluvial fan, flood plain, colluvial, dune, and lucustrine sediments.
- Holocene-age, coarse-grained unconsolidated sediments, including stream- and gravity-deposited sediments. Includes alluvial fan, stream channel, and terrace deposits.
- Pleistocene-age, fine-grained unconsolidated to moderately consolidated sediments.
- Pleistocene-age, coarse-grained unconsolidated to moderately consolidated sediments.

Soft-Rock and Moderately Consolidated to Indurated Sediments

- Tertiary-age and older, fine-grained soft rock and moderately consolidated to indurated sediments; generally bedded or fractured. Bedding or fractures assumed to provide planes of weakness along which slope instability could occur.
- Tertiary-age and older, coarse-grained soft rock and moderately consolidated to indurated sediments; typically massive to thickly bedded.

Igneous Rocks of Various Ages, both Volcanic and Plutonic

- Massive Igneous rocks.
- Foliated and/or fractured igneous rocks.

Metamorphic Rocks of Various Ages, including Meta-igneous and Metasedimentary rocks

- Massive metamorphic rocks.
- Foliated and/or fractured metamorphic rocks.

Landslides

- Mapped landslides. For additonal information, refer to the landslide susceptibility map.

Water Bodies

- Lake or Sea

2.2 Geology and Engineering Geology Coverages

As part of this study we have prepared a detailed digital Engineering Geologic Materials map for Riverside County (Plates 2-1). The overall accuracy is 1:100,000. However, certain areas were digitized at greater detail (1;24,000), and others were digitized at lesser detail (1:250,000). The sources of the geologic data are listed in Table 2-1, below.

Table 2-1: Sources Digitized for Geologic Map Coverage
Riverside County, California

Map Name	Scale
Preliminary Geologic Map of the Blythe 30' by 60' Quadrangle, CA and AZ	1:100,000
Geologic Map of California, Salton Sea Sheet	1:250,000
Geologic Map of California, Santa Ana Sheet	1:250,000
Distribution and Geologic Relations of Fault Systems in the Vicinity of the Central Transverse Ranges, Southern California	1:250,000
Geologic Map of California, San Bernardino Quadrangle	1:250,000
Geologic Map of the Big Maria Mountains NE Quadrangle, Riverside County, California, and Yuma County Arizona	1:24,000
Geologic Map of California, Needles Sheet	1:250,000
Digital map of the Santa Ana Sheet, California – provided by Dr. Morton of the USGS	1:100,000

2.2.1 Development of GIS Engineering Geology Map

There are many ways to group rock and sediments with similar characteristics. For planning purposes, it is most appropriate to group features based on engineering properties, that is, the characteristics that have most importance to the built environment. For this report, more that 60,000 polygons *(area features)* were digitized from the geologic map data outlined above (Table 2-1) for Riverside County. These diverse geologic units were combined based on similar engineering properties. The properties were assigned based on the units' descriptions in the literature that accompanies the geologic maps (Table 2-1). Thus the assignments include many assumptions. The map is meant to provide general guidance to support land use decisions and policies. It should not replace or preclude site-specific observation and testing.

The general explanation of geologic and engineering geology unit symbols included with the digital data is as follows:

- The PType (petrologic type) was taken from the geologic maps at the time of digitization. 'Petrologic' includes the type of rock or sediment and its history of formation.

- The description for each of the PTypes was reviewed from the legend or other supporting literature.

- An abbreviated code of engineering attributes, named EType (engineering type), was created based on the PType analyses.

A matrix was developed to convert the geologic units (PType) to engineering type (EType) based on:

- Rock Type (sedimentary, igneous, metamorphic);
- Age (Holocene, Holocene-Pleistocene, Pleistocene, Tertiary-Pleistocene, Tertiary or older);
- Degree of Consolidation (unconsolidated, weakly consolidated, moderately consolidated, indurated, deeply weathered, friable);
- Depositional Environment (alluvial, eolian, marine, lucustrine);
- Texture (fine, coarse, undifferentiated);
- Structure (massive, bedded, slide complex, foliated, fractured).

2.3 Mass Wasting-Slope Instability Hazards

2.3.1 Introduction

Mass wasting is the down-slope movement of rock and regolith (rock products such as soil, sediment, weathered rock and wind-blown deposits) near the Earth's surface, mainly due to the pull of gravity. Mass wasting includes landslides, mudflows, rock falls and creep. It is an important part of the erosional process, as it moves material from higher elevations to lower elevations, where transporting agents like streams pick up the material and move it to even lower elevations. Mass wasting occurs continuously on all slopes; some mass wasting processes act very slowly, others occur very suddenly, often with disastrous results.

As human populations expand over more of the land surface, mass wasting processes become an increasing concern. In a typical year in the United States, mass wasting causes 25 to 50 deaths and over $1.5 billion in damages.

There are predictable relationships between local geology and mass wasting processes. Knowledge of these relationships can improve planning and reduce vulnerability. Slope stability is dependent on many factors and their interrelationships. Rock type and pore water pressure are possibly the most important factors, followed by slope steepness due to natural or man-made undercutting. The igneous and metamorphic basement rock forming much of the County's hillside terrain (Figure 2-3) is generally grossly stable in its natural condition. However, the steepness of the slopes result in locally precarious rocks that could fall as a result of earthquake ground shaking or intense rainfall. In addition, many existing landslides and soil slumps have been mapped within the County, and where slopes have failed before, they will fail again.

Every slope has an angle of repose (Figure 2-4). Slopes less than this angle can resist the pull of gravity and will be at rest. Slopes steeper than this angle will eventually fail. On average, the angle of repose is 35 degrees from horizontal, but varies widely. The looseness or consolidation of the material, planes of weakness and vegetation all affect angles of repose. Thickly forested slopes can maintain a 45 degree angle; however, slopes as shallow as 26 degrees have failed catastrophically in the San Francisco region. The most effective way for the County of Riverside to protect lives and property from mass wasting is to prohibit development on or near slopes that exceed about 30 degrees in steepness. Figure 2-3 illustrates slopes that should be preserved in their natural condition, due to mass wasting potential.

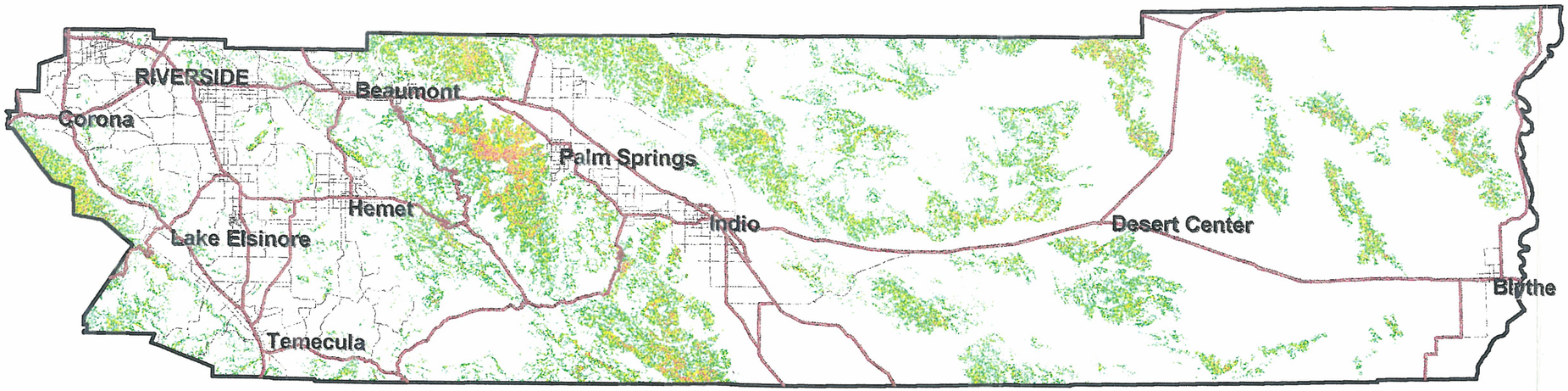
Figure 2-3:

Regions Underlain

by

Steep Slopes

(Summary of GIS Data, for additional detail see Plate 2-2 in-pocket)



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Scale: 1:1,000,000

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Miles

Slope Angle (in degrees)

- Less than 20
- 20-30
- 30-40
- 40 and Greater

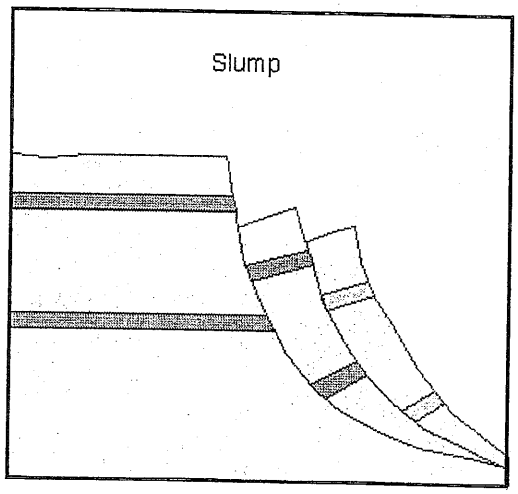
Types of Mass-Wasting Processes: In common usage, any down-slope movement of material is called a landslide. In actuality, landslides are only one of many types of mass wasting, distinguished by style and velocity of movement (Figure 2-4). The processes are separately identified, but are part of a continuum, and distinctions between them are not always sharp. Classification is thus sometimes difficult or arbitrary, but includes these broad categories:

- Slope Failures - a sudden downhill transport of material by sliding, rolling, falling, or slumping.

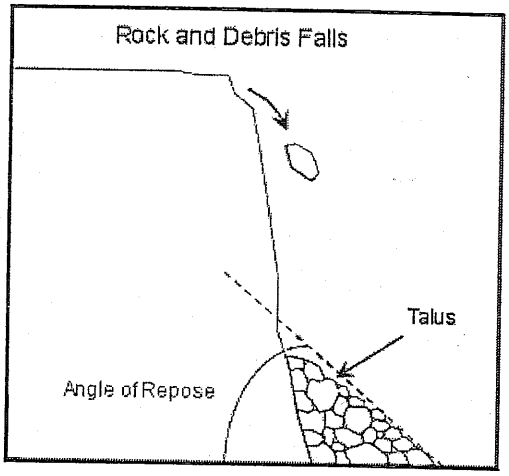
- Sediment Flows - Down-hill transport of rock and plant material mixed with water or air.

Figure 2-4: Slope Failure Types

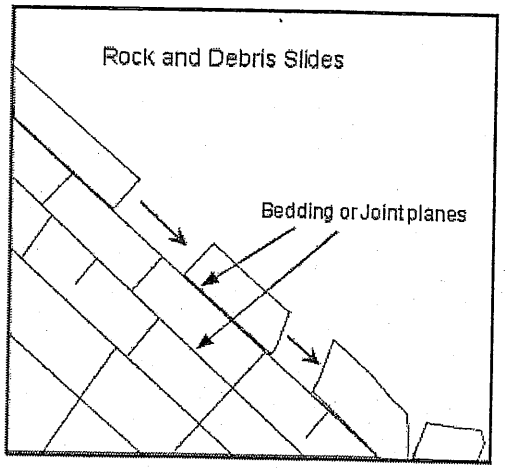
Slumps: Blocks of rock or regolith rotate as units along a concave-upward curved surface. The upper surface of each slump block remains relatively undisturbed. Slumps leave concave scars or depressions on a hill slope. They can be isolated or may occur in large complexes covering thousands of square meters. Slumps often form as a result of human activities, and thus are common along roads where slopes have been steepened during construction. Heavy rains and earthquakes can also trigger slumps.



Falls: Rock falls occur when a piece of rock becomes dislodged. Debris falls are similar, but involve a mixture of soil, regolith, vegetation, and rocks. Because this process involves the free fall of material, falls commonly occur where there are steep cliffs. A rock fall may be a single rock or a mass of rocks. Falling rocks can dislodge other rocks as they collide with the cliff. At the base of most cliffs is an accumulation of fallen material termed talus.



Slides: For many reasons, rock can have planar features that allow rock and debris to slide downhill. Common features include bedding planes, foliation surfaces and joint surfaces. Piles of talus (fallen material) are common at the base of a rock slide or debris slide. Unlike slumps, slides see no rotation of the sliding mass; nor does the mass of material maintain its original shape.



2.3.2 Rock Fall

Areas most at risk from rock fall lie below steep outcrops of relatively well-cemented rock. Such rock underlies much of the County's mountain ranges. Rock fall hazard in the County is high for hillside development, and for development located adjacent to steep slopes. Plate 2-2 and Figure 2-3 illustrate steep slopes where these are most likely to occur. Chapter 1, Seismic Hazards, addresses earthquake-induced rock fall.

2.3.3 Debris Flows

A debris flow is a mixture of rock and/or regolith with water or air. Whether debris will flow downhill depends on numerous factors, including: soil depth and composition, the kind of vegetation, the size and variety of tree roots, subtle variations in slope shape, existence of road cuts or drainage pipes, incongruities in underlying bedrock, and even the presence of animal burrows.

Fine-grained sedimentary rocks are most susceptible to debris flows, especially during exceptionally high rainfall periods. Typically, debris flows occur when a long saturation period is followed by intense bursts of rain, concentrated in just a few hours or days. Water, often traveling beneath the surface from miles away, fills the pores (spaces) in surficial material but not in bedrock or clay, which have far fewer pores and are less permeable (they lack connections between pores). This creates a saturated zone in the surficial material. As the water fills the pores between solid particles, it increases pore pressure and decreases the friction that holds material to a slope. At some point, gravity causes the mass to break loose and slide along the less permeable surface below.

Debris flows, like rockfalls, occur rapidly and without warning. The areas most at risk from debris flows include:

- Canyon bottoms, stream channels, and areas near the outlets of canyons or channels. Multiple debris flows that start high in canyons commonly funnel into channels. There, they merge, gain volume, and travel long distances from their sources.

- Downslope from swales (depressions). Debris flows commonly begin in swales on steep slopes.

- Roadcuts and other altered or excavated areas of slopes. Debris flows and other mass wasting events onto roadways are common during rainstorms,

and often occur during milder rainfall conditions than those needed for debris flows on natural slopes.

- Places where surface runoff of water is channeled, such as along roadways and below culverts.

Where one debris flow has occurred, others will inevitably follow. Much of the County of Riverside is underlain by alluvial fans, deposits that have been shed from streams exiting mountain ranges. These fans and stream washes are evidence of many debris flows in the recent geologic record. In the smallest, most common events, the impact to the County is from boulders transported onto roadways and improvements.

Occasionally, catastrophic debris flow events occur. The greatest southern California debris flow events of the 20th century occurred in 1934, 1938, 1969 and 1978, but there is generally a destructive event each decade. A significant debris flow occurred on July 11, 1999 in the community of Forest Falls, located along the south side of a Mill Creek Canyon in the southeastern part of the San Bernardino Mountains. High-intensity, short-duration rainfall caused the debris flow that resulted in loss of life and property, damaging over 30 homes and numerous automobiles.

Numerous man-made controls have been constructed to reduce the impact of these events on the County. The County operates more than 40 dams, and several hundred miles of levees and storm drains (Riverside County Flood Control and Water Conservation District, 2000).

Without the presence of extensive flood control devices, including large debris catchment basins, the areas downgradient or downstream from unstable slope areas shown on Plate 2-3 may be subject to catastrophic debris flow inundation. Mitigation of debris flow potential should first focus on these areas and geotechnical studies should address the hazard in these zones.

Specific areas susceptible to debris flows are not shown at the scale of the GIS landslide and slope stability map. However, debris flow potential should be evaluated on a site-specific basis for all development areas downgradient from canyons, alluvial fans and swales.

2.3.4 Development of a GIS Landslide and Slope Instability Map

As a major component of this project, we developed digital landslide and slope instability maps (Plate 2-3: Landslide and Slope Instability Map) for Riverside County. The mapping is based on slope steepness (Plate 2-2) and engineering geology characteristics (Plate 2-1: Engineering Geologic Materials Map).

To make the Landslide and Slope Instability Map of Riverside County (Plate 2-3), the following steps were taken:

- Created a slope map for Riverside County by producing a grid map of the U. S. Geological Survey (USGS) Digital Elevation Model (DEM). Vertical Mapper© was used, with grids of 30 meters per side (Plate 2-2).
- Created a grid map of the Engineering Geologic Materials Map (Plate 2-1). Vertical Mapper© was used, with 30 meter grid cells.
- Queried the two grid maps for areas that met parameters for slope instability and landslide susceptibility, as outlined by the flow chart presented in Figure 2-5.
- Drew Landslide Hazard Management Zone boundaries around highly susceptible areas.

BEDROCK SLIDES+

Bedrock Type	Landslide Susceptibility			
	Very High	High	Moderate	Low
	Slope (degrees)			
Foliated and/or Jointed Metamorphic or Igneous Bedrock	>30	20-30	10-20	na
Bedded Sedimentary Bedrock	>20	15-20	10-15	5-10
Nonfoliated and/or Massive Igneous or Metamorphic Bedrock	>40	30-40	20-30	na
Massive Sedimentary Bedrock	>30	20-30	10-20	na

ALLUVIAL OR SOIL SLIDES++

Geologic Material	Slope (degrees)	Landslide Type
Holocene and Pleistocene coarse-grained unconsolidated sediments	>15	Disrupted soil slide
Holocene and Pleistocene fine-grained unconsolidated sediments	>10	Soil slump
	5-10	Soil block slide

Debris flows were not evaluated. Soil lateral spreads considered in the liquefaction susceptibility map.

\+ Modified from: Sadler, Peter, M. and Morton, Douglas, M., Landslides in a Semi-Arid Environment with emphasis on the Inland Valleys of Southern California. Inland Geological Society, 1989.

++ Modified from: CDMG, Special Publication 117, 1997 Guidelines for evaluating and mitigating seismic hazards in California (http://www.consrv.ca.gov/dmg/pubs/sp/117/)

na Not analyzed

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Slope Failure and Landslide Susceptibility Rating Criteria

Figure 2-5

2.4 Expansive Soils

Expansive soils have a significant amount of clay particles which can give up water (shrink) or take on water (swell). The change in volume exerts stress on buildings and other loads placed on these soils. The occurrence of these soils is often associated with geologic units having marginal stability. The distribution of expansive soils can be widely dispersed, and they can occur in hillside areas as well as low-lying alluvial basins.

Expansion testing and mitigation are required by the current grading and building codes. Special engineering designs are used effectively to alleviate problems caused by expansive soils. These designs include the use of reinforcing steel in foundations, drainage control devices, over-excavation and backfilling with non-expansive soil. For new development, future problems with expansive soils can be largely prevented through proper site investigation, soils testing, foundation design, and quality assurance during grading operations as required by the Uniform Building Code, which the County has adopted. Active enforcement, peer review and homeowners' involvement are required to maintain these standards. Homeowners are important because moisture control and modified drainage can minimize the effects of expansive soils. Homeowners should be educated about the importance of maintaining a constant level of moisture below their foundation. Excessive swelling and shrinkage cycles can result in distress to improvements and structures.

Although expansive soils are now routinely alleviated through the County Building Code, problems related to past, inadequate codes constantly appear. Expansive soils are not the only cause of structural distress in existing structures. Poor compaction and construction practices, settlement and landslides can cause similar damage, but require different mediation efforts. Once expansion has been verified as the source of the problem, mitigation can be achieved through reinforcement of the existing foundation, or alternatively, through the excavation and removal of the expansive soils in the affected area.

2.5 Collapsible Soils

Hydroconsolidation, or soil collapse, typically occurs in recently deposited, Holocene (less than 10,000 years old) soils that were deposited in an arid or semi-arid environment. Soils prone to collapse are commonly associated with man-made fill, wind-laid sands and silts, and alluvial fan and mudflow sediments deposited during flash floods. The soils typically contain minute pores and voids. The soil particles may be partially supported by clay or silt, or chemically cemented with carbonates. When saturated, collapsible soils undergo a rearrangement of their grains and the water removes the cohesive (or cementing) material. Rapid, substantial settlement results. An increase in surface water infiltration, such as from irrigation, or a rise in the ground-water table, combined with the weight of a building or structure, can initiate settlement and cause foundations and walls to crack.

A well-documented case of property damage due to collapsible soils occurred in the Murrieta area (Shlemon and Hakakian, 1992). There, alluvium was left in place during rough grading, and later collapsed when ground water levels rose significantly. The ground water rose because of new golf course and residential irrigation. The Murrieta subsidence zone is discussed in more detail in section 2.6.1, below.

In the County of Riverside, collapsible soils occur predominantly at the base of the mountains, where Holocene-age alluvial fan and wash sediments have been deposited during rapid runoff events. In addition, some windblown sands may be vulnerable to collapse and hydroconsolidation. Typically, differential settlement of structures occurs when lawns or plantings are heavily irrigated in close proximity to the structure's foundation. Forensic indications of collapsible soils include:

- tilting floors;
- cracking or separation in the structure;
- sagging floors; or
- non-functional windows/doors.

2.6 Ground Subsidence

Ground subsidence, the loss of surface elevation due to removal of subsurface support, occurs in nearly every state in the United States. It is typically a gradual settling or sinking of the ground surface with little or no horizontal movement, although fissures (cracks and separations) are common. Subsidence is one of the most diverse forms of ground failure, ranging from small or local collapses to broad regional lowering of the earth's surface. While subsidence typically occurs throughout a susceptible valley, additional displacement and fissures occur at or near the valley margin. Susceptible valleys are predominantly filled with unconsolidated sand, and silty sand that includes thin layers of silt and clayey silt. Fine-grained alluvium and organic matter often underlie the fissure areas (Kupferman, 1995). Two types of fissures are reported in the literature: the first are generally straight and correspond to the traces of faults, while the second are more curvilinear on the surface and appear to correspond to the alluvium-bedrock contact at valley margins.

The causes of subsidence are as diverse as the forms of failure, and include dewatering of peat or organic soils, dissolution in limestone aquifers, first-time wetting of moisture-deficient low-density soils (hydrocompaction), natural compaction, liquefaction, crustal deformation, subterranean mining, and withdrawal of fluids (ground water, petroleum, geothermal). Most of the damaging levels of subsidence are induced by human activities. In the areas of southern California where ground subsidence has been reported, the phenomenon is usually associated with the extraction of oil, gas or ground water from below the ground surface, or the organic decomposition of peat deposits, with a resultant loss in volume. Ground subsidence can also occur as a response to natural forces such as earthquake movements, and the evolution of a sedimentary basin as it folds and subsides. Earthquakes can cause abrupt elevation changes of several feet.

Damage caused by subsidence is a world-wide phenomenon that annually costs governments and individuals hundreds of millions of dollars to investigate and to mitigate. According to the National Research Council (1991), the estimated yearly cost of subsidence in the U.S. is about $125 million. Ground subsidence can disrupt surface drainage, reduce aquifer system storage, form earth fissures (cracks and separations), and damage wells, buildings, roads and utility infrastructure. Regional subsidence generally damages structures that are sensitive to slight changes in elevations, such as canals, sewers, and drainages. In the County of Riverside, risk due to regional subsidence is greatest at valley margins.

Subsidence and fissuring have been well-documented in Riverside County (Proctor, 1962; Morton, 1977; Kupferman, 1995) since the early 1960s. Most of the early cases affected only agricultural land or open space. Since the late 1980s, increased urbanization has seen impact on structures designed for human occupancy. In Riverside County, subsidence and fissuring have been caused by falling groundwater tables and by

hydrocollapse when groundwater tables rise (Shlemon and Hakakian, 1992). In addition, many fissures have occurred along active faults that bound the San Jacinto Valley and Elsinore Trough. Some controversy surrounded the initial recognition of these features in the late 1980s and early 1990s. However, there is agreement on the geotechnical conditions that can lead to subsidence and earth fissure formation.

Plate 2-4 shows regions of documented subsidence and regions that may be susceptible to subsidence. The latter include all alluvial valley regions. Subsidence has only been documented in three areas (Figure 2-6):

- the Elsinore Trough, including Temecula and Murrieta.
- the San Jacinto Valley from Hemet to Moreno Valley.
- the southern Coachella Valley.

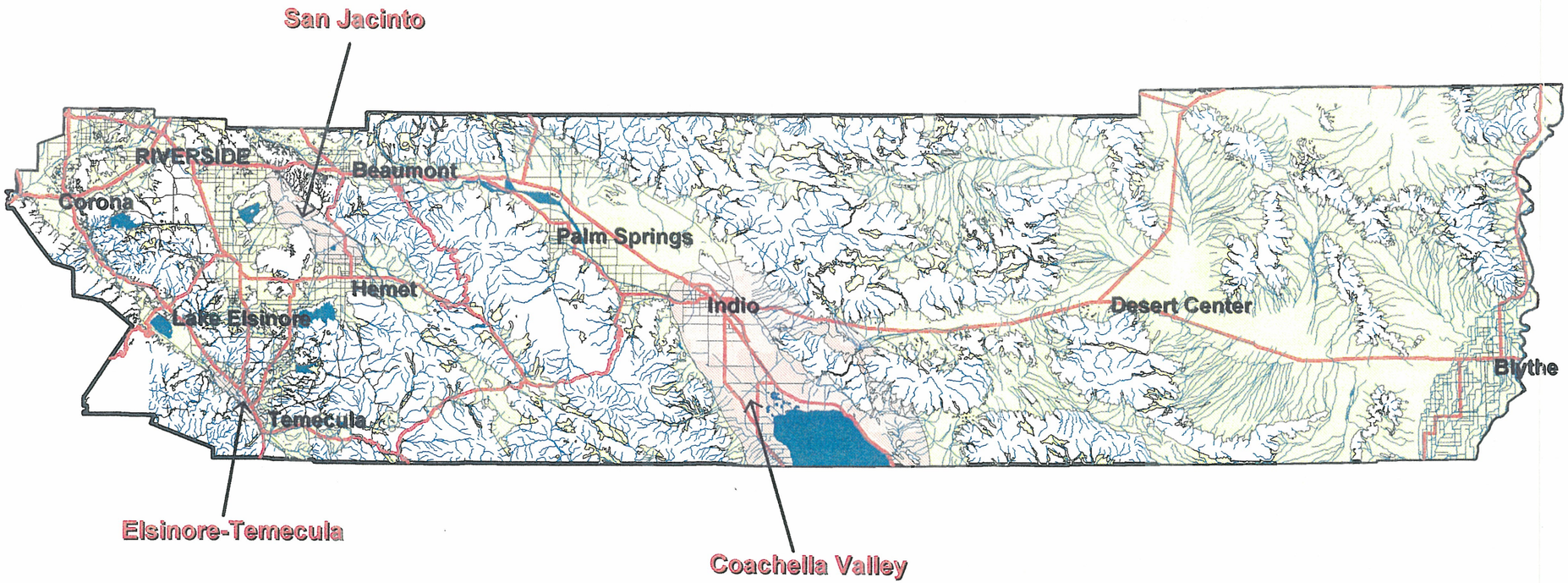
These areas are all potentially sensitive to the withdrawal of ground water. Depending on the depth and mechanical properties of the aquifer and the overlying sediments, they can subside if groundwater resources are not managed properly. Mitigation of ground subsidence usually requires a regional approach to groundwater conservation and recharge. Such mitigation measures are difficult to implement if the geology of the aquifer and overlying sediment are not well understood. Furthermore, conservation efforts can be quickly offset by rapid growth and attendant heavy water requirements (golf courses, for example, consume about 8 acre-feet of water per acre per year). Further, it is not uncommon for several jurisdictions to utilize a continuous groundwater aquifer, and then mitigation requires regional cooperation among all agencies.

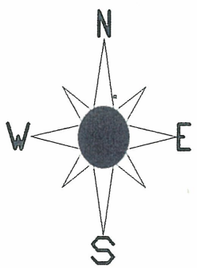
2.6.1 Elsinore Trough

Two separate areas of active subsidence are known in the Elsinore Trough (Shlemon and others, 1995), a broad structural depression called a graben, which has been formed by active faulting in the Elsinore fault system (Figure 2-7). Subsidence in the two areas, near the communities of Temecula and Murrieta, was caused by different mechanisms.

Figure 2-6: Documented Subsidence Areas in Riverside County

(Summary of GIS Data, for additional detail see Plate 2-4 in-pocket)





Scale: 1:1,000,000

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Miles

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Subsidence Zones

- Areas with Documented Subsidence
- Susceptible Areas

Water Bodies

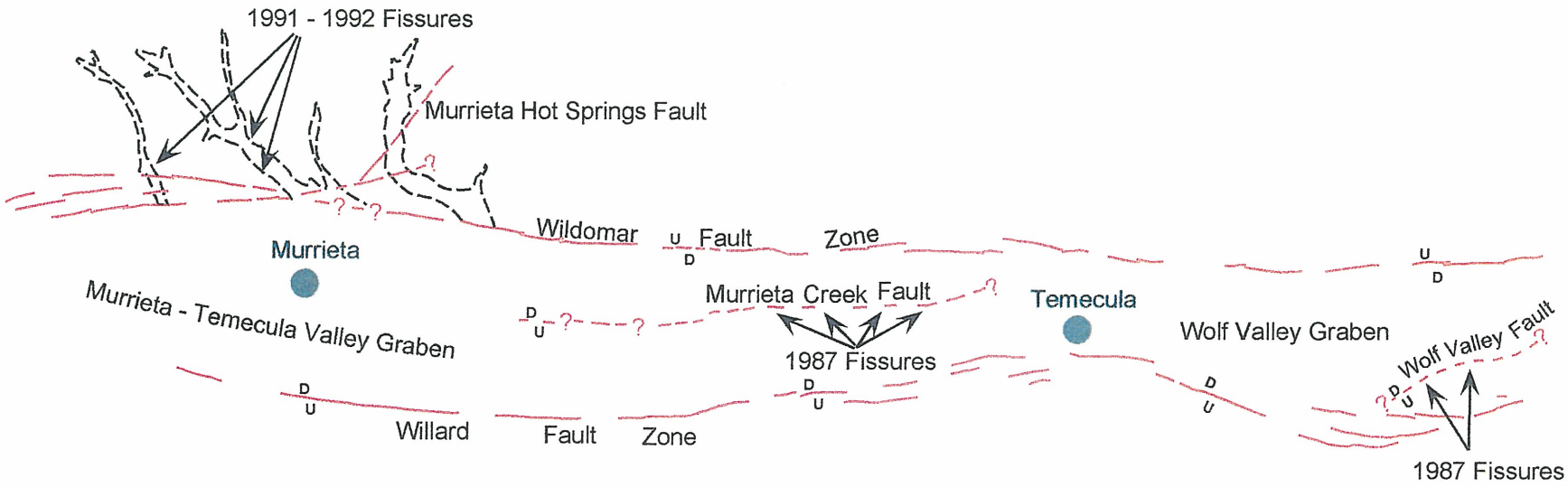
- Lake, Pond, Sea

Major Roads

Water Rivers

- Stream, River, Canal or Ditch

Highways



Fault

Direction of vertical movement along fault; U (up) and D (down)

Modified from Shlemon and Hakakian, 1992

0 1 2
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General Map of the Temecula-Murrieta Area Showing Graben-Bounding Faults, and Major Fissure Areas

Figure 2 - 7

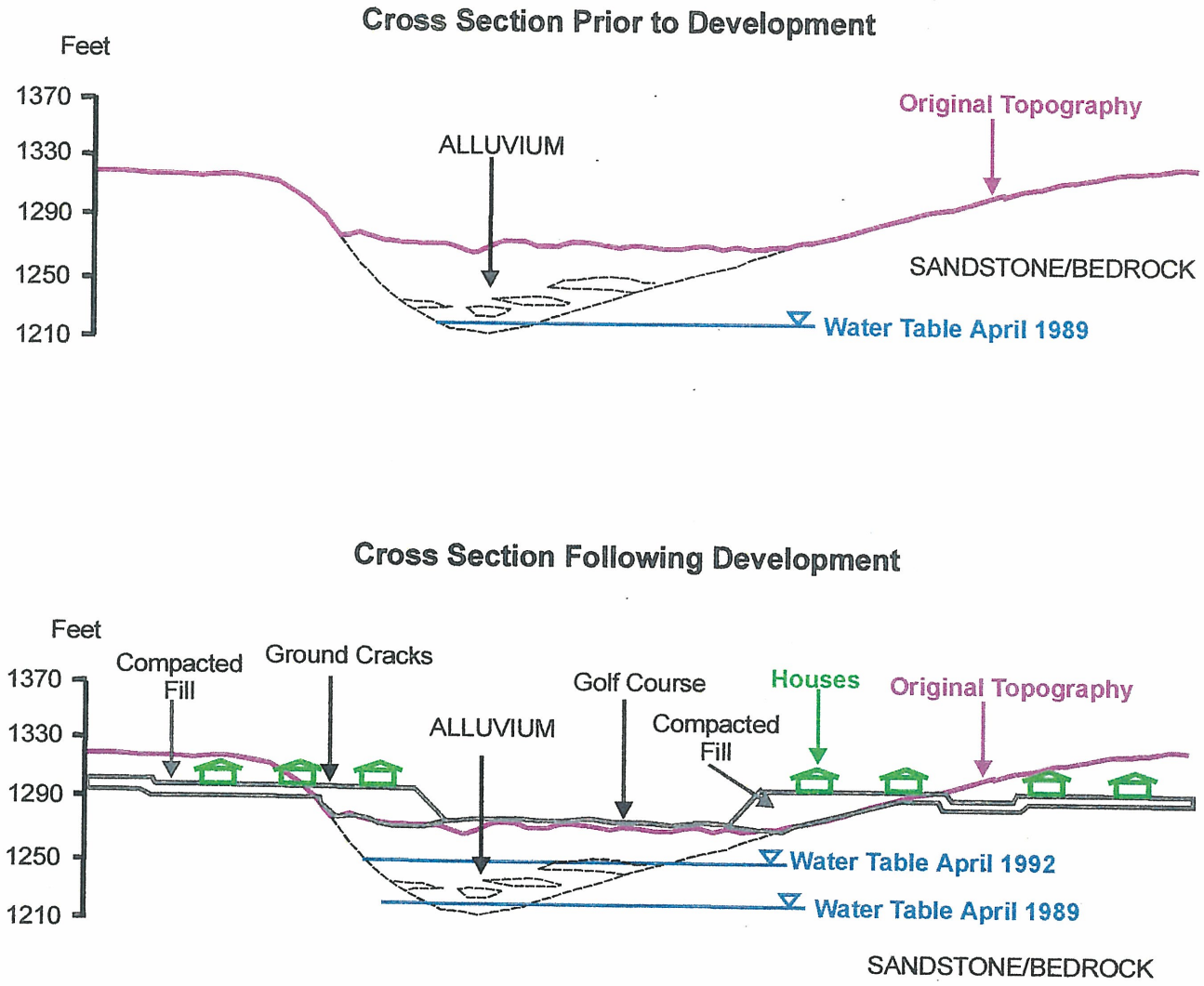
Temecula: The Temecula fissures first appeared in 1987. Short, parallel ground fissures advanced across 7 miles from Wolf Valley in the south to the Temecula-Murrieta valleys in the north (Figure 2-7). By 1991, alleged damages to residential and commercial structures exceeded $50 million (Corwin and others, 1981). The Temecula-area fissures occur in northwest-trending valleys informally designated as the Murrieta, Temecula and Wolf Valley grabens (low areas bounded by faults). In this case, the grabens are approximately one mile wide and bounded by faults of the Elsinore fault system. Studies of the Temecula fissures led to the discovery of two previously unrecognized active faults, the Wolf Valley and the Murrieta Creek. These two faults primarily control the distribution of the Temecula fissures (Shlemon and Hakakian, 1992). Many hypotheses have been proposed to explain the generation of the Temecula fissures. The two most often preferred are:

1) Accelerated pumping of ground water caused deep compaction. Tensile stresses (which pull ground apart) concentrated along nearby, graben-bounding faults.

2) Aseismic creep (fault movement that does not produce earthquakes) occurred along the Wolf Valley and Murrieta Creek faults.

Groundwater pumping is now the favored hypothesis (Shlemon and Davis, 1992), due to the observation that, in the days and weeks prior to subsidence, several new wells began pumping. Since the cessation of pumping, the fissures have not increased in number or size.

Murrieta: The Murrieta fissures first occurred in 1990, primarily in the "California Oaks" subdivision. About 50 discrete fissure areas have formed in and around the 10,000-home development. In litigation, damages associated with the Murrieta fissures were alleged to exceed $100 million by 1992 (Shlemon and Hakakian, 1992). These fissures are similar in appearance to the Temecula fissures, however, they occur within stream-filled channels (Figure 2-8). They occur primarily at the transition between bedrock and alluvium (stream deposits) (Figure 2-8). In places, the alluvium thickness locally exceeds 75 feet, and as much as 60 feet of alluvium was left in-place after site grading. These stream sediments were then surcharged with about 10 feet of compacted fill, and residential structures were built over the fill. Subsequent geotechnical studies (Shlemon and Hakakian, 1992) indicate that ground water levels have risen as much as 50 feet. The rise is attributed to irrigation of a golf course and residential lots.



Modified from Shlemon and Hakakian 1992

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Schematic Cross-Sections Illustrating Collapsible Alluvium and Fissure Formation for the Murrieta Area

Figure 2 - 8

2.6.2 San Jacinto Valley

In the San Jacinto Valley, the ground water table has declined more than 120 feet (Lofgren, 1976). This decline resulted in about three feet of maximum surface subsidence between 1939 and 1959 (Proctor, 1962). Holzer (1984) estimated that most of the subsidence (70-80%) resulted from groundwater withdrawal, with the remainder from subsidence of the sedimentary basin due to local tectonic forces associated with movement of the San Jacinto fault system.

2.6.3 Coachella Valley

The Coachella Valley is filled with more than 10,000 feet of sediments, of which the upper 2,000 feet are water-bearing deposits. The most important source of groundwater recharge to the lower Coachella Valley is the Colorado River (Tyley, 1974). Minor sources of recharge include groundwater inflow from adjacent areas, infiltration of precipitation that falls on the valley floor, and local runoff from the mountains that border the area.

The groundwater basin in the Coachella Valley is currently in a state of overdraft. Groundwater levels are declining at an increasing rate as a result of valley-wide mining for ground water. Water levels declined up to 50 feet from the early 1920s to the late 1940s. In 1949, water from the Colorado River was imported through the Coachella Canal and pumping of ground water decreased. Groundwater levels recovered throughout most of the valley from the 1950s to the 1970s, with some basin recharge attributed to leakage from unlined water canals. Since the late 1970s, the demand for water has exceeded the deliveries of imported surface water, and ground water levels have been declining again as a result of increased pumping. By 1996, in many areas, groundwater levels fell beneath the historical low. These recent declines in water level have the potential to induce new or renewed land subsidence in the Coachella Valley (Ikehara and others, 1997).

In 1948, ground fissuring was observed in the city of La Quinta (Ikehara and others, 1997). This fissuring occurred during a period of rapid ground water withdrawal (Figure 2-9), and therefore, appears related. The 1948 ground fissure occurred near Avenue 52 and Adams Street, in close proximity to the margin of the Coachella Valley and the alluvial contact with rock of the Santa Rosa Mountains. Based on a 1948 photograph presented in Ikehara and others (1997) obtained for this study, the fissure is 20 feet long and up to one foot wide. A recurrence of this or similar ground fissures would clearly result in damage to overlying structures.

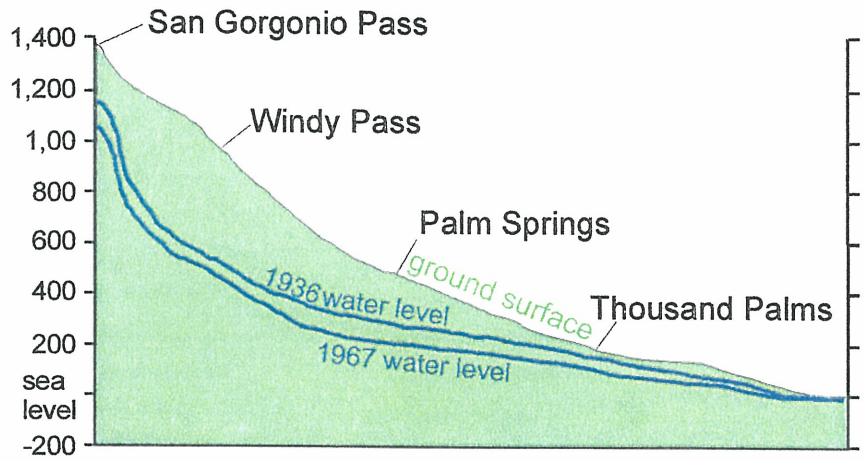
Recent studies by the U.S. Geological Survey (USGS) have determined that long-term declines in water levels of sufficient magnitude to induce land subsidence have occurred in portions of the Coachella Valley. In 1996 the USGS (Ikehara and others, 1997) established a precise geodetic network to monitor elevation changes and thus land subsidence in the lower Coachella Valley. It currently monitors 17 locations. Of the 15 measurement locations with historical elevation data, fourteen indicate cumulative subsidence from -0.2 to -0.5 feet since the 1930s. However, the magnitude of these subsidence determinations is within the range of uncertainty (±0.2 feet), so these measurements do not unequivocally indicate that subsidence has occurred.

Where data were available, the USGS plotted historical subsidence over time and compared this to water level changes in nearby wells. Subsidence occurred during periods of water level decline, and rebound occurred during intervening periods of water level recovery. This correspondence suggests that land subsidence is occurring, and a significant part of the measured subsidence likely has occurred since 1991, about the time when water levels began declining below their previously recorded low levels (Steve Robbins, personal communication, 1999).

The U.S. Geological Survey (Ikehara and others, 1997) plans to precisely measure elevation every 2-3 years to determine the magnitude and extent of subsidence. In addition, monitoring of well water-levels is required to assess the relationship between ground water overdraft and regional subsidence.

As is true elsewhere, mitigation of subsidence in the Coachella Valley will require a regional approach to groundwater conservation and recharge. Because overdraft of the Coachella Valley groundwater basin is caused by all water users in the area, and it is not feasible to predict exactly where ground fissures will appear, one potential mitigation measure is to fund structural repairs or replacement with costs passed on to water users through the Coachella Valley Water District.

Figure 2-9: A comparison of water-table profiles in the Coachella Valley between 1936 and 1967 shows that water levels declined in most of the valley as a result of increased groundwater withdrawls, but in the extreme southeastern part of the valley, water levels remained the same because of historic leakage from the unlined Coachella Canal.



Modified from: Tyley, S. J., 1974, Analog model study of the ground-water basin of the upper Coachella Valley, California: U. S. Geological Survey Water-Supply paper 2027, 77p.

Earth Consultants International Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan	**Groundwater Table Profile of the Upper Coachella Valley**	**Figure 2-9**

Currently, groundwater recharge in the Coachella Valley area is minimal. The Coachella Valley Water District operates a pilot recharge facility south of Lake Cahuilla near Avenue 62 and Madison Street, in the city of La Quinta. The facility has been in operation since 1996 and has shown that recharge is feasible there (Steve Robbins, personal communication, 1999). Design of a full-scale facility at this location will likely begin within the next several years.

2.6.4 Development of a GIS Subsidence Hazard Map for Riverside County

A digital Subsidence Hazard Map for Riverside County was prepared at a scale of 1:250,000 (Plate 2-4). The accuracy of the Subsidence Hazard Map is about 1:100,000. Plate 2-4 focuses on land subsidence initiated exclusively by the withdrawal of ground water from alluvial valleys. As discussed in preceding sections, this is a widespread problem which has been implicated in several areas of documented subsidence.

Surface Classification - To facilitate the subsidence analysis and prediction, the ground surface of the study area was divided into three categories based upon the data collected (Plate 2-4):

1) Areas of documented subsidence
2) Areas of potential subsidence
3) Areas of low to no potential for subsidence.

Areas of potential subsidence are generally underlain by Holocene- and Pleistocene-age alluvial sediments, with the potential for the presence of groundwater. The concept is that alluvial valleys, especially is underlain by thick sediment sequences, have the potential to subside.

2.7 Wind Erosion

Wind-induced soil movement, or wind erosion, is a common and serious environmental problem attracting global attention. Wind erosion damages land and natural vegetation by removing soil from one place and depositing it in another. It mostly affects dry, sandy soils in flat, bare areas, but wind erosion may occur anywhere that soil is loose, dry, and finely granulated. It causes soil loss, dryness, deterioration of soil structure, nutrient and productivity losses, air pollution, and sediment transport and deposition. The presence of dust particles in the air is a source of several major health problems. Atmospheric dust causes respiratory discomfort, may carry pathogens that cause eye infections and skin disorders, and reduces highway and air - traffic visibility. Dust storms can cause additional problems. Buildings, fences, roads, crops, trees and shrubs can all be damaged by blowing soil, which acts as an abrasive.

Soil movement is initiated as a result of wind forces exerted against the surface of the ground. For each specific soil type and surface condition there is a minimum velocity required to move soil particles. This is called the threshold velocity. Once this velocity is reached, the quantity of soil moved is dependent upon the particle size, the cloddiness of particles, and the wind velocity. Suspension, saltation, and surface creep are the three types of soil movement which occur during wind erosion (Figure 2-10). While soil can be blown to virtually any height, over 93% of soil movement takes place within one meter of the ground.

Wind and wind-blown sand are an environmentally limiting factor throughout much of Riverside County. Approximately 20% of the land area of Riverside County is vulnerable to "high" and "very high" wind erosion susceptibility (Figure 2-11). The Coachella Valley, the Santa Ana River Channel in northwestern Riverside County, and the community of Hemet are zones of high wind erosion susceptibility.

2.7.1 Coachella Valley

Wind-blown sand is a well-recognized hazard for developments in the Coachella Valley, with greatest activity in the central region from Palm Springs to the northern portion of La Quinta. Wind-blown sand has forced abandonment of dwellings and subdivided tracts in the central Coachella Valley (Sharp, 1980). Utility poles in the area are frequently armored with sheet metal around the base to protect against wind erosion. Caltech investigators interested in measuring the destructive effects of wind near Garnet Hill located several sample plots with sampling materials that included 2 to 3-inch thick lucite rods, common bricks, hard crystalline rock, and gypsum-cement cubes. As a result of wind erosion, one lucite rod was severed, and many of the brick and rock samples were eroded up to several centimeters per year.

High winds often blow down the axis of the Coachella Valley and shelter from these winds controlled the location of initial development in the upper Coachella Valley. Most of the early development of the winter recreational resort communities began in the lee of the protecting mountains. The Coachella Valley area, is undergoing rapid development and changes in land use that increase wind-blown sand problems. Development has now moved into the central axis of the valley, the high-wind areas. These growing communities need additional mitigation measures.

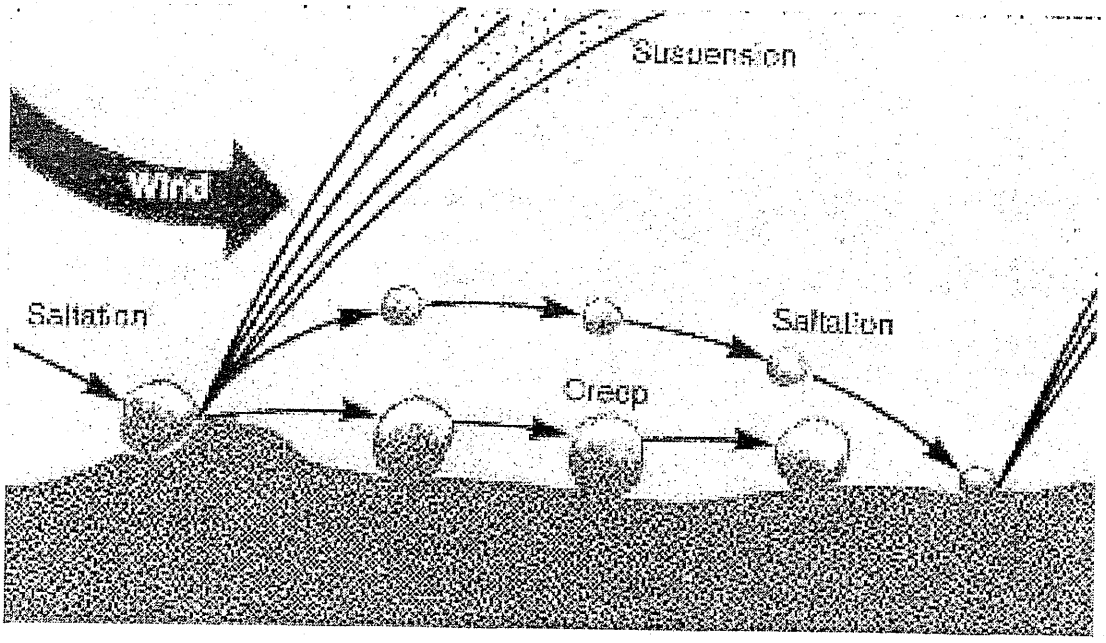


Figure 2-10: Wind-induced soil movement is initiated as a result of wind forces exerted against the surface of the ground and includes suspension, saltation, and surface creep. Soil can be blown high into the atmosphere, however, most soil movement takes place at or below one meter.

According to El-Aghel (1984), five physical factors determine the distribution and intensity of the wind-blown sand hazard in the Coachella Valley:

- Orientation of hill and mountain masses: Mountains bordering the valley have their long axes aligned northwest-southeast and thus offer little resistance to the free flow of air down the long axis of the Coachella Valley. The narrow San Gorgonio Pass accelerates the wind, which improves its ability to pick-up and transport sand.

- Nature of the bedrock: Granitic and metamorphic rocks that comprise the local mountains readily weather to grain sizes that are easily transported by wind.

- Location of the Whitewater River Floodplains: The Whitewater River is the main stream feeding the upper Coachella Valley. It drains much of the adjacent parts of the San Bernardino Mountains. During floods, large quantities of sand and gravel are deposited on the Whitewater floodplains, at the eastern end of San Gorgonio Pass, where wind velocities are the greatest.

- Slope of the valley floor: From the summit of the San Gorgonio Pass (elevation about 1,200 feet) to the Salton Sea (below sea-level), the valley floor slopes without interruption, thereby allowing air to move unhindered.

- Climate: The Coachella Valley is a desert. Its sparse vegetation exposes surficial materials to wind. Precipitation in the adjacent mountains is often short and intense, leading to torrential run-off and considerable deposition on the valley floor.

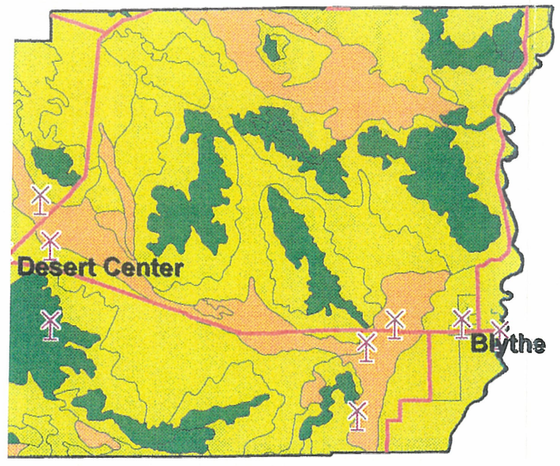
The primary source of sand in the Coachella Valley is the Whitewater River. Increases in the amount of wind-blown sand are related to episodic flooding of the Whitewater River (Sharp, 1964, 1980). A 15-fold increase in wind erosion rates was noted following heavy floods (Sharp, 1980). These floods changed the character of the Whitewater River drainage from stony to sandy. Typically, within a few months, the drainage bottom returned to a predominantly stony appearance.

Mitigation of wind-blown sand erosion is directly related to reduction of flood potential of the Whitewater River, and presents an important mitigation opportunity for Riverside County. Hedges and other barriers are unlikely to be as effective in mitigating wind erosion.

Figure 2-11:

Wind Erosion Susceptibility Map Riverside County California

(Summary of GIS Data, for additional detail see Plate 2-5 in-pocket)



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Wind Erodibility Rating
- Very High
- High
- Moderate
- Low
- Water

Highways

Major Roads

Weather Station

General Wind Direction

Man has exacerbated the wind erosion conditions by removing native vegetation, building roads and other infrastructure across the valley floor. Recreational land uses, especially use of off-road vehicles, accelerates erosion in the area.

2.7.2 Development of a GIS Wind Erosion Susceptibility Map for Riverside County

A digital Wind Erosion Susceptibility Map was prepared as part of this study. The wind hazard map is generally considered accurate to 1:100,000, and is presented in Plate 2-5 at a scale of 1:250,000.

Map information from the U.S. Department of Agriculture State Soil Geographic (STATSGO) data base was captured as 1:250,000 scale USGS topographic quadrangle units. STATSGO included a soils map of the state of California that was refined for Riverside County. These data included a classification of the soil within each polygon for wind erosion susceptibility. This wind erodibility number was used to assign each polygon a WER (Wind Erodibility Rating). WER classification was assigned as follows:

1 = Very Highly susceptible to wind erosion
2 = High susceptibility
3 = Moderate susceptibility
4 = Low susceptibility
5 = Water

Digital data for this mapping are provided to the County of Riverside and should be utilized to support land use decisions.

2.8 Recommendations for Mitigation of Soil Instability Hazards

2.8.1 Regulation and Governance

Land use and development in Riverside County is regulated by the Riverside County Comprehensive General Plan, County Building and Grading Ordinances *(including the Uniform Building Code)*, the California Environmental Quality Act (CEQA), and specific resolutions adopted by the County Board of Supervisors (Kupferman, 1995). Since July 1, 1999, the County of Riverside has enforced the 1997 Uniform Building Code (UBC) by State Mandate, per California Health and Safety Code, Section 18938. This Technical Background Report will be utilized to support and implement policies for a new Safety Element of the County General Plan. In addition, under the California Environmental Quality Act (CEQA), the County of Riverside is required to prepare initial studies addressing potential adverse impact of proposed projects. Additional mitigation of geologic hazards in Riverside County is established by the Land Use Ordinance of Riverside County, Ordinance 348, amended October 21, 1999.

2.8.2 Mitigation of Slope Instability

As a result of this study, a GIS-based Landslide and Slope Instability Map has been prepared for Riverside County. The mapping defines "Landslide Management Zones". Proposed development in these areas should be required to conduct geotechnical studies to determine slope stability and provide mitigation measures where needed.

Slopes steeper than 10% can be made unstable by activities of man. Therefore, it is recommended that the County adopt hillside development guidelines. Hillside development guidelines should enforce existing grading codes, and can require aesthetic guidelines that improve the hillside appearance and preserve slope stability. For example, guidelines could require that slopes be returned to their natural appearance and steepness after grading and undergrounding for a reservoir.

To reduce debris flow potential, not only do the existing debris basins require continued maintenance, but environmental preservation of the mountain ranges is required. Development of the hillside terrain will only increase the potential for debris flows. Thus the County should actively pursue natural preservation of these ranges. The County should also establish an education and warning system to activate following significant wildland fires on the hillsides above the County. This

can include mailers to households in the affected areas, public meetings, and/or door-to-door education.

The best mitigation measure is to preserve steep slopes as natural, however, for regions altered by development or fire, engineering mitigation measures are required. For individual homeowners, below are some general rules suggested by the L.A. County Department of Public Works (1999) to be followed in most cases involving flood waters, debris and erosion:

- NEVER underestimate the power of debris flows.
- TRY to direct debris flows away from improvements.
- AVOID trying to control or confine the flows more than is absolutely required.
- CLEAR a path for the debris.
- ALWAYS place protection to deflect debris, not to dam or stop it.
- DEBRIS will often enter a building through windows - board them up.
- REMEMBER to protect the home first, then consider what time and money are available to protect other less valuable objects such as swimming pools or landscaping.
- TRY to install more permanent measures to protect your home. In general, the problem of debris flows will exist for several years after a burn. Sandbags usually last for only a year.
- ALWAYS work with adjacent affected property owners.
- BE prepared to sacrifice the use of portions of your property to achieve the greatest amount of protection.
- AVOID altering drainage patterns that could worsen conditions for your neighbor.
- DO NOT wait until the storm season to start your planning and installation of flood, debris, and erosion control facilities. Start as soon as possible. Once debris flows and flood waters begin, it is usually too late to install protection.
- PROTECTION is not always pleasing to the eye and appearance should not dictate location or type of installation.
- BE prepared to personally observe and maintain installations during storm periods, for in many cases a minor correction will prevent major failure. However, do not take any unnecessary risks.
- SHOULD flood, debris, and erosion control problems appear to warrant facilities in excess of minor corrective measures such as sandbags and diversion ditches, it is recommended that a geologist or soils engineer be consulted for additional advice.

The key to erosion control is adequate planting to hold soil in place. However, planting can also increase fire hazards during warm weather. To reduce future fire hazards and still provide effective erosion control, the following are recommended guidelines:

- Clear native brush within 30 feet of buildings and limit brush height to 18 inches within 70 feet of buildings. A limited number of specimen shrubs and trees can be allowed within 30

feet of a building, depending on local fire codes.

- Eliminate or reduce chaparral-type plants that serve as fuel for fires and control their regrowth. Keep landscape clean.
- Remove litter under trees and shrubs and prune out dead growth. Remove dead and dry portions of ground cover and succulents. Leave space (15 to 20 feet) between remaining shrubs and trees to curtail the spread of fire.
- Use planting techniques similar to landscaping in newly developed areas for recently burned watersheds.
- Minimize erosion with quick-growing, fire-retardant ground cover, planted with burlap mat, straw mulch, or chemical nutrients throughout areas to be protected.
- Avoid using ice plant on slopes because it tends to "drag" surface soils down when saturated.
- Select only fire-retardant ornamentals.
- Plant fire-retardant shrubs or trees where ground cover or grass ends.
- Stress rapid growth ground cover.
- Increase effectiveness of fire-retardant plantings with a high-pressure sprinkler system.
- Remember rains can normally be expected to start in October, so plan accordingly.

Section 3316.1 of the Uniform Building Code provides for erosion control of slopes primarily utilizing landscaping. Highlights of this section include:

- The faces of cut-and-fill slopes shall be prepared and maintained to control erosion and to provide stability.

- All slopes equal to or greater than 3 feet in vertical height shall be planted with drought-tolerant grass or ground cover in order to protect the slope from erosion and instability. As deemed necessary by the building official, other slopes shall also be planted.

- Slopes exceeding 15 feet in vertical height shall be planted with drought-tolerant shrubs, spaced at no more than 10 feet on center; or trees, spaced not to exceed 20 feet on center, or a combination of such shrubs and trees at equivalent spacings, in addition to a drought-tolerant grass or ground cover.

- A written statement shall be submitted by a landscape architect or slope control specialist certifying that the plant is drought-tolerant and suitable for erosion control and slope stabilization purposes.

- Landscape plans shall be submitted for all slopes required to be planted.

2.8.3 Mitigation of Expansive Soils

Expansion testing and mitigation are required by the current grading and building codes. Special engineering designs include the use of reinforcing steel in foundations, drainage control devices, over-excavation and backfilling with non-expansive soils. Active enforcement, peer review and homeowner's involvement are required to maintain these standards. Although expansive soils are now routinely alleviated through the County Building Code, problems related to past inadequate codes constantly appear. Homeowners should be informed and educated about the importance of maintaining a constant level of moisture below their foundation. Excessive watering, or allowing expansive soils to become too dry, both have negative consequences. Excessive swelling and shrinkage cycles can result in distress to improvements and structures.

2.8.4 Mitigation of Collapsible Soils

Sampling and laboratory testing for collapsible soils is required under the County-enforced Uniform Building Code. Collapse potential may be mitigated by removal and recompaction under optimum moisture conditions, pre-saturation of foundation soils, and improvements to post-development site drainage. Special attention must be paid to avoid saturation of foundation soils after construction. For example, there should be positive drainage away from the foundation, and planters with open bottoms should be avoided in areas adjacent to foundations.

The raw data for mapping this hazard in the County of Riverside exists in the form of Bureau of Reclamation Soil Survey Maps. While the mapping of collapsible soils is beyond the scope of this project, a future study should be directed at preparing a collapsible soils distribution map.

2.8.5 Ground Subsidence

In regions of active or potential subsidence, four distinct regulations require proposed development to prepare geotechnical reports that address subsidence and outline mitigation where required. These regulations include:

- Safety Element of the General Plan;
- Uniform Building Code;
- California Environmental Quality Act; and
- County Subsidence Report Zones.

As a result of past experience, the County of Riverside has developed extensive methodology to mitigate ground subsidence hazard and reduce associated losses. During preliminary site investigations, geotechnical consultants are required to evaluate the potential for subsidence and fissuring. In cases where subsidence and fissuring are discovered during development, the Riverside County Board of Supervisors adopt a local "Subsidence Report Zone" (Kupferman, 1995). The purpose of a report zone is to prevent construction of structures for human occupancy on known or potential earth fissures.

As a case history, the Riverside County Geologist (Kupferman, 1995) has outlined the County Board of Supervisors' adoption of a Subsidence Report Zone, following the discovery of earth fissures in the Temecula area:

1. In 1987, a northwest-trending, curvilinear system of earth fissuring about 3 km long was observed in recently graded residential tracts.

2. Ground cracks and water levels in nearby wells were monitored by consultants for the developers.

3. The developers and their geotechnical consultants notified Riverside County of the problem and the County ceased issuance of building permits for areas in the vicinity of the cracks.

4. About three months later, similar northwest-trending features were noticed in a commercial part of Temecula. Attorneys and expert consultants (ground water, geotechnical and geologic) were retained by the County for legal and technical assistance.

5. In early 1988, the Riverside County Board of Supervisors resolved to create a Subsidence Report Zone. The zone included areas of known and suspected fissuring, and spanned the alluvial areas of Temecula Valley between two mapped fault zones (Figure 2-7). The zone was approximately 1.6 km wide and 15 km long. Before issuing further building permits, the board required special geotechnical studies that addressed the fissuring, and a licensed structural engineer to certify that proposed structures within this zone were safe for their intended use. Reports submitted to satisfy these requirements ranged from one-page opinions to detailed trenching investigations. Initially, reports were submitted and accepted by the Building and Safety Department if these reports included the required certification. Subsequently, more detailed subsurface investigation reports were reviewed and approved by the County Geologist.

6. Initial site-specific studies indicated that fissuring coincided with active (Holocene) faulting. The County notified the State Division of Mines and Geology, which began a study in accordance with the Alquist-Priolo Special Studies Zone Act (APSSZ) (Hart, 1990). This

resulted in establishment of a state Special Studies Zone (SSZ) where the fissures coincided with active (Holocene) faulting. Planned development within these zones was required to comply with the APSSZ Act. The new special studies zones were 0.2 - 0.3 km wide and 2.0 - 4.0 km long. The original, larger Subsidence Report Zone also remained in effect.

7. Two years after initial adoption, the Subsidence Report Zone and the Board of Supervisors' resolution was changed. The new resolution kept the original zone intact, removed the certification by a structural engineer, and retained the requirement that fissuring should be addressed by geotechnical engineers for projects within the Zone.

8. The SSZ and the larger Subsidence Report Zone are still in place; however, most of the area is now incorporated into cities. Indications are that the cities are still implementing these zones.

9. No new cracks have occurred within the Subsidence Report Zone since it was established. The original fissures within the narrow state Special Studies Zone continue to show periodic movement.

10. The original, wide Subsidence Report Zone was ruled an appropriate safeguard. It did not substantially slow development, and allowed building to proceed with controls that evaluated the potential for fissuring.

As reported by Kupferman (1995), two additional Subsidence Report Zones have since been created by the County Board of Supervisors:

Murrieta Area-California Oaks: In 1991, a Subsidence Report Zone was created in the Murrieta area, as a result of ground cracking at the California Oaks project (see section 2.6.1). This cracking was determined to be a result of a rising ground water table, rather than a falling ground water table. Shlemon and Hakakian (1992) attribute the cracking at California Oaks to be the result of saturation of collapsible alluvium that was left in-place during rough grading. The limits of the Subsidence Report Zone for the Murrieta area was based on natural hydrologic and political boundaries (Kupferman, 1995). Shortly after creation of this Zone, the area was adopted into the city of Murrieta and continues to be enforced by the city.

The cracking at California Oaks led to modifications in County policies. The County Department of Buildings and Safety adopted a set of technical guidelines for the review of geotechnical reports. The guidelines require that a project geotechnical consultant must document observations and inspections during grading; and that the County Geologist review and approve geotechnical reports for all grading projects (Kupferman, 1995).

Silverhawk Development: In 1994, a third Subsidence Report Zone was established. The establishment of this Zone was pre-emptive, as no ground fissuring had yet been observed. However, geotechnical data, and similarities in geology, topography, hydrology and grading with the previously established California Oaks zone, warranted its establishment. This third Subsidence Report Zone was removed following the preparation of geotechnical studies by the project developer.

2.8.5.1 Recommended Minimum Requirements to Address Subsidence Potential:

This Technical Background Report recognizes the hazard of subsidence and ground fissuring in Riverside County and supports the implementation of a Safety Element policy to require preliminary soils engineering and engineering geologic reports. Prior to issuance of grading permits, the potential for subsidence must be addressed in regions identified by this study as active or susceptible. This recommendation is supported by the Uniform Building Code.

At a minimum, geotechnical investigations and reports that address subsidence potential should:

- Identify and locate any faults, scarps, and fissures in the vicinity.
- Review available land level lines of past ground surface movement in the vicinity, including degree of differential subsidence across nearby faults and proximity of regional subsidence bowls.
- Review groundwater development in the vicinity, including the location of nearby, high-capacity wells. Review available historic water level data from nearby wells.
- Review available maintenance records of nearby wells for signs of possible subsidence-induced damage.
- Review subsurface units from available well drillers' logs.

At a minimum, conclusions should discuss:

- Location (or absence) of all surface ruptures on or adjacent to the site.
- Type of faults and nature of anticipated offset, including direction of relative displacement, and maximum possible displacement.
- Statement of relative risk, addressing the probability or relative potential for future surface displacement. This may be stated in semi-quantitative terms such as low, moderate, or high, or in terms of slip rates determined for specific fault segments.
- Degree of confidence in, and limitations of, the data and conclusions.

At a minimum, recommendations should provide:

- Set-back distances from faults and fissures. State, Federal or local guidelines may dictate minimum standards otherwise.
- Mitigative measures for appropriate structures that cannot avoid crossing faults and fissures. Examples include, but are not limited to, critical pipelines, aqueducts, flood channels, railroads, and roadways.
- Discussion of the need for additional studies, or inspection during construction.

2.8.6 Mitigation of Wind Erosion

As mentioned, the most effective mitigation of this hazard is to curtail the primary source of sand in the Coachella Valley – periodic flooding of the Whitewater River. Mitigation of this would require a multi-million dollar upstream dam and maintenance to remove trapped sediment. Lining the Whitewater River channel would reduce the sand supply, but reduce the favorable aspects of ground water infiltration. While building and maintaining a dam may be economically justifiable based on the continued wind-blown sand damage throughout the valley, it is more likely that local, smaller-scale mitigation measures will continue to be implemented.

2.9 Summary

Physiographic and Geologic Setting

- The hazards of subsidence and hydroconsolidation are concentrated in valley regions filled with sediments, while mass wasting (e.g. landsliding, rockfall) is associated with the mountainous regions primarily underlain by igneous and metamorphic rock.

- The bedrock exposures of Riverside County consists predominantly of igneous and metamorphic rock with some sedimentary units. They vary from hard rock underlying steep slopes of the San Jacinto Mountains to the weathered granitic rocks of Joshua Tree National Park and hillsides near the city of Riverside.

- Alluvial (river) valleys between these mountain ranges contain sediments with significant variation in thickness. Some valleys contain a few hundred feet of Pleistocene and Holocene sediments, whereas others, such as the Coachella, San Jacinto and Elsinore valleys, contain several thousand feet to several miles of sediment. The thickest sediments have been deposited in basins that are being pulled apart by the movements of tectonic plates.

Development of GIS Engineering Geology Map

- Detailed digital Geologic and Engineering Geologic maps for Riverside County have been prepared for this study. The accuracy of the overall Geology and Engineering Geology maps are 1:100,000. However, certain portions of the map were digitized at greater detail (1;24,000), and other areas were digitized at lesser detail (1:250,000).

- More that 60,000 polygons *(area features)* were digitized from geologic map data for Riverside County. These diverse geologic units were combined based on similar engineering properties. The map is meant to provide general guidance to support land use decisions and policies. It is developed from regional data and includes many assumptions in assigning engineering properties based on descriptions of geologic units. Therefore, the data should not replace or preclude site-specific observation and testing.

Slope Stability

- Landslide Management Zones (LMZ) represent regions susceptible to slope instability and should generate slope stability studied prior to issuing development permits. Without the presence of extensive flood control devices, including large debris catchment basins, the areas outlined by the LMZs may be subject to debris flow inundation. Mitigation of debris flow potential in should be directed at development in these areas. Occasionally, catastrophic debris flows occur. The greatest southern California debris flows of the 20th century occurred in 1934, 1938, 1969 and 1978, but there is generally a destructive event each decade. Most often, the impact to the County will be boulders transported onto roadways and improvements by smaller, more common events.

- The angle of repose for slopes averages 35 degrees, but varies widely. However, slopes as shallow as 26 degrees have failed catastrophically. An effective way for the County of Riverside to protect lives and property is to prohibit development on or near slopes that exceed about 30 degrees in steepness, measured from the horizontal.

- To reduce hazard from debris flows and other mass wasting, debris basins require continued maintenance, and environmental preservation of mountain ranges is required. Development of hillside terrain increases the potential for slope instability. Thus the County should actively pursue natural preservation of these ranges. The County should also establish an education and warning system that can be activated following significant wildland fires on the hillsides above the County. This can include mailers to households in the affected areas, public meetings, and/or door-to-door education.

Development of a GIS Landslide and Slope Instability Map

- As a major component of this project, we developed digital landslide and slope instability mapping for Riverside County. The mapping is based on slope steepness, as well as engineering geology. The general procedures followed to create the Landslide and Slope Instability Map, included:

    - *Creation of a slope map for Riverside County by producing a grid map of the U. S. Geological Survey (USGS) Digital Elevation Model (DEM) for the County in Vertical Mapper© with a grid cell size of 30 meters on each side.*

- *Creation of a grid map of the Engineering Geologic Materials Map map in Vertical Mapper© using a 30 meter grid cell size.*

- *Queries of both grid maps for areas that meet the parameters for slope instability and landslide susceptibility.*

Expansive Soils

- Expansive soils contain clay particles that can give up water (shrink) or take on water (swell). Mitigation can be achieved through reinforcement of an existing foundation, or alternatively, through the excavation and removal of the expansive soils in the affected area. Moisture control and modified drainage can also minimize the effects of expansive soils. For new development, problems with expansive soils can be largely prevented through proper site investigation, soils testing, foundation design, and quality assurance during grading operations as required by the Uniform Building Code.

Collapsible Soils

- Collapsible soils in the County of Riverside are predominantly found near the mountains, in Holocene alluvial fans and washes deposited during rapid stream runoff. In addition, some windblown sands may be vulnerable to collapse and hydroconsolidation. Typically, differential settlement of structures occurs when lawns or plantings are heavily irrigated in close proximity to the structure's foundation.

- Collapsible soils caused damage, possibly exceeding $100 million, to homes in the Murrieta area of Riverside County. In the Murrieta case, alluvium left in-place during rough grading later collapsed when ground water levels rose significantly as a result of new golf course and residential irrigation.

Ground Subsidence

- Damage caused by subsidence is a world-wide phenomenon that annually costs hundreds of millions of dollars to investigate and to mitigate. Land subsidence and associated fissuring have been well-documented in Riverside County. Most of the early cases affected agricultural land or open space. Since the late 1980s, increased urbanization has seen impact on structures designed for human occupancy.

- While subsidence typically occurs throughout a susceptible valley, additional displacement and fissures occur at or near the valley margin. In the County of Riverside, regional subsidence hazard is greatest at the valley margins.

- In Riverside County, ground subsidence and fissuring have resulted both from falling ground water levels, and rising ground water levels. Many of the fissures have occurred along active faults that bound the San Jacinto Valley and Elsinore Trough. Some controversy surrounded the initial recognition of these features in the late 1980s and early 1990s.

- Regions deemed susceptible to subsidence include all the alluvial valley regions. Three areas of documented subsidence have been defined:

    - The Elsinore Trough, including the communities of Temecula and Murrieta.
    - The San Jacinto Valley from Hemet to Moreno Valley.
    - The southern Coachella Valley.

Elsinore Trough-Ground Subsidence

- Two separate areas of subsidence have been documented in the Elsinore Trough, attributed to two different causes.

    - ***Temecula***: The Temecula fissures first occurred in 1987 and formed short, parallel ground cracks over about 7 miles, from Wolf Valley on the south to the Temecula-Murrieta valleys on the north. By 1991, alleged damages to residential and commercial structures exceeded $50 million. Many hypotheses have been considered to explain the Temecula fissures. Of these, rapid ground water pumping is now favored. Several new wells began pumping several days to several weeks prior to the subsidence; and since the cessation of pumping, the fissures have neither grown nor multiplied.

    - ***Murrieta***: The Murrieta fissures first occurred in 1990, primarily in the "California Oaks" subdivision. In litigation, damages associated with the Murrieta fissures were estimated to exceed $100 million by 1992. These fissures are similar in appearance to the Temecula fissures, however, they occur within alluvial filled channels. The Murrieta fissures are believed to have been triggered by golf course and residential irrigation.

San Jacinto Valley-Ground Subsidence

- Ground water table declines in the San Jacinto Valley have exceeded 120 feet and resulted in about three feet of surface subsidence between 1939 and 1959. The subsidence is attributed to a combination of ground water withdrawal, and tectonic basinal subsidence associated with movement along the San Jacinto fault system.

Coachella Valley-Ground Subsidence

- Back in 1948, ground fissuring was observed in the city of La Quinta. This regional subsidence occurred during a period of rapid ground water withdrawal. Water level had declined as much as 50 feet between the early 1920s and the late 1940s, before water from the Colorado River was imported through the Coachella Canal in 1949. When this surface water was introduced, pumping of ground water decreased, and water levels recovered throughout most of the valley from the 1950s to the 1970s. Some of the basin recharge was also attributed to the leakage from unlined water canals.

- Currently, the ground water basin in the Coachella Valley is in a state of overdraft. Ground water levels are declining at an increasing rate. Since the late 1970s, the demand for water has exceeded the deliveries of imported surface water. Ground water levels in 1996 were in many areas lower than the historical low ground water levels. These observed declines in water level have the potential to induce new or renewed land subsidence in the Coachella Valley.

- As is true in many places, mitigation of subsidence in the Coachella Valley will require a regional approach to ground water conservation and recharge. These mitigation measures are expected to be difficult to implement. Currently, ground water recharge in the Coachella Valley area is minimal. The Coachella Valley Water District operates a pilot recharge facility south of Lake Cahuilla that has been in operation since 1996 and has shown that recharge is feasible. Design of a full scale facility at this location will likely begin within the next several years.

- The U.S. Geological Survey plans to precisely measure elevation every 2-3 years to determine the magnitude and extent of subsidence. In addition, monitoring of well water-levels is required to assess the relationship between ground water overdraft and regional subsidence.

Wind Erosion

- Wind erosion is a serious environmental problem attracting global attention. Soil movement is initiated as a result of wind forces against the surface of the ground.

- The presence of dust particles in the air is the source of several major health problems. Atmospheric dust causes respiratory discomfort, may carry pathogens that cause eye infections and skin disorders, and reduces highway and air - traffic visibility. Dust storms can cause additional problems as well. Buildings, fences, roads, crops, trees and shrubs can all be damaged by abrasive blowing soil.

- Wind and wind-blown sand is an environmentally limiting factor throughout much of Riverside County. Approximately 20% of the land area of Riverside County is vulnerable to "high" and "very high" wind erosion susceptibility. The Coachella Valley, the Santa Ana River Channel in northwestern Riverside County, and the community of Hemet are zones of high wind erosion susceptibility.

- Wind-blown sand is a well recognized hazard for developments in the Coachella Valley; it has forced abandonment of dwellings and subdivided tracts in the central Coachella Valley.

- The primary source of sand in the Coachella Valley is the Whitewater River. increases in the amount of wind-blown sand are related to episodic flooding of the Whitewater River. A 15-fold increase in wind erosion rates was noted following heavy floods. Mitigation of wind-blown sand is directly related to mitigation of flood potential on the Whitewater River. Efforts to control the wind using hedges and other barriers will not be as effective in mitigating wind erosion.

Regulatory Framework for Mitigation of Geologic Hazards

- Land use and development in Riverside County is regulated by the Riverside County Comprehensive General Plan, County Building and Grading Ordinances *(including the Uniform Building Code)*, the California Environmental Quality Act (CEQA), and specific resolutions adopted by the County Board of Supervisors.

CHAPTER 3: FLOOD HAZARDS

3.1 Overview

During the 20th century, floods were the number-one natural disaster in the United States in terms of number of lives lost and property damage. Flood currents often move at high velocities and possess tremendous destructive power. Their lateral forces can demolish buildings and erode bridge foundations and footings, leading to collapse. Since 1965, eleven Gubernatorial and Presidential flood disaster declarations have been made for Riverside County.

Flood Facts:

- Most lives are lost when people are swept away by flood currents.
- Most flood-related deaths are due to flash floods.
- Fifty percent of all flash flood fatalities are vehicle-related.
- Most property damage results from inundation by sediment-laden water.
- Most homeowners' insurance policies do not cover flood water damage.
- Individuals and business owners can protect themselves from property losses by purchasing flood insurance through FEMA's National Flood Insurance Program.

There are four principal types of flood hazard:

Stream Flooding: The County of Riverside is vulnerable to flooding associated with several major drainages, including but not limited to the Santa Ana, San Jacinto and Whitewater, as well as smaller scale and flash flood events on many of the alluvial fans that flank the County's hillsides. Large-scale developments have utilized golf courses and greenbelts as part of a network of channels that collect flood flows on the upstream side of a project, carry it safely through the project, and disperse it on the downstream side. However, given the low permeabilities of the underlying bedrock, heavy runoff from the surrounding hills and mountains during strong storms cannot be prevented. A multi-hazard mitigation opportunity exists, as control of flooding on the Whitewater River will also reduce the sand supply and subsequent wind-blown sand hazard for the area, as discussed in Chapter 2.

Bridge Scour: Bridge foundations are vulnerable to scouring during a flood. Major bridge crossings that are vital to the County of Riverside should be designed and built to withstand scouring.

Dam Inundation: More than twenty dam failure inundation paths would affect the County of Riverside. In addition, canals and levees may be vulnerable to the earthquake-induced effects of liquefaction, lateral spreading and primary fault rupture. Liquefaction and lateral spreading damaged Imperial Valley canals during earthquakes in 1979 and 1987, and local flooding resulted.

Earthquake-Induced Flooding (Tsunamis and Seiches): In Riverside County, the susceptibility to tsunami (seismic sea wave) inundation is nil. However, an earthquake may cause local flooding by creating seiches (reverberating waves) in enclosed bodies of water, or by damaging water storage facilities.

The floods of the early and mid-1990s have caused an increased awareness of the potential for personal and structural losses and damages, particularly in the highly urbanized parts of flood plains and alluvial fans throughout California. Near the mountains, a combination of steep slopes and high rates of rainfall rapidly concentrate runoff, causing flows with high velocities and large peak discharges. As peak flood flows reach valley floors, large amounts of debris are deposited and compound the flooding problem. Areas of newer development that are upslope from older urban areas cause increased runoff and new flooding problems in the older areas. Ground subsidence, common in parts of California, reduces the level of flood protection provided by existing infrastructure, and increases the area, depth, and duration of flooding in the areas of subsidence. (Subsidence hazards in Riverside County are discussed in detail in Chapter 2 of this Technical Background Report.) Localized flooding can occur on the alluvial fans descending from steep hillsides. Flood flows on alluvial fans often take unpredictable paths.

Floods that affect the County of Riverside can be attributed to three different types of storm events. The first are general winter storms that combine high-intensity rainfall and rapid melting of the mountain snowpack. The second type is due to tropical storms out of the southern Pacific Ocean, such as tropical storm Kathleen in September 1976, that caused $15 million in damages in the Coachella Valley area. The third type is summer thunderstorms, such as those experienced in 1941 and 1948 (FEMA, 1996). These create flash floods. Water collects rapidly and runs off quickly from steep mountains into adjoining valleys. These floods have sharp peak discharges, high velocities and short durations. They also carry a large amount of debris, due to the mountains' steepness and lack of vegetative cover.

The need for improved flood conveyance structures and levee designs to reduce potential flood hazards has resulted in studies that focus on collection and analysis of precipitation and flood data. Rainfall-runoff and hydraulic models are being utilized to analyze flood potential, adequacy of flood protective measures, surface- and ground water interchange characteristics, and the variable efficiency of mobile (sand bed) flood channels.

State of California Government Code Section 65302 (g) requires local governments to assess the potential impact that flooding, and failure of dams or other water retention structures, might have on their jurisdiction. This chapter reviews published flood inundation maps and a directory of dams showing inundation limits. Safety Elements of General Plans must assess the impact of flooding from storm activity such as a 100-year flood event. A 100-year flood event is a relatively large flood that has a 1/100 chance of occurring in any one year, and a 26% chance of occurring during a typical 30 year home mortgage.

It is important to understand that every storm has an equal likelihood of seeing a 100 year flood. The 100 year recurrence interval represents the long-term average period between floods of a specific size. The fact that a 100 year flood has just occurred in no way decreases the chance of another 100 year flood.

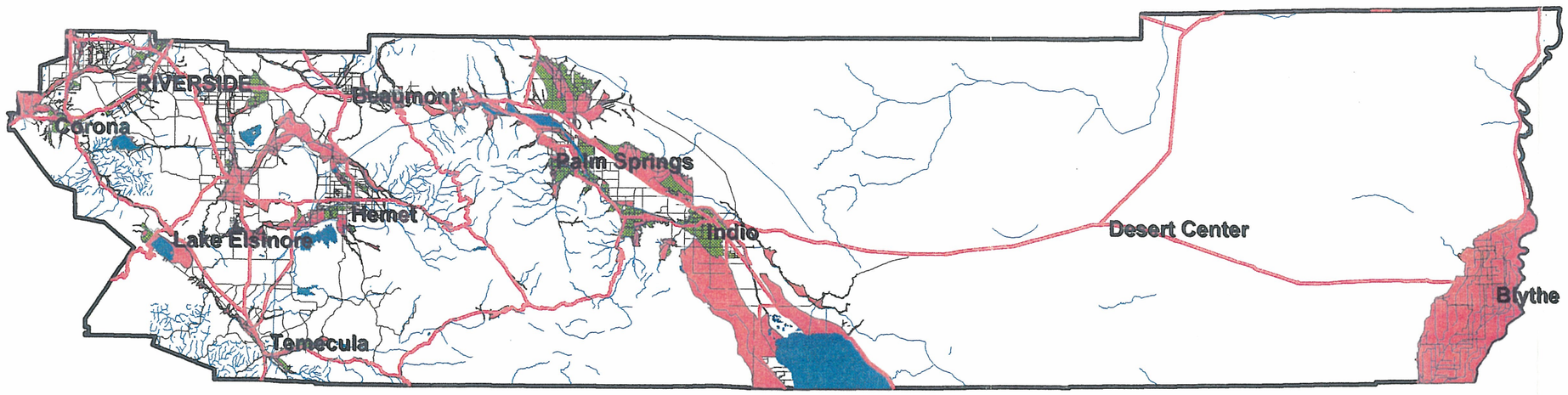
Smaller-scale flooding generally associated with overburdened storm drain and canal systems can damage property and hinder emergency activities such as fire department access or evacuation. Consequently, the potential for more frequently occurring, small-scale flooding is also assessed in this report.

The County of Riverside participates in the National Flood Insurance Program. Consequently, Flood Insurance Rate Maps (FIRMs) prepared by the Federal Emergency Management Agency (FEMA) to show potential flood zones are available for areas within County limits. These maps were used to provide the general boundaries of the 100-year and 500-year flood inundation area shown on Figure 3-1.

Figure 3-1:

100- and 500-Year Flood Hazard Zones of Riverside County California

(Summary of GIS Data, for additional detail see Plate 3-2 in-pocket)



Earth Consultants International

Flood Prone Areas

- 100 Year Flood Zone
- 500 Year Flood Zone

Water Rivers
Stream, River, Canal

Highways

Water Bodies
Lake, Pond, Sea

Major Roads

N
W
E
S

Scale: 1:1,000,000

10 0 10 20 30

Miles

3.2 Previous Flood Disasters Affecting Riverside County

The length of this section indicates the ongoing severity of the flood problem in Riverside County, as elsewhere.

3.2.1 Floods Meriting Disaster Proclamations

The following flood disasters affecting Riverside County resulted in either a Gubernatorial Proclamation of a State of Emergency or Presidential Major Disaster Declaration (California Governor's Office of Emergency Services, 2000):

1965 Heavy Rainfall: Abnormally heavy and continuous rainfall
Declared: ***Riverside (11/24/65)***, San Bernardino, Ventura (11/26/65), San Diego (12/23/65)
Damage: public-$5,826,239; private-$16,017,500; TOTAL-$21,843,739

1966 Winter Storms: Abnormally heavy and continuous rainfall
Declared: Kern, ***Riverside***, Tulare (12/9/66), San Bernardino, San Luis Obispo (12/13/66), Monterey (12/16/66), City of Escondido (San Diego County 12/16/66), Inyo (12/23/66)
Damage: public-$14,599,391; private-$14,161,650; TOTAL-$28,761,041

1969 Storms: Storms, flooding
Declared: Los Angeles, San Luis Obispo (1/23/69), Fresno, Inyo, ***Riverside***, San Bernardino, Santa Barbara, Tulare, Ventura (1/25/69), Amador, El Dorado, Kern, Kings, Madera, Modoc, Mono, Monterey, Orange, Placer, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Tuolumne (1/28/69), Mariposa, Merced (1/29/69), Calaveras, San Benito, Sierra (2/8/69), Contra Costa, Humboldt, Mendocino, Sonoma (2/10/69), Plumas, Tehama, Yuba (2/16/69), Butte, Marin, Yolo (3/12/69)
47 dead, 161 injured
Damage: public-$185 million; private-$115 million; TOTAL-$300 million

1976 High Winds and Flooding: High winds, heavy rains and flooding
Declared: Imperial, ***Riverside (9/13/76)***, San Bernardino, San Diego (9/22/76)
Damage: public-$65,743,671; private-$54,389,100; TOTAL-$120,132,771

1977 Threat of Floods/Mudslides
Declared: Monterey, ***Riverside (9/8/77)***
Damage: $6.110 million estimated

1978 Winter Storms
Declared: Inyo, Mono, San Diego, San Luis Obispo (3/9/78), Kings, Monterey (2/27/78), Kern, Los Angeles, Orange, ***Riverside***, San Bernardino, Santa Barbara, Tulare, Ventura

(2/13/78)
14 dead, at least 21 injured
Damage: public-$73,456,185; private-$44,346,600; TOTAL-$117,802,785; 2538 homes destroyed

1979 Severe Storms: Severe flooding, excessive rains, flash floods
Declared: ***Riverside (7/26/80)***
Damage: public-$2,972,100; private-$22,895,000; TOTAL-$25,867,100

1980 Winter Storms: Rain, winds, mud slides, and flooding (See Section 3.2.3 for details.)
Declared: Santa Barbara (2/21/80), Los Angeles, Orange, ***Riverside***, Ventura (2/19/80), San Bernardino, San Diego (2/7/80)
Damage: public-$164,990,642; private-$75,755,500; agricultural-$75,894,675; TOTAL-$316,640,817.

1982-83 Winter Storms: Heavy rains, high winds, flooding, levee breaks
Declared: Contra Costa, San Joaquin, Sacramento (12/8/82), Marin, San Mateo, Los Angeles, San Diego (1/27/83), Alameda, Orange, San Benito, Santa Barbara, Santa Clara, Santa Cruz, Shasta, Sonoma, Ventura, Trinity (1/31/83), Colusa, Lake, Mendocino, Monterey, San Luis Obispo, Solano, Yolo (2/7/83), Butte, Glenn, Kern, Kings, San Bernardino, Sutter Tehama, Merced (3/3/83), Del Norte, Fresno, Madera, Napa, Placer, ***Riverside***, Stanislaus, Tulare (3/15/83), Humboldt, Mariposa, Nevada, Yuba (3/21/83)
Damage: public-$151,185,870; private-$158,641,170; agricultural-$213,789,992; TOTAL $523,617,032

1983 Colorado River Flooding
Declared: ***Riverside***, San Bernardino (6/23/83), Imperial (6/28/83)
Damage: public-$1,393,915; private-$3,246,400; TOTAL-$4,640,315; 32 homes destroyed; 114 homes and 13 businesses damaged.

1983 Summer Storms: High winds, storms, and flooding
Declared: Inyo, ***Riverside***, San Bernardino (8/29/83)
3 deaths
Damage: public $9,589,275, private $15,102,080, agricultural $9,997,800; TOTAL -$34,689,155

1992-93 Late Winter Storms: Snow, rain, and high winds
Declared: Alpine, Los Angels (2/19/93), Humboldt, Napa, Santa Barbara, Culver City and the City of Los Angeles (2/8/93, for event beginning 1/25/93), Contra Costa, Mendocino, Sonoma (1/25/93, for event beginning 1/25/93), Fresno, Imperial, Madera, Monterey, San Bernardino, Sierra, Tehama, Trinity, and Tulare (1/21/93, for event beginning 1/19/93),

Modoc, Orange, ***Riverside (1/19/93***, for event beginning 1/15/93), Lassen, Siskiyou (1/15/93, for event beginning 1/13/93), Plumas (1/13/93, for event beginning 1/12/93), San Diego (1/7/93, for event beginning 1/7/93)
20 deaths, 10 injuries
Damage: public property-$32,215, TOTAL-$600 million

1995 Severe Winter Storms

Declared: Los Angeles, Orange (1/6/95), Humboldt, Lake, Sonoma (1/9/95), Butte, Colusa, Contra Costa, Del Norte, Glenn, Kern, Lassen, Mendocino, Modoc, Monterey, Napa, Placer, Plumas, San Luis Obispo, Santa Barbara, Santa Clara, Santa Cruz, Tehama, Ventura, Yolo, Yuba (1/10/95), Alpine, Amador, Nevada, ***Riverside***, Sacramento, San Bernardino, San Mateo, Shasta, Sutter, Trinity (1/11/95), San Diego (1/13/95), Alameda, Marin (1/14/95), Fresno, Kings (1/17/95), El Dorado (2/15/95), Madera, Solano (2/17/95), Siskiyou (3/14/95)
11 deaths
Damage: public-$299.6 million; individual-$128.4 million; businesses $58.4 million; highways-$158 million; ag-$97 million; TOTAL-$741.4 million; damage to homes: major-1,883; minor-4, 179; destroyed-370.

1995 Late Winter Storms

Declared: all California counties (except Del Norte)
17 deaths
Damage: public property-$190.6 million; individual-$122.4 million; business-$46.9 million; highways-$79 million; ag-$651.6 million; TOTAL-approximately $1.1 billion; damage to homes: major-1,322; minor-2,299; destroyed-267

1998 El Nino

Declared: Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, Fresno, Glenn, Humboldt, Kern, Kings, Lake, Los Angeles, Marin, Mendocino, Merced, Monterey, Napa, Orange, ***Riverside (2/2/98)***, Sacramento, San Benito, San Bernardino, San Diego, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Siskiyou, Solano, Sonoma, Stanislaus, Sutter, Tehama, Trinity, Tulare, Ventura, Yolo, Yuba.
17 deaths
Damage: $550 million

3.2.2 Historic Flood Flows

For any hazard, an essential mitigation step is to understand the phenomenon in detail. The U.S. Geological Survey has operated several stream gages along Riverside County's drainages. The type of data available include peak discharge

and graphs of daily mean discharge in cubic feet per second, as well as stage in feet above gage datum. The historical stream flow data indicate that peak flows typical occur in January, February, and March.

To provide a general indication of the relative severity of historical floods throughout Riverside County, FEMA (1996) compiled flood gage data (Table 3-1) that have been updated with information from The U.S. Geological Survey (2000). In addition to gage data, historic levels of Lake Elsinore (Table 3-2) provide an indication of the flood history of Riverside County. Reports of flooding accounts since 1969 in Riverside County have been summarized by FEMA (1996), Chin and others (1991), and Kupferman (1994):

- ***February 1969***: Two distinct periods of heavy rain struck Riverside County during January and February of 1969, producing the most runoff since March of 1938. Four persons lost their lives and $40 million in damage to public and private property was reported.

- ***October 1974***: An extremely high-intensity thunderstorm in October of 1974 resulted in widespread flooding and property damage in western Riverside County. The sudden flooding associated with this storm included unpredictable braiding and fanning of flood flows on alluvial fans.

- ***September 1976***: On September 10 and 11, 1976, the southwestern side of the Coachella Valley was subjected to intense rainfall associated with Tropical Storm Kathleen. This storm resulted in $14.6 million in damages to Cathedral City, Rancho Mirage, Palm Desert, La Quinta, and Oasis. Isolated thunderstorms struck many of the same areas again on September 23rd and 24th, causing an additional $4.4 million in damage.

- ***August 1977***: During its passage over the Coachella Valley in August 1977, Tropical Storm Doreen caused flooding in Indio, Palm Desert, Thousand Palms, and Desert Hot Springs.

- ***March 1978***: During February and March of 1978, several successive periods of heavy rain resulted in $9 million in flood damage within Riverside County. The regions suffering the greatest damage included the Palm Springs area adjacent to the Whitewater River, the Corona area, Murrieta Creek, and portions of the Santa Margarita and Santa Ana basins.

- ***July 1979***: Intense local thunderstorms on July 20, 1979, in the hills above Rancho Mirage and Cathedral City, resulted in the flooding of 130 homes and $6.4 million in damage. One person was killed by flash flooding.

- ***February 1980***: The 1980 floods were the most costly on record for Riverside County. Ten deaths and more than $70 million in property damage were recorded. Another $10 million was spent to fight floods and rehabilitate flood control structures. (See Section 3.2.3, for more detail on the 1980 flooding).

- ***September 1981***: A local thunderstorm on September 7th in the Lakeview Mountains caused flooding of Lakeview Wash, about 6 miles southeast of March Air Force Base. Sixteen residences had interior damage.

- ***1992-93 Winter Storms***: Storm damage in Riverside County as a result of the 1992-93 winter storms included flooding, slope failure, erosion, rising ground water, and unanticipated seepage and contamination. Flood damage was reported along Temecula and Murrieta creeks. The new National Pollutant Discharge Elimination System (see Section 3.8.3) is directed at mitigating sediment erosion at grading sites.

Table 3-1: Historical Stream Gage Data for Riverside County

Location	Drainage Area (square miles)	Period of Record	Date	Peak Discharge (cfs)
San Jacinto River near San Jacinto	141	1920 to present	February 16, 1927	45,000
			February 21, 1980	17,300
			March 2, 1938	14,300
			February 6, 1937	14,000
			January 25, 1969	7,410
			November 22, 1965	6,300
Bautista Creek near Hemet	39.4	1947-1969	April 3, 1958	1,440
			July 19, 1955	1,170
			February 25, 1969	650
Bautista Creek at Valle Vista	47.2	1969 to present	February 21, 1980	11,400
			March 28, 1980	1,390
			August 17, 1977	1,050
Murrieta Creek at Temecula	222	1924 to present	January 4, 1916	23,300
			February 21, 1980	21,800
			January 23, 1943	17,500
			March 2, 1938	16,800
			March 1, 1978	14,800
			February 25, 1969	10,400
Temecula Creek near Aguanga	131	1957 to present	April 3, 1958	3,540
			February 21, 1980	3,420
			January 29, 1980	2,640
			January 25, 1969	2,550
			February 25, 1969	2,550

Whitewater River at Whitewater	57.5	1948 to present	March 2, 1938	42,000
			November 22, 1965	24,000
			January 25, 1969	16,200
			February 25, 1969	13,500
			December 6, 1966	5,500
			March 4, 1978	5,000
			February 21, 1980	3,200

Table 3-2: Peak Elevation Levels of Lake Elsinore

DATE	ELEVATION OF LAKE ELSINORE (feet)
April 1980	1265.7
April 1916	1265.6
April 1917	1260.7
May 1922	1259.7
May 1927	1259.0
May 1938	1258.9
April 1918	1258.7
June 1941	1258.6

3.2.3 Winter Floods of 1980

A series of six Pacific cyclones struck southern California during February 13-21, 1980 (Chin and others, 1991). Resultant flooding caused 18 deaths and about $500 million in damages. For Riverside County, the floods of 1980 are the worst on record, responsible for ten deaths and more than $70 million in damages. Historical flooding events in 1862, 1864 and 1938 may have been larger in terms of peak discharges, but may have been of comparable flood sizes. Those floods occurred prior to construction of many of southern California's dams and reservoirs, which reduce peak discharge. In 1980, extensive flooding along banks of reservoirs and streams, including failure of the San Jacinto River levees, led to a Presidential Disaster Declaration.

About $4 million was spent for flood fighting and other emergency operations, and another $6 million for rehabilitation projects following the flood. This was the single largest expenditure of funds for flood fighting and rehabilitation in any southern California county during the 1980 floods. The levee breaks along the San Jacinto River had the largest consequences of any southern California event associated with the 1980 flooding. The levee breaks left many homeless, and caused damages of $29 million to urban areas and $1.9 million to agricultural area. Chin and others (1991) provide detailed documentation of the impacts of the 1980 storms for each affected river basin in Riverside County:

Santa Margarita River Basin: Vail Lake on Temecula Creek, about 10 miles east of Temecula in southwestern Riverside County, spilled for the first time since its construction in 1948. The maximum spill from Vail Lake reached 8,000 cubic feet per second (cfs). Murrieta Creek, which converges with Temecula Creek to form the Santa Margarita River, experienced a peak flow of 21,800 cfs at the city of Temecula, its highest flow on record.

Santa Ana River Basin: The Santa Ana River is the largest coastal stream in southern California. The basin includes the San Jacinto River and Lake Elsinore, where much of the flood disaster was centered. The contents of the Prado Flood Control reached 111,000 acre-feet on February 22nd, the second highest level on record. Mudflows and slope failures along the Santa Ana due to saturated soils caused extensive property damage throughout the Santa Ana River Basin. Upstream of Riverside County, debris flows destroyed more than 60 homes in the Harrison Canyon area of San Bernardino. By reducing peak discharge, reservoirs probably prevented worse disaster. In the flood of January 22, 1862, the largest in the history of the Santa Ana River basin, an estimated peak flow of 320,000 cfs destroyed the settlement of Agua Mansa in northern Riverside County. Discharges in the vicinity of this location were about 100,000 on March 2, 1938 and about 19,500 cfs on February 18, 1980. The reduction over time is a direct result of upstream reservoirs. With the recent completion of the Seven Oaks Dam, even more flood mitigation is in place.

San Jacinto River: The San Jacinto River flows northwestward from its headwaters in the San Jacinto Mountains, passes near the town of San Jacinto in the San Jacinto Valley, and turns southwestward toward Lake Elsinore about 30 miles downstream from San Jacinto. Many years ago the course of the river was altered and the reach past San Jacinto and through the valley was leveed. On the morning of February 21, 1980, the levee upstream of the city of San Jacinto failed, and the flood water reverted to its original channel. Additional levees further north also failed. Flood water spread out across valley farmlands and into town.

Lake Elsinore: One of the major disasters of the 1980 flooding occurred at Lake Elsinore. Prior to the importation of Colorado River water in 1965, the lake was dry for many years. Much urbanization developed around the lake during years of low water levels. Since the importation of Colorado River water, a lake of about 6 square miles has been maintained. Prior to 1980, outflow is known to have occurred only in 1872, 1883-84, and 1916-17. During these rare occurrences, water flows northward out of the lake through Temescal Creek. Since it had been so long since outlflow had occurred, gravel had built up at the Temescal Creek outlet. Not until February 23rd did the U.S. Army Corp of Engineers began dredging the outlet. Inflow to Lake Elsinore from the San Jacinto River peaked at 8,000 cfs on February 22nd, and the lake surface reached its maximum elevation of 1,265 feet on March 20th. In the low-lying areas around the lake, 874 dwellings and facilities were damaged, and 2,000 residents were displaced. Nearly all the 400 mobile homes in the threatened area were relocated in time to prevent damage.

3.3 Flood Problem Areas

The most widely distributed flood map product is the Flood Insurance Rate Map (FIRM). The Federal Emergency Management Agency (FEMA) is mandated by the Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 to evaluate flood hazards and provide FIRMs for local and regional planners to further promote sound land use and floodplain development. Flood risk data presented on FIRMs are based on historic, meteorologic, hydrologic, and hydraulic data, as well as open-space conditions, flood control works and development. To prepare a FIRM that illustrates the extent of flood hazards in a flood-prone community, the Federal Emergency Management Agency (FEMA) conducts an engineering study referred to as Flood Insurance Study (FIS). Using information gathered in these studies, FEMA engineers and cartographers delineate Special Flood Hazard Areas (SFHAs) on FIRMs. SFHAs are those areas subject to inundation by a flood that has a 1-percent or greater chance of being equaled or exceeded during any given year. This type of flood is referred to as a base or 100-year flood. The base flood is a regulatory standard used by Federal agencies and most states, to administer floodplain management programs, and is also used by the National Flood Insurance Program (NFIP) as the basis for insurance requirements nationwide.

For the County of Riverside, FEMA (1996) has updated a Flood Insurance Study (FIS) originally completed in 1985 for the unincorporated areas of the County. The FIS evaluates principal flood problems and flood protection measures for the County of Riverside. According to the FIS for the County of Riverside (FEMA, 1996), most of the major floods in the County have occurred as a result of general winter storms. However, serious flooding, including potentially lethal flash flooding, has also occurred as a result of summer thunderstorms, particularly in the desert areas. Riverside County's precipitation averages vary from more that 30 inches per year in the San Jacinto Mountains to less than 5 inches per year in the Blythe region.

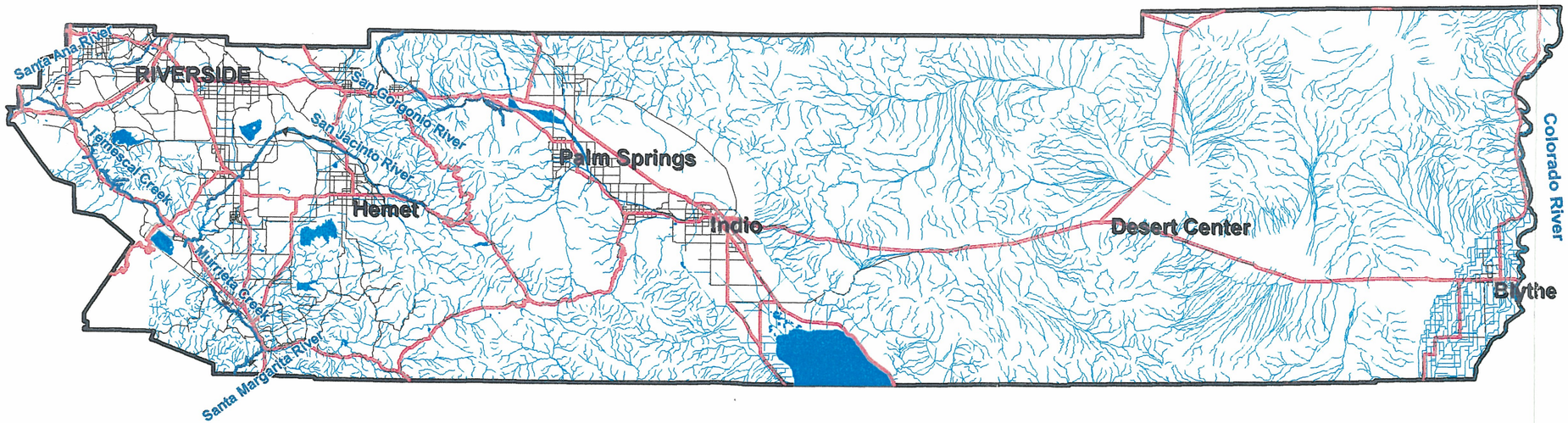
The major rivers in the western portion of the County are dry most of the year and pose flood threats to developments within the flood plain during general storms of long duration (FEMA, 1996). These rivers are the Santa Ana, San Jacinto, San Gorgonio and Santa Margarita rivers, as well as Temescal and Murrieta creeks (Figure 3-2). Plate 3-1 has been prepared at 1:250,000 scale to illustrate the drainages of Riverside County.

When a major storm moves into the area, water collects rapidly as surface runoff. Resultant flood flows have predominantly short durations and sharp peaks. Major floods along the San Jacinto River resulting from intense rainfall have been shown to typically peak in approximately 1.5 days with a total duration of flooding of 4 days.

Figure 3-2:

Drainage Systems of Riverside County

(Summary of GIS Data, for additional details see Plate 3-1 in-pocket)



Earth Consultants International

- Major Drainage
- Lake, Pond, Sea or Ocean
- Stream, River, Canal or Ditch
- Highways
- Major Roads

N
W
E
S

Scale: 1:1,000,000

10 0 10 20 30

Miles

Tributaries to the major rivers present additional flood hazards. Flooding in these streams is caused mostly by local thunderstorms. Flood flows are of typically short duration, but can cause extensive damage as a result of high velocities associated with the tributary drainages.

The desert areas extending to the east from the Palm Springs area are susceptible to sheet flow flooding, with flow depths generally less than 2.0 feet. These type of flows leave the mouths of canyons and often follow unpredictable paths.

During major floods, flood water carries heavy debris loads and causes considerable damage from deposition. For example, the Santa Ana River carried a total sediment load of more than 11 million tons of sediment during the storms of 1969 (Chin and others, 1991). In addition, considerable damage is caused by erosion and scouring by high-velocity flows.

Findings of the FEMA FIS, as well as additional information from the County water districts, the U.S. Geological Survey and the Army Corp of Engineers, are summarized below. Except as noted, the data cover the last 100 years:

San Gorgonio River: Flooding on the San Gorgonio River caused damage during 1938, 1965, 1966 and 1969. During the floods of 1969, the San Gorgonio River attained an estimated peak discharge of 17,000 cubic feet per second (cfs), which resulted in loss of life and extensive damage in the Cabazon area.

San Jacinto River: The San Jacinto River has flooded during 1916, 1927, 1931, 1937, 1938, 1966, 1969, 1980, and 1993. Its largest flood of record occurred on February 16, 1927 with a peak discharge of 45,000 cfs near the city of San Jacinto. Agricultural, railway, and highway properties were extensively damaged. In addition, failure of its levee system in 1980 resulted in extensive damage.

Murrieta Creek: Nine major floods have been reported for Murrieta Creek, during 1862, 1884, 1916, 1938, 1943, 1969, 1978, 1980, and 1993.

Santa Ana River: Flooding of the Santa Ana River is known to have resulted in many damaging floods in 1862 *(estimated >300,000 cfs)*, 1867, 1884, 1891, 1916, 1938, 1969, 1980 and 1993. Prior to extensive dam and reservoir controls, the Santa Ana River had a large flood event about every five years.

Perris Valley: Due to increased urbanization (Guay, 1996), the Perris Valley region has a growing risk of flood hazards. The Perris Valley Storm Drain and the San

Jacinto River are the major sources of flooding for the area. They have previously inundated primarily agricultural land east and southeast of the city of Perris. The valley is extremely flat, causing flood waters to move slowly and spread over a large area. In addition, there is sudden constriction of flood flows at the entrance to the upper end of Railroad Canyon, south of the city of Perris. This causes ponding and backs up the flood plain for seven miles upstream (FEMA, 1996). The Perris Valley Storm Drain that drains March Air Force Base to the north, generates similar flooding.

Increased urbanization increases flood potential by increasing the percentage of impervious surfaces. When water cannot penetrate into the ground, more flooding ensues. Urban areas in Perris Valley have more than tripled since the early 1970s, from 10% to 36% urban. Guay (1996) demonstrated that these additional impervious areas have increased storm water runoff volumes and peak discharges.

Desert Hot Springs: The city of Desert Hot Springs is situated on deposits created by past flooding events from Big Morongo Wash and canyons of the Little San Bernardino Mountains. Clearly, the Desert Hot Springs region is subject to flooding from Big Morongo Wash and its tributaries.

Coachella Valley: Although mean annual precipitation on the floor of the Coachella Valley is low (4 inches), high and intense precipitation in the surrounding mountains can have a significant impact on the valley floor many miles away.

Coachella Valley floods are typically of short duration, high peak volumes and carrying large amounts of debris. This is due to the arid climate and the steep, high mountains. When a major storm moves in, water collects rapidly and runs off quickly, creating flash floods in the Coachella Valley.

Whitewater River Basin: Historical records dating back to 1769 were reviewed by the Army Corp of Engineers. In the Whitewater River basin, a major flood occurs on average every ten years. Floods occurred in 1825, 1833, 1840, 1850, 1859, 1862, 1867, 1876, 1884, 1886, and 1891. More recent, and thus more accurate records indicate that there were floods in January 1916, December 1921, April 1926, February 1927, February 1937, March 1938, and December 1940. Most recently, substantial floods occurred in November 1965, December 1966, January 1969, February 1969, and September 1976. The greatest storm on record was in March, 1938, with peak discharge estimated at 42,000 cubic feet per second - almost twice the peak of the second largest storm (November 22, 1965, 24,000 cfs).

3.3.1 Earthquake Hazard to Local Water Tanks/Reservoirs

Earthquakes can generate floods by causing the failure of water retention structures such as reservoirs. Flood control and reservoir facilities, even when empty, can be damaged by strong ground shaking, and pose an inundation hazard if they are not repaired soon after an earthquake and prior to the next wet season. Another common agent of earthquake damage is a seiche. A seiche is a seismically-induced wave that reverberates on the surface of water in an enclosed or semi-enclosed basin like a lake, reservoir, bay or harbor. The wave period (how quickly it repeats its motion) will vary depending on the dimensions of the basin. The periods that can damage a structure will depend on the physical characteristics of the structure, including size, shape and materials. Seiches can continue to oscillate for a time after the earthquake shaking ceases.

Seismically-induced inundation can also occur if strong ground shaking causes structural damage to above-ground water tanks. If a tank is not adequately braced and baffled, sloshing water can lift the tank off its foundation, splitting the shell, damaging the roof, and bulging the bottom of the tank (causing "elephants foot") (EERI, 1992). Movement can also shear the pipes leading to the tank, allowing water to escape through the broken pipes. This type of damage was reported in the Landers, Big Bear and Northridge earthquakes. Houses downgradient from a damaged water tank in the Santa Clarita area were inundated due to the Northridge earthquake. Thanks to lessons learned from recent earthquakes, new standards for design of steel water tanks were adopted in 1994 (Lund, 1994). The new tank design includes flexible joints that can accommodate movement in any direction.

3.3.2 Bridge Scour

Scour at highway bridges involves sediment transport and erosion processes that remove streambed material from the bridge vicinity. Scour can occur within the main channel, on the flood plain, or both. Scour processes are generally classified into separate components:

- **Pier scour** occurs when flow impinges against the upstream side of the pier. The flow is forced downward, causing scour of the streambed adjacent to the pier.

- **Abutment scour** happens when flow impinges against the abutment. Flow changes direction and mixes with adjacent main-channel flow, scouring the abutment toe.

- **Contraction scour** occurs when flood-plain flow is forced back through a narrower opening at the bridge. This increases velocity and can produce scour.

- Total scour for a particular site combines effects from all three components.

While different materials scour at different rates, the eventual scour attained is similar regardless of material. It depends primarily on the duration of peak streamflow acting on the material (Lagasse and others, 1991).

Nationwide, several catastrophic collapses of highway and railroad bridges have occurred due to scouring and a subsequent loss of foundation support. This has led to a nationwide inventory and evaluation of bridges (Richardson and others, 1993). The State of California participates in the bridge scour inventory and evaluation program. In addition, California's program to seismically retrofit bridges includes underpinning foundations. In western Riverside County, this should help reduce the vulnerability of foundations to scour. However, since the eastern portion of the County has only a moderate seismic risk, scheduling bridges in these areas for seismic underpinning is of lower priority.

3.4 Geographic Information Systems Flood Mapping

Flood data were collected and digitized as part of this study. These data are shown at 1:250,000 on Plate 3-2, and summarized on Figure 3-1. The flood maps used to create this map had varying scales. The overall map is accurate to no less than 1:24,000.

These digital data come from a collection of resources. Flood Insurance Rate Maps (FIRM) maps, with completion dates ranging from 1980 to 1999, were compared to the existing County data. The combined maps were then compared to the Q-3 digital flood coverage data set from FEMA (1999). In addition, the U.S. Geological Survey's flood prone map information (Table 3-3) was used to complete the flooding map. The following procedures were followed during the creation of the Flood and Inundation Susceptibility Map of Riverside County (Plate 3-2) :

Flood Insurance Rate Maps (FIRM) from the Federal Emergency Management Agency (FEMA) were digitized for unincorporated parts of Riverside County.

FEMA has three categories for flood zones:

Zone A- Special flood hazard areas inundated by 100-year flood.

- Subzone A- No base flood elevations determined.
- Subzone AE- Base flood elevations determined.
- Subzone AH- Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- Subzone AO- Flood depths of 1 to 3 feet (usually sheet flow or sloping terrain); average depths determined for areas of alluvial fan flooding, velocities also determined.
- Subzones A1-30- Areas of 100-year flood; base flood elevations and flood hazard factors determined.
- Subzone A99- To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.

Zone B- Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with the average depths less than one (1) foot or where the contributing drainage area is less than one (1) square mile; or areas protected by levees from the base flood.

Zone X- Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

Table 3-3: U. S. Geological Survey Flood Prone Area Maps Digitized for this Study

Map Name	Scale	Date
Alberhill	1:24,000	1973
Beaumont	1:24,000	1975
Blythe	1:24,000	1974
Blythe NE	1:24,000	1975
Desert Hot Springs	1:24,000	1971
El Casco	1:24,000	1976
Fontana	1:24,000	1976
Guasti	1:24,000	1977
Indio	1:24,000	1976
Lake Mathews	1:24,000	1974
McCoy Wash	1:24,000	1975
Mecca	1:24,000	1973
Mortmar	1:24,000	1976
Oasis	1:24,000	1976
Palm Springs	1:24,000	1973
Palo Verde	1:24,000	1976
Rancho Mirage	1:24,000	1976
Redlands	1:24,000	1975
Ripley	1:24,000	1975
San Jacinto	1:24,000	1976
Seven Palms Valley	1:24,000	1971
Sitton Peak	1:24,000	1974
Steele Peak	1:24,000	1974
Sunnymead	1:24,000	1974

Temecula	1:24,000	1973
Thermal Canyon	1:24,000	1973
Whitewater	1:24,000	1971
Wildomar	1:24,000	1973
Yucaipa	1:24,000	1976

Q-3 digital flood data were obtained from FEMA (1999) and added to the map to cover incorporated as well as unincorporated parts of the County that the FIRM data did not cover.

U. S. Geological Survey (USGS) 7.5' quadrangle Flood Prone Areas maps (Table 3-3) were digitized and added to the map to cover areas not mapped by FEMA. The USGS only covers 100-year flooding in its Flood Prone Areas maps. Zone A is defined as flood-prone areas that have a 1 in 100 chance, on the average, of being inundated during any year. Flood prone areas have been delineated without consideration of present or future flood control storage that may reduce flood levels. Four subzones are represented:

Subzone L- Approximate area occasionally flooded if levees are breached.
Subzone O- Approximate area occasionally flooded.
Subzone I- Flood prone area subject to inundation from local thunderstorms.
Subzone S- Flood prone areas from sheet flow.

The current flood map for the County of Riverside was compared to the map compiled for this study (Plate 3-2) to insure that all county data were represented in the new map. One small area in the city of Riverside was taken from the county map and added to the new map. As a results of this study, areas prone to 100-year flooding were added along the west side of the Salton Sea and the western parts of Blythe for areas not covered by any of the afore mentioned data sets. Data sets for these areas are missing or nonexistent, yet these areas are flood prone, based on flood level elevations of the surrounding areas, and topography of the areas.

3.4.1 Benefits of Flood Mapping Using Geographic Information Systems

Many existing Flood Insurance Rate Maps (FIRMs) are based on flood probability estimates that may now be out-of-date. FIRMs are typically hand-drawn on paper maps that have limited vertical accuracy or can not be easily matched to "real-world" geographical coordinates (Jones and other, 1998). They are based on elevation data that, in many cases, have been or will be superseded by more accurate data. In addition paper FIRM maps are relatively expensive and time-consuming to update.

Existing flood maps need continual updating. In the nearly 20 years since original studies were completed, additional information has become available about peak flows and flood plain elevations that will significantly change the flood estimates these maps display. However, complete restudies using traditional methods are expensive and time consuming, so it is unlikely that the maps can be updated quickly enough to meet demand.

Flood maps updated with Geographic Information Systems techniques have many advantages. They are:

- Relatively inexpensive. According to Jones and others (1998), costs are about 10-20 percent of a re-study using traditional methods. Therefore, frequent updates are more feasible.

- Typically more detailed. Digital maps can provide information like depth-of-flood, identify areas where uncertainty in flood or land elevations causes uncertainty in extent of flood inundation, and easily combine with other digital data, such as locations of roads and buildings.

3.4.2 Essential Facility Inventory Exposed to Flood Hazards in Riverside County

An advantage of GIS data is the ability to run simple queries on digital data sets. For example the inventory of essential facilities and hazardous materials sites available from national data sets (FEMA, 1999) can be overlain on the 100 and 500 year flood hazard zones. The results of these queries are presented in Table 3-4.

Table 3-4: Facilities in Riverside County Exposed to Flood Hazards

Facility Type	Total No. in County*	No. in Flood Hazard Zones
Airports	39	14
Hospitals	18	4
Police Stations, Fire Stations and Emergency Operation Centers	109	47
Schools	380	92
Highway Bridges	1,306	446
Hazardous Materials Sites	1,978	695

*: Based on HAZUS '99 various national-level inventories

3.5 County Flood Control and Reservoir Projects

3.5.1 Seven Oaks Dam

The Seven Oaks Dam was completed in 1999 by the U.S. Army Corps of Engineers, Los Angeles District, as part of the Santa Ana River Mainstem Project. The dam sits on the Santa Ana River in the upper Santa Ana Canyon about 14 miles northeast of Riverside County. It is an important flood control structure for the Santa Ana River channel through northwestern Riverside County. Historical flood flows on the Santa Ana have exceeded 300,000 cfs.

The Seven Oaks Dam project consists of a zoned, earth-filled embankment, spillway, outlet tunnel, air shaft, gate chamber, and intake structure tower. Seven Oaks is the 12th highest dam in the country and provides flood protection to the growing urban communities of Orange, Riverside, and San Bernardino counties. It operates in tandem with Prado Dam, about 40 miles downstream. During the early part of each flood season, runoff is stored behind the dam in order to build a debris pool to protect the outlet works (U.S. Army Corp of Engineers, 2000). Small releases are made on a continual basis to maintain the downstream water supply. During a flood, Seven Oaks Dam will store water destined for Prado Dam for as long as the reservoir pool at Prado Dam is rising. When the flood threat at Prado Dam has passed, Seven Oaks will begin to release its stored flood water at a rate which does not exceed the downstream channel capacity. At the end of each flood season, the reservoir at Seven Oaks will be gradually drained and the Santa Ana River will flow through unhindered.

3.5.2 Prado Dam

Prado Dam is a flood control and water conservation project constructed and operated by the U.S. Army Corps of Engineers, Los Angeles District. Completed in 1941, the project is built at the upper end of the Lower Santa Ana River Canyon, at a natural constriction controlling 2,255 square miles of the 2,450 square mile Santa Ana River watershed. The dam embankment is located in Riverside County approximately 2 miles west of the City of Corona. Portions of the reservoir are in both Riverside and San Bernardino Counties (California Division of Safety of Dams, 2000). The dam is approximately 30 miles upstream of the Pacific Ocean. Prado Dam is the downstream element of the Santa Ana River flood control system. Its purpose is to collect runoff from uncontrolled upstream drainage areas along with releases from other storage facilities.

The historic maximum release from Prado Dam was 5,992 cubic-feet per second (cfs) on February 22, 1980 (California Division of Safety of Dams, 2000).

Historically, releases larger than 5,000 cfs have been damaging to downstream improvements. Downstream channel improvements are currently underway as part of the Corps of Engineers' Santa Ana River project. These will dramatically increase the downstream channel capacity to over 30,000 cfs.

3.5.3 Lake Elsinore

Throughout its history, Lake Elsinore has been subject to flooding and drying, depending on runoff amounts. Every year the lake loses an average of 15,000 acre-feet (one acre-foot is approximately 325,900 gallons) to evaporation, which drops the surface level more than 4.5 feet. When the lake is low, fish have died and recreational use has stopped. In the last 75 years, annual inflow to has exceeded 15,000 acre-feet only 15 times. The lake went dry in the 1960s. It flooded in 1980 and again in 1983, causing millions of dollars in damages. The lake nearly went dry in 1991, then the "March miracle" rains the next year raised the level more than six feet. El Niño conditions filled the lake in 1993 and in 1995 (Elsinore Valley Municipal Water District, 2000).

The Lake Elsinore Management Project was designed to help ease this "feast or famine" cycle. Completed in 1995, the Project restructured the boundaries of the lake to prevent flooding, minimize evaporation, and enhance wetlands. The Project also improves water quality. In wet years, runoff from the 782 square mile San Jacinto Watershed pours into Lake Elsinore, which is the lowest point in the watershed. Currently, natural runoff is the only source of water for the lake. In the past, when runoff caused up-stream reservoirs to spill, Lake Elsinore often filled, but rarely discharged. In the past, as the lake began to evaporate, salt concentrations would rise, affecting water quality. The Project enables more frequent discharges from the lake during heavy runoff.

3.5.4 East Side Reservoir Project

The East Side Reservoir Project is situated in the Domenigoni/Diamond valleys, four miles southwest of the city of Hemet. Rock excavations began in 1995, and dam construction began in 1996. The reservoir will be called Diamond Valley Lake and will provide additional water supplies for drought protection and peak summer needs by 2001 (Metropolitan Water District, 2000).

More than 110 million cubic yards of clay, sand, and rock was required for this largest earth fill dam project in the United States. The project will be southern California's largest reservoir, with a capacity of 800,000 acre-feet (261 billion

gallons). It almost doubles southern California's surface storage capacity and is intended to secure six months of emergency storage in the event of a major earthquake. The project cost is estimated at about $2 billion and consists of three earth and rock fill dams ranging in height from 130 to 285 feet. Water will be delivered from the Colorado River Aqueduct through the San Diego Canal and from the California State Water Project through the new 12-foot diameter, 45-mile Inland Feeder Project.

3.5.5 Inland Feeder Project

The Inland Feeder Project more than doubles the water delivery capacity of the east branch of the State Water Project and helps replenish local groundwater basins. The project begins in the Devil Canyon area north of the city of San Bernardino and ties into Metropolitan Water District's Colorado River Aqueduct south of Lake Perris, near the city of San Jacinto. The approximately 44 mile long feeder passes through or near the communities of Riverside, Perris, Moreno Valley, and San Jacinto Valley. It will be an important source of water for the Eastside Reservoir Project, delivering about 1,000 cubic feet per second, or about 646 million gallons a day. The estimated cost of the project is $1.2 billion, with a completion date of 2004 (Metropolitan Water District, 2000).

The Inland Feeder Project crosses the San Andreas fault system just north of the Riverside County line, and crosses the San Jacinto fault system at several places. Many of California's aqueduct systems cross active fault systems, as they are difficult to avoid. It is important that earthquake emergency planning include major disruptions of water supply.

3.5.6 Murrieta Creek-Flood Control Master Plan

The Master Plan is to channelize Murrieta Creek and its major tributaries using several concrete-lined open channels and a small network of underground storm drains. The proposed system will carry storm runoff through the rapidly developing Murrieta Creek valley to the valley's south end, where Murrieta Creek and Temecula Creek converge to form the Santa Margarita River.

3.5.7 Lake Mathews

The County of Riverside Flood Control and Water Conservation District has obtained funding for a $20 million Drainage Water Quality Management Plan for the Lake Mathews Watershed Project. The Project objective is to address nonpoint

source pollution in Lake Mathews and Cajalco Creek, which drains into Lake Mathews. This will be primarily accomplished by construction of a series of wetlands. Lake Mathews is the terminal reservoir for the Colorado River Aqueduct. It is owned and operated by the Metropolitan Water District and provides drinking water for approximately 15 million people.

3.5.8 Whitewater River

The Whitewater River is the principal drainage course through the Coachella Valley that includes the desert resort community of Palm Springs. It is typically dry, but when it carries water it flows southeasterly. From the city of La Quinta southward, the Whitewater River is contained by the Coachella Valley Stormwater Channel, which flows northeast, around the city of Indio, and eventually into the Salton Sea. The Whitewater drains areas as far away as the summit of San Gorgonio Pass, and the steep southern and eastern slopes of Mount San Gorgonio, with a total drainage area of approximately 850 square miles.

The Whitewater River from Point Happy to the Salton Sea is a man-made channel, the Coachella Valley Stormwater Channel. It generally follows the historical path of the Whitewater River and is mostly unlined, with an average cross-section width of 250 feet, depth of 30 feet, and levees extending 10 feet above the surrounding ground. The Coachella Valley Water District maintains the channel, including straightening and grading as necessary.

3.5.9 Salton Sea

The most recent body of water to inundate the Salton Trough is the Salton Sea. The western six miles of the present Salton Sea lies within Riverside County and the remainder is in Imperial County. The Sea was formed accidently in 1905 (Coachella Valley Water District, 2000).

Around 1900, a private canal company constructed the Alamo Canal to irrigate Imperial Valley farmland with water from the Colorado River. Because technology and funds were not then available to construct a canal through the sand dune range which separates Imperial Valley from the Colorado River, the Alamo Canal diverted water from the river near the Mexican border and went around the sand dunes.

The canal intake silted up in 1904 and the company attempted to cut another opening for the All-American Canal System. In autumn of 1905, before work was completed, floods eroded the cut and widened it until the entire Colorado River was diverted into the Salton Sink. Many efforts failed to return the river to its natural

course. The river flowed unchecked into the sink until February 1907, when Southern Pacific Railway finally closed the gap by building a trestle over the place where the banks were breached and dumping thousands of tons of rock into the stream bed. The surface of the Salton Sea stood at 195 feet below sea level when the break was repaired, and water lapped at the southern edge of Mecca.

Other than occasional flash floods, the sea's only source of water is farm drainage from Imperial, Mexicali and Coachella valleys. Evaporation during the summer months causes the sea's elevation to fluctuate about one foot annually. Total evaporation is about 6.5 feet a year. The Sea reached its lowest elevation, 250 feet below sea level, in 1925, and since has gradually risen to its present elevation of 227-228 feet below sea level.

In the late 1970s and 1980s, major flash flooding in Imperial and Coachella Valleys and flood controlled releases from Colorado River dams negated local conservation efforts to control the rising sea (Coachella Valley Water District, 2000). In 1979 and 1980, for the first time since Hoover Dam was built, all major reservoirs on the Colorado system were full and water was released for flood orders. The additional Colorado River water flowed to Mexico, where it was put to use irrigating increased acreage in the Mexicali Valley. Because Mexicali farmland also drains to the Salton Sea, a portion of the released water eventually wound up in the Salton Sea. Major flash floods hit the desert nearly every year from 1976 to 1983. The sea's elevation increased 9 inches during the flooding of September 1976, alone .

Because the sea has no natural outlet, salinity has been increasing and there is concern that it will someday be unable to sustain fish life. Riverside County has entered into a Joint Powers Agreement with the Coachella Valley Water District, Imperial County and Imperial Irrigation District to find a solution that saves the sea's recreational value without reducing its function as a repository for irrigation drainage waters. The Imperial Irrigation District faces State mandates to reduce waste flows to the Sea. Also, the Imperial Irrigation District and the Metropolitan Water District of southern California have an agreement to divert conserved Colorado River water from Imperial to coastal cities. Full implementation could reduce flows into the Salton Sea.

Rising water causes problems for recreational facilities around the Sea, most of which are located at water's edge. With the relatively flat shoreline, a slight increase in elevation can cause flooding. As more land has been placed under cultivation, more water from the Colorado has been brought in for irrigation, creating additional drainage water, which has increased the elevation of the Sea. Improved irrigation practices and a cutback in California's use of Colorado River water after the Central Arizona Project is completed are expected to contribute to a gradual decrease in the sea's elevation during the next two decades (Coachella Valley

Water District, 2000).

3.5.10 Riverside County Flood Control and Water Conservation District Projects

A list and summary of proposed Riverside County Flood Control and Water Conservation District projects for fiscal year 2000 is summarized in Table 3-5, and the motivation for each project is described below:

Table 3-5: Flood Control Project Request FY 2000
Riverside County Flood Control District

AREA	DESCRIPTION	AMOUNT
SANTA ANA RIVER at NORCO BLUFFS	Construction-General	$2,200,000
SANTA MARGARITA and MURRIETA CREEK SUB-BASIN	Feasibility Study - Flood Control	$232,000
	Preconstruction Engineering & Design	$100,000
SAN JACINTO RIVER	Reconnaissance Study - Flood Control & other purposes	$100,000
SANTA ANA RIVER – MAINSTREAM	Construction-General	$23,000,000
PRADO DAM	Construction-General	$5,000,000

Santa Ana River At Norco Bluffs: The Santa Ana River passes along the northerly border of the city of Norco. The southerly bank of the river is a bluff, varying from 46 to 96 feet above the streambed. Atop the bluff is a residential neighborhood. In the floods of January and February 1969, flow impingement on the riverbank undermined the toe of the slope, causing severe bank sloughing. The bluff retreated 50 to 60 feet to the south. No improvements were lost, but the threat became apparent. The floods of 1978 and 1980 caused another 30 to 40 feet of bluff retreat, and the loss of a single family residence.

Santa Margarita, Murrieta Creek Sub-Basin: Murrieta Creek passes through the cities of Murrieta and Temecula in southwest Riverside County, then confluences with Temecula Creek to form the Santa Margarita River, which flows into San Diego County, through the Camp Pendleton Marine Base, and into the Pacific Ocean. Murrieta and Temecula experienced severe flood damage in January 1993, estimated in excess of $10 million dollars, from Murrieta Creek overflow. Camp Pendleton also suffered extensive flood damage, estimated at $88 million, to facilities and aircraft due to Santa Margarita River overflow. For the past several years, a coalition of local citizens, community leaders, environmentalists, and developers have worked closely with the District to identify solutions to the flooding problems within the Murrieta Valley. A U. S. Army Corps of Engineers Feasibility Study addressing flood control, environmental enhancement, and recreation for Murrieta Creek was initiated in April 1998.

San Jacinto River: The 730-square mile San Jacinto River watershed drains into Lake Elsinore in western Riverside County. The San Jacinto River originates in the San Jacinto Mountains and passes through the cities of San Jacinto, Perris, Canyon Lake and Lake Elsinore. The river is an important regional resource that provides water supply, wildlife habitat, drainage and recreation values to the region. The only major flood control structures on the river are levees in the city of San Jacinto built by the Corps of Engineers in the early 1960s. In the 30-mile reach of the river between Lake Elsinore and the city of San Jacinto, only minor channelization exists. The river is characterized by expansive overflow areas, including the Mystic Lake area (Riverside County Flood Control and Water Conservation District, 1999). The San Jacinto River has caused major flooding damage to agricultural areas and rendered Interstate 215 and several local arterial transportation routes impassable.

Santa Ana River Mainstem Project: The Water Resources Development Act of 1986 (Public Law 99-662) authorized the Santa Ana River Mainstem project, which includes improvements and various mitigation features, set forth in the Chief's Report to the Secretary of the Army. The Boards of Supervisors of Orange, Riverside, and San Bernardino Counties continue to support this critical project as stated in past resolutions to Congress. Significant construction has been completed on the lower Santa Ana River Channel and on the San Timoteo Creek Channel. Construction activities on Oak Street Drain and the Mill Creek Levee have been completed. Seven Oaks Dam construction is complete. For FY 2000, appropriations were requested by the Riverside County Flood Control and Water Conservation District (1999) to address various endangered species issues, as well as maintenance and construction projects along the Santa Ana River Channel.

Prado Dam: The Prado Dam portion of the Santa Ana River Mainstem project continues to advance to an eventual construction start (Riverside County Flood Control and Water Conservation District, 1999). Engineering design for the dam embankment and outlet works is approximately 90% complete. Design work has been initiated on the various interior dikes included in the project, and additional design contracts are ready to be let for the balance of engineering work necessary prior to construction.

3.6 Dam Failure

3.6.1 Dam Inventory Data for Riverside County

Data for Riverside County dams were obtained from the National Inventory of Dams (2000), based on 1998-99 data submitted by local agencies. The National Inventory of Dams (NATDAM) database (FEMA, 1993) is undergoing the addition of 19 new fields and will include dam retrofit information in the future. A summary of the dam inventory data available through NATDAM is presented in Table 3-6. NATDAM hazard classification is based entirely on the downstream hazard potential, as follows:

- ***LOW HAZARD POTENTIAL***: Dams where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

- ***SIGNIFICANT HAZARD POTENTIAL***: Dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or affect other concerns. These dams are often located in predominantly rural or agricultural areas, but could be located in areas with population and significant infrastructure.

- ***HIGH HAZARD POTENTIAL***: Dams where failure or misoperation will probably cause loss of human life.

Table 3-6: National Inventory of Dam (NATDAM) Data for Riverside County

Dam Name	River	Nearest City	Height (feet)	Storage (acre-feet)	Year Built	Drainage Area (square miles)	Haz. Type *
VAIL	TEMECULA CREEK	TEMECULA	152	62,000	1949	306	H
QUAIL VALLEY	SAN JACINTO RIVER	LAKE ELSINORE	37	178	1959	1.6	S
EL CASCO	SAN TIMOTEO CR	REDLANDS	19	188	1879	0.09	S
RAILROAD CANYON	SAN JACINTO RV	LAKE ELSINORE	94	19,367	1928	664	H
LAKE HEMET	SAN JACINTO RIV	VALLE VISTA	135.00	19,112	1895	67	H
FOSTER	LILY CREEK	IDYLLWILD	38.00	56	1945	0.85	L
FAIRMOUNT PARK	SANTA ANA RV	RIVERSIDE	12.00	330	1923	22	S
MOCKINGBIRD CAN	MOCKINGBIRD CAN	RIVERSIDE	74.00	2,905	1914	13.13	H
HARRISON STREET	HARRISON CREEK	RIVERSIDE	50.00	350	1954	2.03	H
WIDE CANYON	WEST WIDE CANYON	FUN VALLEY	84.00	1,490	1968	33.5	S
BOX SPRINGS	BOX SPRINGS CR	RIVERSIDE	49.00	630	1960	4	H
PIGEON PASS	PIGEON PASS	SUNNYMEAD	36.00	1,400	1958	8.71	H
SYCAMORE	SYCAMORE CANYON	RIVERSIDE	63.00	1,510	1956	10.7	H
ALESSANDRO	ALESSANDRO CR	RIVERSIDE	66.00	530	1956	4.63	H
WOODCREST	WOODCREST CREEK	RIVERSIDE	44.00	420	1954	5.32	H
JURUPA BASIN	JURUPA WASH	ENNIS	22.00	291	1983	1.69	S
MARY STREET	ALESSANDRO WASH	CASA BLANCA	40.00	570	1981	6.7	H

DECLEZ DETENTION	SAN SEVAINE CR	GLEN AVON HEIGHTS	30.00	480	1984	10.7	H
TAHQUITZ CR DEBRIS	TAHQUITZ CREEK	AGUA CALIENTE	32	-9.9	1991	18	H
SUNNYMEAD RANCH	RECHE CANYON	SUNNYMEAD	41	540	1985	2	H
PRENDA	PRENDA CREEK	RIVERSIDE	44	291	1954	1.93	H
LEE LAKE	TEMESCAL CREEK	CORONA	47	2,800	1919	53	S
METZ ROAD DB	SAN JACINTO RIV	PERRIS	12	154	1981	1	S

Table 3-6: National Inventory of Dam Data for Riverside County (continued)

Dam Name	River	Nearest City	Height (feet)	Storage (acre-feet)	Year Built	Drainage Area (square miles)	Haz. Type *
TAHCHEVAH	TACHEVAH CREEK	PALM SPRINGS	42	1,720	1964	3.2	H
OAK STREET	OAK STREET CR	CORONA	36	400	1979	6.02	H
MABEY CANYON	MABEY CREEK	CORONA	46	111	1974	1.5	H
HENRY J MILLS RES	OFFSTREAM	RIVERSIDE	23	103	1979	0	L
SKINNER CLEARWELL	OFFSTREAM	TEMECULA	44	410	1991	0	S
DUNN RANCH	HAMILTON CR	ANZA	44	126	1987	0.2	S
ROBERT A SKINNER	TUCALOTA CREEK	TEMECULA	109	62,800	1973	51	H
MATTHEWS	CAJALCO CR	CORONA	264	222,400	1918	40	H
PERRIS	BERNASCONI PASS	PERRIS	130	154,852	1973	10	H
LAKEVIEW	SAN JACINTO RIV	NA	37	990	1994	NA	H
EASTSIDE	DOMENIGONI VALLEY CR	NA	284	NA	2001	13	H
GOODHART CAN DTN BN	GOODHART CANYON	WINCHESTER	15	1,038	NA	3.8	H

HENRY J MILLS # 2	OFFSTREAM	NA	34	92	NA	0.1	S
HJ MILLS RECLAM	OFFSTREAM	NA	48	98	NA	0.03	S
PRADO DAM	SANTA ANA RIVER	ORANGE	106	295,581	1941	2,233	H
EAST SIDE DETENTION DIKE NO. 1	WHITEWATER RIVER	THERMAL	42	21,000	1949	NA	L
EAST SIDE DETENTION DIKE NO. 2	WHITEWATER RIVER	THERMAL	48	18,000	1949	NA	L
WEST SIDE DETENTION DIKE NO. 2	WHITEWATER RIVER	NA	37	630	1968	NA	L
WEST SIDE DETENTION DIKE NO. 3	WHITEWATER RIVER	NA	22	1,300	1970	NA	L
WEST SIDE DETENTION DIKE NO. 4	WHITEWATER RIVER	NA	48	4,900	1968	NA	L

*: NID hazard types are defined in text

3.6.2 Dam Inundation Potential Along the Colorado River

The portions of the County along the Colorado River corridor could suffer from catastrophic failure of dams well outside of the County. From south to north, the dams along the Colorado River upstream of the County of Riverside are summarized below:

- ***Palo Verde*** Diversion ***Dam***: Located 9 miles north of Blythe, the dam is a mix of concrete and earth embankment with a structural height of 43 feet and a hydraulic height of 10 feet.

- ***Headgate Rock Dam***: Located near Parker, Arizona, the dam has a structural height of 70 feet and hydraulic height of 52 feet.

- ***Parker Dam***: Located 12 miles north of Parker, Arizona, this concrete arch dam was completed in 1938. The dam has a structural height of 320 feet

and a hydraulic height of 75 feet. Lake Havasu is the reservoir created by the dam and it has a storage capacity of 648,000 acre-feet.

- ***Davis Dam***: Located near Laughlin, Nevada, Davis Dam is a zoned, earth-fill dam built completed in 1950. The dam has a structural height of 200 feet, and creates the Lake Mohave reservoir with a total capacity of 1.8 million acre-feet.

- ***Hoover Dam***: Located about 36 miles south of Las Vegas in the Black Canyon of the Colorado River, Hoover Dam is the highest and third largest concrete dam in the United States. Construction of the dam began in 1931 during the Great Depression and the dam was completed in 1936. The dam has a structural height of 726 feet. The reservoir (Lake Mead) has a storage capacity of 28.5 million acre-feet.

The U.S. Bureau of Reclamation (1993) evaluated inundation potential along the Colorado River by modeling failure of combinations of Hoover, Davis and Parker dams, as follows:

1) Failure of Hoover Dam resulting in the subsequent failure of Davis Dam and Parker Dam *(peak flow=24.2 million cubic feet per second (cfs))*.
2) Failure of Davis Dam resulting in the subsequent failure of Parker Dam *(peak flow=3.4 million cfs)*.
3) Failure of Parker Dam *(peak flow=600,000 cfs)*.
4) A major storm inflow routed through Hoover Dam *(peak flow=341,000 cfs)*.

The mapping prepare by the U.S. Bureau of Reclamation (1993) is digitized and presented on Plate 3-3, as well as Figure 3-3. The results are summarized for the Blythe area in Table 3-7. Blythe has a listed population of about 8,000, which triples during the winter months. Its elevation of about 207 feet above sea-level is well under the modeled water surface elevations for catastrophic failure of any combination of Colorado River dams. Fortunately, in the unlikely case there is a catastrophic failure, a minimum of 23 hours is estimated before the flood waters reach the Blythe region.

Table 3-7: Inundation Modeling of Colorado River Dams

Conditions at Blythe (elevation = ±207 feet)			
Scenario	**Peak Flow (cfs)**	**Max. Water Surface Elevation (feet)**	**Travel Time (hours)**
Failure of Hoover, Davis and Parker	6.1 million	331	33
Failure of Davis and Parker	500,000	283	43
Failure of Parker	360,000	280	23
Major storm release from Hoover	313,000	279	

3.6.3 GIS Dam Inundation Mapping for Riverside County

We prepared a digital map of the coverages of Potential Dam Inundation zones for Riverside County at a scale of 1:250,000 (Plate 3-3). The original map data were obtained from various sources (Table 3-8), and at various scales. The overall map is good to an accuracy of 1:100,000.

The different types of dams included in our digital database and the number of that type found in Riverside County are:

- Earth (35)
- Gravity (1)
- Earth and Rock (2)
- Variable Radius Arch (2)
- Hydraulic Fill (1).

Dam Inundation maps were obtained from the California Office of Emergency Services (OES). The maps were digitized from the set of files described in Table 3-8. Inundation mapping was available for 23 dams whose inundation paths affect the County, and digital data include flood wave travel times when available. These maps are intended to be used by State and local officials for the development and approval of dam failure emergency procedures as described in Section 8589.5 of the California Government code, a portion of the Emergency Services Act. The maps also provide information needed to make natural hazard disclosure statements required under recent legislation (AB 1195 Chapter 65, June 9, 1998, Natural Hazard Disclosure Statement).

The inundation hazard rating scale developed for this mapping is based on dam age, construction material, height, storage capacity versus drainage area and pathway hazard potential. The hazard ratings are provided with the digital data for each inundation pathway (Plate 3-3), summarized in Figure 3-3, and described below:

- ***High*** (rating 4 - 5) (Red, Plate 3-3) - Dams that holds back a lake or significant amounts of water year around. These have large reservoirs and large drainage basins. If construction materials are gravity or hydraulic fill, dams automatically fall into this category due to potential seismic failure.

- ***Moderate*** (rating 2 - 3) (Orange, Plate 3-3) - Dams that hold back a lake or significant amounts of water year around, that are constructed with earth fill materials. These dams have significant heights and large drainage areas, but pathways from them do not immediately flow towards populated areas.

- ***Low*** (rating 1) (Blue, Plate 3-3) - These hold water outside the rainy season and thus are not debris basins. Made of rock or earth materials, these are usually small impoundments with no direct path to populated areas.

- ***Debris basins*** (Brown, Plate 3-3) - These hold water during rainy periods.

These hazard classifications differ from the National Inventory of Dams (NATDAM) classification system (FEMA, 1993), which includes in the high hazard category any dam with the potential to cause loss of life. Therefore, more detail concerning the evaluation of risk is provided by this study.

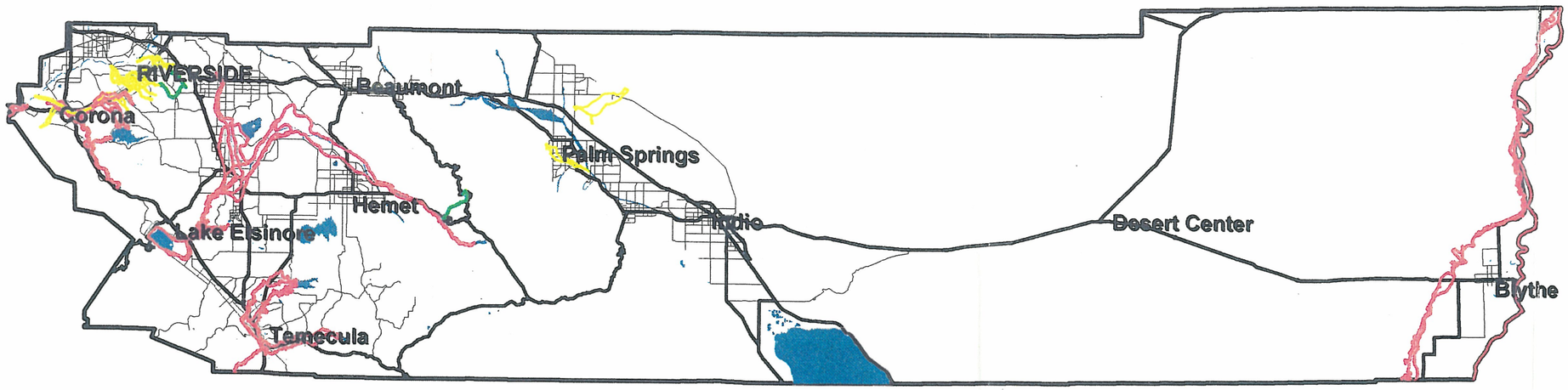
Table 3-8: Dam Failure Inundation Map Sources

Dam	Map Numbers	Scale	Analysis By:
Alessandro	1,2,3	1:9,600	Neste, Brudin & Stone, Inc.
Box Springs	1,2	1:9,600	Neste, Brudin & Stone, Inc.
Colorado River	6,7,8	1:126,720	Dept. of Interior, Bureau of Reclamation
Foster	1,2	1:6,000	Neste, Brudin & Stone, Inc.
Harrison Street	1,2,3	1:9,600	Neste, Brudin & Stone, Inc.
Henry J. Mills	1	1:12,000	Nelson N. Lee
Lake Hemet	1,2,3,4,5	1:63,360	Neste, Brudin & Stone, Inc.
Lake Mathews	1,2	1:24,000	Metropolitan Water District
Lee Lake	1	1:24,000	Krieger & Stewart
Mabey Canyon	1	1:24,000	Neste, Brudin & Stone, Inc
Mary Street	1,2,3	1:9,600	Neste, Brudin & Stone, Inc.
Mockingbird Canyon	1	1:24,000	Robert L. Taylor
Perris	1,2,3,4	1:24,000	Dept. of Water Resources
Pigeon Pass	1,2,3	1:24,000	Neste, Brudin & Stone, Inc
Prado	2,3	1:24,000	US Corps of Engineers
Prenda	1,2,3	1:9,600	Neste, Brudin & Stone, Inc.
Railroad Canyon	1	1:63,360	Krieger & Stewart
Robert A. Skinner	2,3	1:24,000	Nelson N. Lee
Sycamore	1,2	1:9,600	Neste, Brudin & Stone, Inc.
Tahchevah	1	1:24,000	Neste, Brudin & Stone, Inc.
Vail	1,2,3	1:24,000	James M. Montgomery
Wide Canyon	1	1:24,000	Riverside County FCWCD
Woodcrest	1,2,3	1:9,600	Neste, Brudin & Stone, Inc.

Figure 3-3:

Dam Failure Inundation Zones of Riverside County

(Summary of GIS Data, for additional detail see Plate 3-3 in-pocket)



Earth Consultants International

Dam Hazard Zones

- High
- Moderate
- Low

(see text for definitions)

Highways

Major Roads

Water Bodies

Lake, Pond, Sea

N

W E

S

Scale: 1:1,000,000

10 0 10 20 30

Miles

3.6.4 Performance of Dams in Earthquakes

Several California dams have been tested by earthquakes, the most notable being the 1971 San Fernando and the 1989 Loma Prieta. In 1971 the Lower San Fernando Dam was damaged, and although it did not fail, evacuation of more than 70,000 persons below the dam was required. The earthen Austrian Dam was damaged in the 1989 Loma Prieta earthquake.

A wide variety of creative solutions have been applied to improve the seismic stability of dams in California. Although there have been major advances in analysis techniques, rehabilitations have not changed radically. Multiple arch dams are still being stiffened and embankment dams buttressed. The performance of Austrian Dam during the 1989 Loma Prieta Earthquake reinforces concerns about damage to the tops of earth dams by earthquakes (Babbitt, 1993).

Experience has shown that dams must be made safe before the earthquake hits. Afterwards, there are too many obstacles to hinder quick detection and treatment of earthquake damaged dams, or to implementing evacuation plans if they are needed. Provisions for emergency response are prudent, but they are not substitutes for pre-earthquake rehabilitation. Babbitt recounts some examples of obstacles encountered:

- Key response personnel were not available. They had been injured or their families needed them.
- Communications were blocked. When telephone and radio facilities were not damaged, they were overloaded.
- Access to dams was difficult. Roads and bridges are designed to lower standards than dams. They should not be expected to survive earthquakes that damage dams.
- Repair materials, equipment and operators were in short supply.
- Helicopters were not available for inspections. News media and high level officials tied them up.

The California Division of Safety of Dams requires that dams have gravity outlets and that their operation be regularly demonstrated. Dam owners must provide dam break inundation maps to the State Office of Emergency Services so that local jurisdictions can prepare evacuation plans. Each of these measures has proven useful in dealing with earthquake and other emergencies at dams.

Two facets of the 1971 Lower San Fernando Dam incident are especially germane:

(1) The reservoir behind the damaged dam had to supply a large portion of the water for Los Angeles for two weeks while severe damage to the supply aqueducts was repaired. This scenario could be repeated in Riverside County following a major earthquake. Many of the County's aqueduct systems cross major fault systems at numerous locations.

(2) A major public awareness effort was required to gain support for construction of the Los Angeles Dam, the functional replacement for Lower San Fernando Dam (Babbitt, 1993).

The new dam was constructed in the old dam's basin. The old dam was repaired and the area between the dams is maintained dry to provide double protection for the downstream area where 70,000 people were evacuated after the 1971 earthquake.

3.6.5 Seismic Retrofit Projects

No single agency tracks the status of dam improvement projects for California. However, the National Inventory of Dams (U.S. Army Corp of Engineers, 2000) plans to include retrofit information in future inventories. Retrofit information should be added to the County's digital database provided by this study.

Pigeon Pass Dam: The California Division of Safety of Dams (2000) describes an improvement project for Pigeon Pass Dam, which is owned and operated by the Riverside County Flood Control District. Pigeon Pass Dam, is a 30-foot high, 2,900-foot long clayey sand embankment structure that forms a 912 acre-foot flood control reservoir in the Sunnymead area of Riverside County. The foundation is alluvium of various ages. The outlet is ungated, allowing the reservoir to empty within hours after rainfall ceases on the 9 square mile drainage area. In December 1978, transverse cracks were discovered in the embankment. The causes of the cracks were determined to be a combination of embankment shrinkage and differential foundation settlement due to hydrocompaction and possibly seismic shaking. The largest crack was repaired by excavating and placing compacted embankment. The proximity of a nearby active fault, the San Jacinto at 4 miles, dictated that repairs include more than treating identified cracks. During an earthquake, cracks could rapidly reopen or new ones form in the rather brittle embankment, particularly where the dam is founded on cohesionless soils. Mitigation measures undertaken for Pigeon Pass Dam included a chimney drain placed in a trench in the downstream slope to act as a crack stopper. The work was safely accomplished in a short time (Babbitt, 1993).

Railroad Canyon Dam: The Railroad Canyon Dam received a $6 million face lift in 1997 to withstand greater seismic and flood forces, in accordance with Federal weather criteria and the State Division of Safety of Dams (Elsinore Valley Municipal Water District, 2000).

Lake Mathews: A major seismic hazard reduction project is underway at Lake Mathews reservoir, about 5 miles south of the city of Riverside. The purpose is to reduce the seismic vulnerability of Lake Mathews outlet facilities and to ensure a reliable supply of water following a major earthquake. The project cost is estimated at about $100 million, with a completion date of May 2004 (Metropolitan Water District, 2000).

3.6.6 Mitigation Alternatives-Storage Restrictions

Reservoir storage restrictions can provide effective, rapid ways to increase dam safety, but can prove troublesome in the long term. Temporary storage restrictions have improved the safety of 21 dams in California (Babbitt, 1993). These operating restrictions are placed soon after analyses identify stability problems. The engineers who do the stability analyses usually recommend the restriction depth. The restrictions allow time to design and finance repairs, find alternate water supplies and to conduct environmental studies. Reducing the allowable reservoir storage directly reduces the damage potential should an earthquake rupture the dam. It also reduces seepage pressures in dams and foundations and eliminates liquefaction potential wherever problem soils are completely drained.

Permanent storage restrictions are being used on only 12 California dams (Babbitt, 1993). These restrictions can be difficult to maintain. Dam operators and regulators change and documents get lost. There is pressure to lift restrictions during periods of drought and other crises. If long-term restrictions are used, the conditions at the reservoirs must make the restrictions easy to maintain. Lowered or notched spillways are a more foolproof method of implementing storage restrictions.

3.7 Flood Hazard Reduction in Riverside County

The statutes governing dam safety are defined in Division 3 of the California State Water Code (California Department of Water Resources, 1986). It empowers the California Division of Safety of Dams to monitor the structural safety of dams that are greater than 25 feet in dam height or 50 acre-feet in storage capacity.

State law generally makes local government agencies responsible for flood control in California. Paragraph (c) of Section 8401 of the Water Code states: "The primary responsibility for planning, adoption, and enforcement of land use regulations to accomplish flood plain management rests with local levels of government." Similarly, Section 65300 of the Government Code requires that each county and city develop and adopt a comprehensive, long-term general plan for the physical development of the jurisdiction.

As part of the County's general plan requirements, the land use element of the plan must identify areas that are subject to flooding. The County's general plan also must include a safety element to help protect the community from unreasonable risks associated with flooding. The water portion of the conservation element must be developed in coordination with any countywide water agency and with all districts and city agencies that control water for any purpose within the city or county for which the plan is prepared. The conservation element may cover land and water reclaimed within the city or county.

While local agencies operate and maintain many flood control facilities, funding for the construction of such facilities often is shared among Federal, State and local agencies. Additionally, local agencies independently fund many local projects without financial assistance from the Federal or State governments. The cost of maintaining the facilities is a local responsibility.

Table 3-9 summarizes agencies with local flood control responsibilities in Riverside County. Local governments are authorized to appropriately zone river basin lands within their jurisdictions. However, State and Federal agencies (Department of Water Resources, the U.S. Army Corps of Engineers and Federal Emergency Management Agency) often provide assistance to local planning and zoning commissions by determining the probability of flooding and the potential flood damage, and by assisting with ordinances that minimize development in flood plains.

Table 3-9:
Local Agencies with Flood Control Responsibilities in Riverside County*

NAME OF AGENCY	CONTACT PERSON, TITLE	PHONE NUMBER	GEOGRAPHIC AREA OF SERVICE
Riverside County Flood Control & Water Conservation District	David Zappe, General Manager	909-275-1250	Western half of Riverside County.
Coachella Valley Water District	Tom Levy, General Manager	760-398-2651	Majority of Coachella Valley.
Palo Verde Irrigation District [1]	Gerald Davisson, District Manager	760-922-3144	Palo Verde Valley in extreme eastern Riverside County and a portion of Imperial County.
Imperial Irrigation District [1]		619-339-9416	Imperial Valley - Imperial County and southeastern Riverside County.
County Service Areas 103 & 121 [2]	Mel Bohlken, Administrator	909-275-1110	CSA 103 serves Wildomar in southwest Riverside County and CSA 121 serves Thousand Palms in the Coachella Valley.
Desert Water Agency	Jack Oberle, General Manager	619-323-4971	Certain territory in Riverside County but excludes waters of the Whitewater River system.
San Gorgonio Pass Water Agency [3]	Steve Stockton, General Manager	909-845-2577	Certain territory in Riverside County.

*source: California Department of Finance (1997)
1 This district performs agricultural/local drainage rather than regional flood control.
2 The two County Service Areas maintain local retention basins.
3 While the agency has authority to acquire and control storm water, its actions in this regard have been limited to taking "runoff" water from local rivers and streams to replenish the groundwater on lands within the agency's jurisdiction.

3.7.1 National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods. The NFIP makes

Federally-backed flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. National Flood Insurance is available in the County of Riverside.

The NFIP is managed by the Federal Emergency Management Agency's Federal Insurance Administration and Mitigation Directorate. The Federal Insurance Administration manages the insurance component of the NFIP, and works closely with FEMA's Mitigation Directorate, which oversees the floodplain management aspect of the program. The NFIP's policy retention rate is 88.6%, which means more than 11 percent of policyholders are lost each year. Yet the NFIP is self-supporting for the average historical loss year, which means that operating expenses and flood insurance claims are not paid for by the taxpayer, but through premiums collected for flood insurance policies.

Owners of all structures within the projected inundation area of the 100-year flood (Special Flood Hazards Area, SFHA) are required to purchase and maintain flood insurance as a condition of receiving a Federally related mortgage or home equity loan on that structure. However, nationwide estimates indicate that 75% of households in SFHAs do not have a National Flood Insurance Policy (NFIP). Structures located in SFHAs have a 26 percent chance of being flooded over the course of a 30-year mortgage. The likelihood that a building will catch fire over the same 30-year period is about 4 percent. A structure in a SFHA is far more likely to experience a flood than a fire. However, homeowners in SFHAs are far more likely to carry fire insurance (90%) than flood insurance (25%).

Floods do not just occur in the SFHAs where flood insurance coverage is required by law. Some 20 to 25 percent of the NFIP's claims come from structures located outside a designated SFHA.

3.7.2 Riverside County Flood Control District

The Riverside County Flood Control District is the largest agency in Riverside County that is responsible for flood control, including most of the western County. During the District's fifty year history, it has developed an extensive flood control system in western Riverside County including 35 dams, debris basins and detention basins, 48 miles of levees, 188 miles of open channel and 182 miles of underground storm drain (Zappe, 1997). Proper operation and maintenance of the flood control system is critical to protect the lives and properties of the residents of western Riverside County, and is essential to ensure that economic activity and transportation corridors are not disrupted during times of flooding.

3.7.3 Flood Protection Measures

Flood protection can involve a variety of changes to structures and property that can vary in complexity and cost. Basic improvements may be done by individuals. However, complicated or large-scale changes and any that affect the structure of the house or its electrical wiring or plumbing, should be carried out only by a professional contractor licensed to work in the County.

One example of flood protection is to add a waterproof veneer to exterior walls. This is something that only a licensed contractor should do. Then, when flooding is imminent, seal all openings, including doors, to prevent the entry of water. In areas where flood waters are less than 2 feet deep, a house can be severely damaged if water reaches the interior. The damage to walls and floors can be expensive to repair, and the house may be uninhabitable while repairs are underway.

As shown in Figure 3-4, the veneer can consist of a layer of brick backed by a waterproof membrane. Before the veneer is applied, the siding is removed and replaced with exterior-grade plywood sheathing. If necessary, the existing foundation footing is extended to support the brick. Changes are also made to the interior walls so that they will resist moisture damage. In the area below the expected flood level, standard batt insulation is replaced with washable closed-cell foam insulation, and any wood blocking inside the wall cavity is made of exterior-grade lumber.

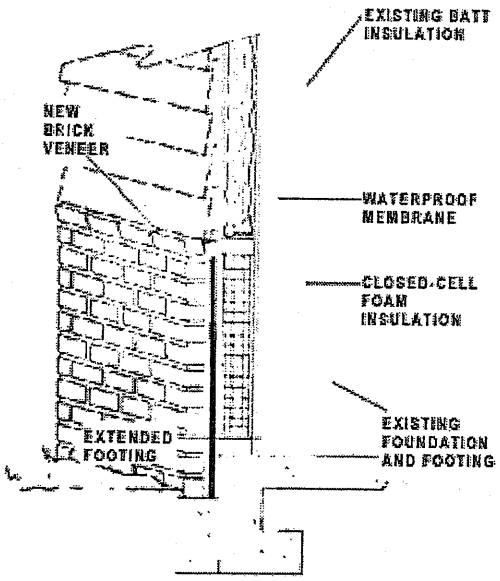


Figure 3-4: Adding Waterproof Veneer to Exterior Wall. FEMA 384, 1999

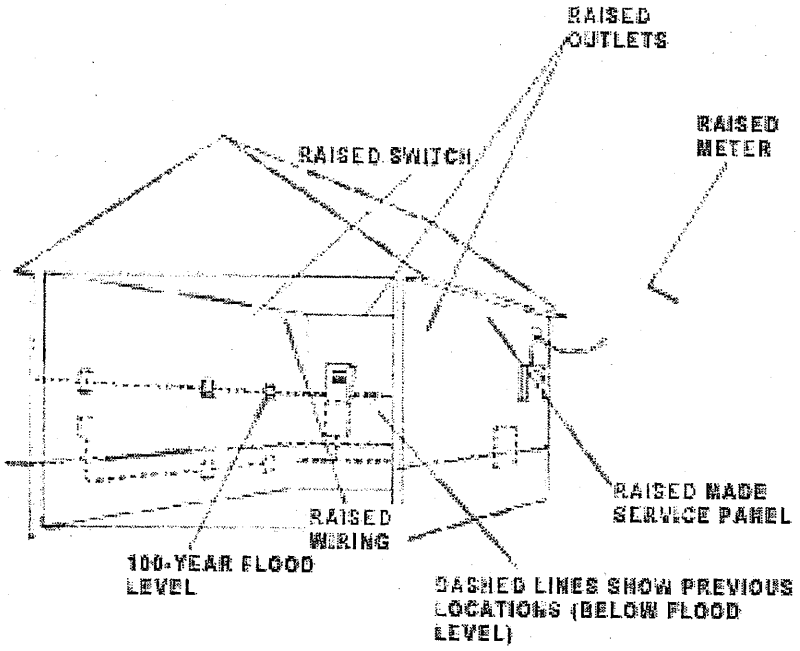


Figure 3-5: Raising Electrical Systems, FEMA 384, 1999

Another flood mitigation measure is to raise the electrical system components of a home in a SFHA (Figure 3-5). Electrical system components, including service panels (fuse and circuit breaker boxes), meters, switches, and outlets, are easily damaged by flood water. If they are inundated for even short periods, they will probably have to be replaced. Even more seriously, they can short circuit and cause fires. Raising electrical system components helps avoid those problems. Also, an undamaged, functioning electrical system will help assist in flood clean up and repairs.

All components of the electrical system, including the wiring, should be raised at least one foot above the 100-year flood level. In an existing house, this work usually will require the removal of some interior wall sheathing (drywall, for example). When repairing a flood-damaged house or building a new house, the electrical system should be elevated above the 100-year flood level as a matter of course. Like all electrical work, this should be done by a licensed contractor.

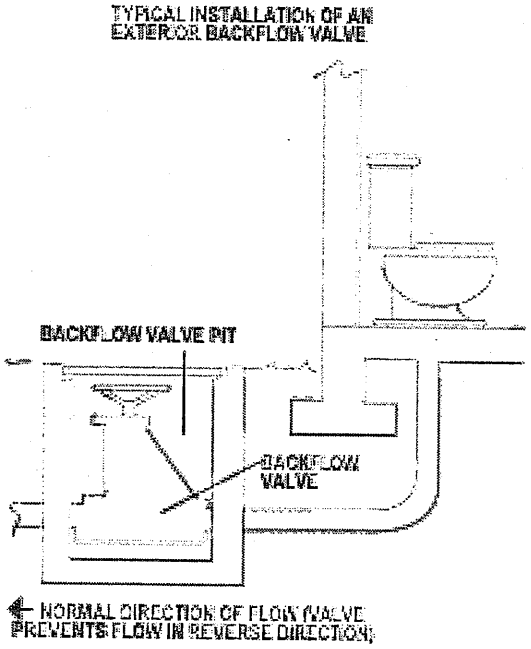


Figure 3-6: Sewer Backflow Valve Installation
FEMA 384, 1999

In some flood-prone areas, flooding can cause sewage to back up into houses through drain pipes. This causes damage that is difficult to repair and creates health hazards. A good way to protect a house from sewage backup is to install backflow valves, which are designed to block drain pipes temporarily and prevent flow into the house (Figure 3-6). Backflow valves are available in a variety of designs that range from the simple to the complex. Some designs must be operated by hand, so the effectiveness will depend on the amount of warning of impending flooding. Among the simpler valves are a flap or check valve, which will open to allow flow out of the house but close when the flow reverses. These valves operate automatically but do not provide as strong a seal.

3.7.4 Flood Safety

The Riverside County Flood Control and Water Conservation District (2000) provides general flood safety information to help educate the public.

Floods can take several hours to days to develop:

- A **flood watch** means a flood is possible in your area.
- A **flood warning** means flooding is already occurring or will occur soon in your area. If it is raining a lot, or if you are in a mountainous area, it's a good idea to keep listening to local radio or TV stations (not stations far away from you). If you hear about a flash flood watch for your area, stay on high ground.
- If you hear a **flash flood warning**, climb to higher ground immediately. Leave your car, camping gear, or other belongings where they are. You may have only minutes to escape. Flash floods can also happen without warning. If you hear a rumbling sound, if animals are running away from where your are, or if you feel the ground shaking, climb to higher ground immediately.

After a flood, keep yourself and your family safe by following these important safety tips:

Do not walk through flowing water: Drowning is the number one cause of flood deaths. While most of these drownings occur during flash floods, a mere six inches of moving water can knock you off your feet. Use a pole or stick to make sure that the ground is still there if you must move through an area where the water is standing but not flowing.

Do not drive through a flooded area: More people drown in their cars than anywhere else. Don't drive around road barriers; the road or bridge may be washed out. Six inches of moving water can carry a small car away! But much bigger vehicles are also at risk.

Stay away from flood control facilities: Warn your children about the dangers of playing in or near flood control facilities such as drainage channels, storm drains, open drainage ditches, natural streams, gutters and inlets to drainage facilities.

Stay away from power lines and electrical wires: Electrocution is also a major killer in floods. Electrical current can travel through water. Report downed power lines to your utility company or local emergency manager.

Turn off your electricity when you return home: Some appliances, such as television sets, can shock you even after they have been unplugged. Don't use appliances or motors that have gotten wet

unless they have been taken apart, cleaned and dried.

Watch for animals, especially snakes: Small animals that have been flooded out of their homes may seek shelter in yours. Use a pole or stick to poke and overturn items, to help scare away small animals.

Look before you step: After a flood, the ground and floors are covered with debris including broken bottles and nails. Floors and stairs that have been covered with mud can be very slippery.

Carbon monoxide exhaust kills: Only use a generator or other gasoline-powered machine outdoors. The same goes for camping stoves. Fumes from charcoal are especially deadly - never cook with charcoal in an enclosed area.

Think before you drink: After flooding, drinking water often becomes contaminated. Do not drink your tap water until you have been told it is safe to do so.

Clean everything that got wet: Flood waters have picked up sewage and chemicals from roads, farms, factories and storage buildings. Spoiled food and flooded cosmetics and medicines are health hazards. When in doubt, throw them out.

Take good care of yourself: Recovering from a flood is a big job. It is tough on both the body and the spirit. Yand your family should expect to feel the disaster's effects for some time. Rest often and take good care of yourself and your loved ones.

3.8 The Future of Flood Hazard Mitigation

This topic is discussed in more detail within the Policy chapter (Chapter 5) prepared for this Safety Element. Substantial changes in flood hazard mitigation methods are in progress. These changes are a result of environmental legislation such as the Endangered Species Act, and improvements in the understanding and analysis of flood hazards in arid environments. Nationwide, there is a move to leave nature in charge of flood control. The advantages include lower cost, preservation of wildlife habitat and improved recreation potential. However, this type of flood mitigation is difficult to implement in areas where development has already occurred, as well as regions susceptible to sheet flow. Where water spreads across broad areas, mitigation without channels or culverts is problematic.

Flood control structures have often been built piecemeal over the years, and new development may funnel water into older systems without enough capacity. Building a new major channel now costs about $2 million per mile, while maintenance of an existing major project averages about $12,000 per mile (Ingley, 2000). These issues have been mitigated in recent years by the preparation of Master Plans by local storm control agencies.

Environmental legislation that protects rare and endangered species will continue to make construction of flood control structures difficult. In arid environments, twice as many species and about 250 percent more plant cover are associated with natural wash areas, compared with surrounding land (Ingley, 2000). The County should consider a "Flood-prone Land Acquisition Program" that will reduce the costs associated with flooding and mitigation. Developers will still be able to profit from if wash corridors are left intact, as home buyers will pay premiums to live near these open spaces.

3.8.1 Wetlands

As part of its Eastside Reservoir project, the Metropolitan Water District purchased 9,000 acres for the Southwestern Riverside County Multi-Species Reserve, including lands around the reservoir, Lake Skinner, and the 2,500-acre Dr. Roy E. Shipley Reserve.

Behind Prado Dam in Riverside County, Orange County Water District operates 465 acres of constructed freshwater wetlands to reduce the nitrogen levels in the Santa Ana River. The river provides much of the county's coastal plain groundwater recharge. The Prado wetlands are home to several rare and endangered bird and waterfowl species. More than 226 acres are set aside as habitat for the endangered least Bell's vireo and southwestern willow flycatcher.

3.8.2 Conflicts with Environmental Legislation

Flood control programs and methods are currently undergoing dramatic change. Softer, non-structural solutions implementing flood plain management principles are replacing concrete-based structural measures of the past. Where structures are absolutely necessary, they incorporate softer, more environmentally-friendly materials and designs where feasible. But millions of citizens of Riverside County still rely on the existing flood control systems that have been constructed to ensure protection of their lives and property. There is currently a heavy regulatory burden on local government, who worry that they cannot maintain existing systems of flood control facilities which provide the backbone of protection for the public's health and safety. The head of the Riverside County Flood Control District (Zappe, 1997) calls for reform of the Endangered Species Act.

It seems that everything about the Endangered Species Act is controversial, including debate about its effectiveness and what revisions it may need. Certainly, any legislation that can have such complex, profound and wide-reaching impact needs ongoing scrutiny, as it may have unintended consequences.

In order to participate in the National Flood Insurance Program, the Federal Emergency Management Agency (FEMA) requires that Riverside County and its incorporated cities maintain the carrying capacity of all flood control facilities, and floodways. Communities which fail to meet their maintenance responsibility are subject to expulsion from the National Flood Insurance Program, loss of other Federal aid, and even exposure to suits by FEMA for recovery of flood insurance and disaster payments.

According to Zappe (1997), effectiveness of flood control efforts to protect public safety has been diminished by the regulatory activities of Federal agencies including the U.S. Army Corp of Engineers (Corps), the Environmental Protection Agency (EPA), and the U.S. Fish and Wildlife Service (Service). These agencies have effectively been given veto power over local flood control maintenance activities under authority of the Federal Clean Water Act (CWA) and the Federal Endangered Species Act (ESA). Although these laws have been on the books for many years, their impacts have grown as Federal agencies have issued new and more stringent regulations. As the Service has added new listings of endangered species, formerly routine maintenance activities of existing flood control facilities, have become subject to Federal permit and mitigation requirements, along with the attendant delays and increased costs.

Under the Federal Clean Water Act, three separate permits are required to operate and maintain flood control systems (Zappe, 1997):

- A National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit is required to discharge storm waters to "waters of the United States".

- A Section 404 Dredge and Fill Permit must be obtained from the Corps for any project which discharges fill to waters of the United States. Under Section 7 of the ESA, the Corps is required to consult with the Service where a permitted activity may jeopardize an endangered or threatened species or critical habitat. The EPA retains veto power over any permit issued by the Corps.

- A Section 401 Water Quality Certification or Waiver must be obtained before any given 404 Permit becomes valid. This process has been delegated by EPA to the State Water Resources Control Board.

Zappe (1997) cites many examples of threats to health and safety in Riverside County as a result of this regulatory environment:

- In January, 1993, the Old Town area of Temecula suffered $10 million dollars of property damage in major flooding from overflow at Murrieta Creek. No one was killed, but a number of citizens escaped their cars just before they were swept away. Some businesses never fully recovered and folded. Prior to the flood, Federal officials had refused to allow mechanical clearing of vegetation and removal of accumulated sediment on the creek, due to concerns about the endangered least Bell's vireo. Only after the damage occurred did they allow the flood control maintenance to take place.

- During the early 1990s, the Riverside County Flood Control District wanted to control burrowing rodents in two large earth fill dams, Alessandro Dam in the city of Riverside, and Pigeon Pass Dam in the city of Moreno Valley. The U.S. Fish and Wildlife Service said no because filling of rodent burrows could result in an incidental "taking" of the endangered Stephens' kangaroo rat. Failure to control burrowing rodents in these large earth fill dams could have led to a catastrophic failure. Fortunately, adoption of a habitat conservation plan for the endangered rat has resolved this issue.

- In the mid 1990s, for more than two years, the Riverside County Flood Control District was prevented from making critical repairs to Santa Ana River levees, a Federally-constructed flood control project owned and operated by the District, The District is mandated to maintain these levees by the Federal government (U.S. Army Corps of Engineers), but could not do so because two endangered woolly-star plants were discovered in the general area of the remedial work.

- The Potrero Creek Debris Basin, near San Jacinto, filled to capacity during the winter of 1994/95. Permits to excavate the basin and remove debris were sought in July 1995. The Corps and the Service requested site surveys for the endangered Stephens' kangaroo rat, the endangered slender-horned spine flower, and two other sensitive species, the San Bernardino kangaroo rat and the Los Angeles pocket mouse. This resulted in a delay of the debris removal project until January of 1996, late in the rainy season.

Flood control agencies have also had difficulties getting permits for new flood control projects (Zappe, 1997), including:

San Jacinto River Flood Control Project near Perris: In 1988, the Riverside County Flood Control District began 6 years of negotiations with the Service to address concerns about a potentially endangered plant, the San Jacinto Saltbush. The District added significant environmental enhancements desired by the Service, in hopes of avoiding an endangered listing of the Saltbush. These enhancements included adding a 100-foot wide riparian corridor for the entire 10 mile length of the project, and providing an additional 250-foot wide corridor of land contiguous to the channel for mitigation and protection for the Saltbush and several other plant species of concern to the Service. In order to provide guarantees, the Flood Control District, the County of Riverside and the city of Perris executed a Memorandum of Understanding (MOU) with the Service and the California Department of Fish and Game. The MOU provided for development of a habitat corridor plan for the San Jacinto River subject to review and approval by the Service, and a final draft plan was submitted to the Service for consideration and approval in November 1993. The District emphasizes that the MOU and corridor plan were developed voluntarily and working directly with representatives of the Service, to address Service concerns. Later, the Service proposed listing of the Saltbush and three other species as endangered, unilaterally abrogating the MOU.

Zappe (1997) recommends several specific reforms to the Endangered Species Act:

- A categorical exemption should be added to provide for routine maintenance and emergency repair of all existing flood control facilities and appurtenant structures which protect public health and safety, including dams, debris basins, detention basins, open channels and highway drainage structures.

- Standards should be established for the quality of the science required to justify a proposed listing, and the science and administrative record should be subject to review and approval by an independent panel of qualified scientists before a proposed listing may be published in the Federal Register.

- Criteria should be established for distinguishing true species from subspecies, and only true species should qualify for listing.

- The time period for public comment, and/or for requesting a public hearing, concerning the proposed listing of a species should be increased. In addition, proposals to list a species should be published prominently in newspapers of broad general circulation.

- Early consultation with potentially affected local government, including counties and incorporated cities, should be mandatory before a proposed listing is published in the Federal Register.

- Processing and review of permit applications, and habitat conservation plans should be subject to specific time periods for completion, and should be deemed approved if not completed within the allotted time.

3.8.3 National Pollutant Discharge Elimination System (NPDES)

The County of Riverside participates in the National Pollutant Discharge Elimination System, or NPDES Program. The Program is under guidance of a permit filed with the California Regional Water Quality Control Board, to fulfill the requirements of the Federal Clean Water Act amendments of 1987. This permit is currently required by all cities and counties with a storm drain system that serves a population of 100,000 or more.

On October 29, 1999, Phase II of the NPDES was signed into law. Phase II sets the population threshold at 50,000, and decreases the size threshold for construction site permits from 5 acres to 1 acre.

Under the NPDES, the County is responsible for six minimum control measures. These minimum measures consist of:

- public education and outreach on storm water impacts,
- public involvement/ participation,
- illicit discharge detection and elimination,
- construction site storm water runoff control,
- post-construction storm water management in new development and redevelopment, and
- pollution prevention/good housekeeping for municipal operations.

In order to comply with the Federal law, the County should continue to participate in the NPDES program. Based on observations of extensive erosion at construction grading sites during the 1992-93 storms (Kupferman, 1994), the County should also enforce the new construction site NPDES permit requirements for one-acre and larger projects.

3.9 Summary

During the 20th century, floods were the number-one natural disaster in the United States in terms of lives lost and property damage. Since 1965, eleven Gubernatorial and Presidential flood disaster declarations have been declared for Riverside County.

Previous Flood Disasters

A series of six Pacific cyclones struck southern California during February 13-21, 1980. The floods of 1980 are the worst on record for Riverside County, resulting in ten deaths and more than $70 million in damages. Extensive flooding along banks of reservoirs and streams, including failure of the San Jacinto River levees, led to a Presidential Disaster Declaration.

The San Jacinto River and Lake Elsinore, where much of the flood disaster was centered, are part of the Santa Ana River Basin. The flood of January 22, 1862, the largest recorded in the history of the Santa Ana River basin, destroyed the settlement of Agua Mansa in the northern portion of Riverside County with an estimated peak flow of 320,000 cfs based on old flood marks. Discharges in the vicinity were about 100,000 cfs on March 2, 1938 and 19,500 cfs on February 18, 1980. The reduction in peak discharges over time is a direct result of upstream reservoirs, and with the recent completion of Seven Oaks Dam, even more flood mitigation is in place.

On the morning of February 21, 1980, the levee upstream of the city of San Jacinto failed, and the flood water reverted to its original channel. The levee breaks along the San Jacinto River had the largest consequences of any event associated with the 1980 flooding in southern California. The levee breaks left many homeless, and resulted in damages of $29 million to urban areas and $1.9 million to agricultural area. Another major disaster associated with the 1980 flooding occurred at Lake Elsinore at the terminus of the San Jacinto River. Since it had been so long since outlflow had occurred from Lake Elsinore, gravel had built up at the Temescal Creek outlet. Not until February 23rd did the U.S. Army Corp of Engineers began dredging the outlet. Inflow to Lake Elsinore from the San Jacinto River reached a peak of 8,000 cfs on February 22nd, and the lake surface reached its maximum elevation of 1,266 feet on March 20th. In the low-lying areas around the lake, 874 dwelling and buildings were damaged, and 2,000 residents were displaced.

Flood Problem Areas

The most widely distributed flood map product is the Flood Insurance Rate Map (FIRM). Flood risk data presented on FIRMs are based on historic, meteorologic, hydrologic, and hydraulic data, as well as open-space conditions, flood control works and development.

The County of Riverside participates in the National Flood Insurance Program. Consequently, Flood Insurance Rate Maps (FIRMs) prepared by FEMA showing potential flood zones are available for areas within County limits.

- ***San Gorgonio River***: Flooding on the San Gorgonio River caused damage during 1938, 1965, 1966 and 1969. During the floods of 1969, the San Gorgonio River attained an estimated peak discharge of 17,000 cubic feet per second (cfs), which resulted in loss of life and extensive damage in the Cabazon area.

- ***San Jacinto River***: The San Jacinto River has flooded during 1916, 1927, 1931, 1937, 1938, 1966, 1969, 1980, and 1993. Its largest flood of record occurred on February 16, 1927 with a peak discharge of 45,000 cfs near the city of San Jacinto. Agricultural, railway, and highway properties were extensively damaged. In addition, failure of its levee system in 1980 resulted in extensive damage.

- ***Murrieta Creek***: Nine major floods have been reported, during 1862, 1884, 1916, 1938, 1943, 1969, 1978, 1980, and 1993.

- ***Santa Ana River***: Flooding of the Santa Ana River is known to have resulted in many damaging floods in 1862 *(estimated >300,000 cfs)*, 1867, 1884, 1891, 1916, 1938, 1969, 1980 and 1993. Prior to extensive dam and reservoir controls, the Santa Ana River had a large flood event about every five years.

- ***Perris Valley***: Due to increased urbanization, the Perris Valley region has a growing risk of flood hazards. (Guay, 1996). The valley is extremely flat, causing flood waters to move slowly and spread out over a large area. Increased urbanization increases flood potential by increasing the percentage of impervious surfaces in a given region. Urban areas in Perris Valley have more than tripled in the last 20 years.

- ***Desert Hot Springs***: The city of Desert Hot Springs sits on deposits from past floods from Big Morongo Wash and canyons of the Little San Bernardino Mountains.

- ***Coachella Valley***: Although the mean annual precipitation on the floor of the Coachella Valley is low (4 inches), high and intense precipitation in the steep, high surrounding mountains poses hazard. Floods that affect the Coachella Valley are typically of short duration, high peak volumes and carry large amounts of debris.

Tributaries to the major rivers in Riverside County present additional flood hazards. Flooding in these streams is caused mostly by local thunderstorms. The desert areas extending to the east from the Palm Springs area are susceptible to sheet flow flooding. These type of flows leave the mouths of canyons and often follow unpredictable paths.

During major floods, flood water carries heavy debris loads and causes considerable damage from deposition. For example, the Santa Ana River carried a total sediment load of more than 11 million tons of sediment during the storms of 1969.

Earthquake Hazard to Local Water Tanks/Reservoirs

Earthquakes cause floods by causing failure of water retention structures such as reservoirs. Seismically-induced inundation can occur if strong ground shaking causes structural damage to above-ground water tanks. Damage is also generated by seiches. A seiche is an earthquake-induced wave that reverberates on the surface of water in an enclosed or semi-enclosed basin, such as a reservoir, lake, bay or harbor. Also, if a tank is not adequately braced and baffled, sloshing water can lift it off its foundation, splitting the shell, damaging the roof, and bulging the bottom of the tank. Movement can also shear off the pipes leading to the tank, allowing water to escape through the broken pipes. New tank design includes flexible joints that can accommodate movement in any direction.

Bridge Scour

Nationwide, several catastrophic collapses of highway and railroad bridges have occurred due to scouring and a subsequent loss of support of foundations. Scour at highway bridges involves sediment-transport and erosion processes that remove streambed material from the bridge vicinity. The State of California participates in the bridge scour inventory and evaluation program. In addition, California's seismic retrofit program of bridges includes underpinning of foundations. This may help reduce the vulnerability of foundations to be undermined by scour. However, since the eastern portion of the County has only a moderate seismic risk, bridges in these areas may be of lower priority for seismic underpinning.

Geographic Information Systems Flood Mapping for Riverside County

Flood data were collected and digitized as part of this study. The flood maps used to create this map had varying scales, but the overall map is accurate to no less than 1:24,000. These digital data come from a collection of resources. Flood Insurance Rate Maps (FIRM) maps, with completion dates ranging from 1980 to 1999, were compared to the existing County data. The combined maps were then compared to the Q-3 digital flood coverage data set from FEMA. The U.S. Geological Survey's flood prone map information was used to complete the flooding map.

Benefits of Flood Mapping Using Geographic Information Systems

Flood maps updated with Geographic Information Systems techniques include many advantages. They are relatively inexpensive with costs merely 10-20 percent those of a re-study using traditional methods. Thus, frequent updates are more feasible. In addition, digital maps are more detailed, and can provide depth-of-flood details, identify areas where uncertainty in flood or land elevations causes uncertainty in extent of flood inundation, and can be easily analyzed with other digital data, such as locations of roads and buildings.

Essential Facility Inventory Exposed to Flood Hazards in Riverside County

The inventory of essential facilities and hazardous materials sites available from national data sets were overlain on flood hazard zones for the County. The results of these queries indicate that: 14 of 39 Airports; 4 of 18 Hospitals; 47 of 109 Police Stations, Fire Stations and Emergency Operation Centers; 92 of 380 Schools; 446 of 1,306 Highway Bridges; and 695 of 1,978 Hazardous Materials Sites in the County are located in the 100 or 500 year flood zones.

County Flood Control and Reservoir Projects

- ***Seven Oaks Dam*** : The Seven Oaks Dam was completed in 1999 by the U.S. Army Corps of Engineers, Los Angeles District, as part of the Santa Ana River Mainstem Project. It is an important flood control structure for the Santa Ana River channel through northwestern Riverside County. The Seven Oaks Dam operates in tandem with Prado Dam, about 40 miles downstream. Historical flood flows on the Santa Ana have exceeded 300,000 cfs.

- ***Prado Dam***: Prado Dam is a flood control and water conservation project located at the upper end of the Lower Santa Ana River Canyon, a natural constriction controlling 2,255 square miles of the 2,450 square mile Santa Ana River watershed. The dam embankment is approximately 2 miles west of the City of Corona. Portions of the reservoir are in both Riverside and San Bernardino Counties. Historically, releases larger than 5,000 cfs have been damaging to downstream improvements. However, when current downstream channel improvements are completed, the downstream channel capacity will increase dramatically to over 30,000 cfs.

- ***Lake Elsinore***: Throughout its history, Lake Elsinore has been subject to "feast or famine" flooding and drying, depending on runoff amounts. The lake loses an average of 15,000 acre-feet (an acre-foot is approximately 325,900 gallons) a year to evaporation, dropping the surface level more than 4.5 feet per year. In wet years, runoff from the 782 square mile San Jacinto watershed pours into Lake Elsinore, which is the lowest point in the watershed.

- ***East Side Reservoir Project***: The East Side Reservoir project almost doubles southern California's surface storage capacity and secures six months of emergency storage in the event of a major earthquake. The project is situated in the Domenigoni/Diamond valleys, four miles southwest of the city of Hemet. The reservoir will provide additional water supplies for drought protection and peak summer needs by 2001. Water will be delivered from the Colorado River Aqueduct through the San Diego Canal and from the California State Water Project through the new 12-foot diameter, 45-mile Inland Feeder Project.

- ***Inland Feeder Project***: The Inland Feeder Project more than doubles the water delivery capacity of the east branch of the State Water Project and helps replenish local groundwater basins. The approximately 44 mile long feeder passes through or near the communities of Riverside, Perris, Moreno Valley, and San Jacinto Valley. The Inland Feeder Project crosses the San Andreas fault system just north of the Riverside County line, and crosses the San Jacinto fault system at several places. Many of California's aqueduct systems cross active faults, as they are difficult to avoid. It is important that earthquake emergency planning anticipates major disruptions of water supply.

- ***Salton Sea***: The most recent body of water to inundate the Salton Trough is the Salton Sea. It formed accidently when 1905 floods eroded a cut in a bank of the Colorado River. The cut was made during construction of the All-American Canal. The entire Colorado River was diverted. Presently, the western six miles of Salton Sea lies within Riverside County and the remainder is in Imperial County. With the Sea's relatively flat shoreline, a slight increase in elevation can cause flooding, as most of the recreational facilities are located at water's edge. In the late '70s and '80s, major flash flooding in Imperial and Coachella Valleys and flood controlled releases from Colorado River dams negated local conservation efforts to control the rising sea. Improved irrigation practices and a cutback in California's use of Colorado River water after completion of the Central Arizona Project are expected to contribute to a gradual decrease in the sea's elevation during the next two decades.

Dam Failure

Records maintained at the California Office of Emergency Services provided potential inundation maps for 23 dams affecting Riverside County. We prepared a geographic information system digital coverage of potential dam inundation zones for Riverside County at a scale of 1:250,000. Digital data include flood wave travel times when available. These maps are intended to be used by State and local officials for the development and approval of dam failure emergency procedures as described in Section 8589.5 of the California Government code. The maps can also provide information for natural hazard disclosure statements required under recent legislation (AB 1195 Chapter 65, June 9, 1998. Natural Hazard Disclosure Statement).

Dam Inundation Potential Along the Colorado River

The portions of the County along the Colorado River corridor could potentially suffer from catastrophic failure of dams well outside of the County. The U.S. Bureau of Reclamation prepared a study that evaluated inundation potential along the Colorado River by modeling combinations of failures of Hoover, Davis and Parker dams. Blythe, which has a listed population of about 8,000 that triples during the winter months, sits 207 feet above sea-level - well under the modeled water surface elevations for catastrophic failure of any combination of Colorado River dams. Fortunately, in the unlikely case there is a catastrophic failure, a minimum of 23 hours is estimated before the flood waters reach the Blythe region.

Performance of Dams in Earthquakes

Several California dams have been tested by earthquakes. The experience has shown that dams must be made safe before earthquakes occur. After the earthquake strikes, there are too many obstacles to protect the public with quick detection and treatment of earthquake damaged dams, or implementation of evacuation plans. After recent earthquakes, key response personnel were not available, communications were blocked, access to dams was difficult, repair materials, equipment and operators were in short supply, and helicopters were not available for inspections.

In 1971, the San Fernando earthquake damaged the damaged Lower San Fernando Dam. The reservoir had to supply a large portion of the water for Los Angeles for two weeks while severe damage to the supply aqueducts was repaired. This scenario could be repeated in Riverside County following a major earthquake, as many of the County's aqueduct systems cross major faults at numerous locations.

A wide variety of creative solutions have been used to improve the seismic stability of dams in California. Although there have been major advances in analysis techniques, rehabilitations have not changed radically. Multiple arch dams are still being stiffened and embankment dams buttressed. Reservoir storage restrictions are effective ways to rapidly increase dam safety, but can prove troublesome in the long term.

Seismic Retrofit Projects

No one agency tracks the status of dam improvement projects for California. However, the National Inventory of Dams (U.S. Army Corp of Engineers, 2000) plans to include retrofit information in future inventories. Retrofit information should be added to the County's digital database provided by this study.

- ***Pigeon Pass Dam:*** In December 1978, cracks were discovered in the embankment. The causes of the cracks were determined to be a combination of embankment shrinkage and differential foundation settlement due to hydrocompaction and possibly seismic shaking. Because the San Jacinto fault is within 4 miles of the dam, seismic retrofit was undertaken. Mitigation measures included a chimney drain placed in a trench in the downstream slope to act as a crack stopper.

- ***Lake Mathews***: A major seismic hazard reduction project is underway at Lake Mathews reservoir about 5 miles south of the city of Riverside. The purpose is to reduce the seismic vulnerability of Lake Mathews' outlet facilities, and to ensure a reliable supply of water following a major earthquake.

- ***Storage Restrictions***: Temporary storage restrictions have been used to improve the safety of 21 dams in California. These operating restrictions are placed soon after analyses identify stability problems. They allow time to design and finance repairs, and find alternate water supplies. Reducing the allowable reservoir storage directly reduces the damage potential should an earthquake rupture the dam. Permanent storage restrictions are being used on only 12 California dams. These restrictions can be difficult to maintain, as there is pressure to lift restrictions during periods of drought and other crises. Lowered or notched spillways are a more foolproof way to implement storage restrictions.

Flood Hazard Reduction

State law generally makes local government agencies responsible for flood control in California. Paragraph (c) of Section 8401 of the Water Code states: "The primary responsibility for planning, adoption, and enforcement of land use regulations to accomplish flood plain management rests with local levels of government." As part of the

County's general plan requirements, the land use element of the plan must identify areas that are subject to flooding. The County's general plan also must include a safety element for the protection of the community from unreasonable risks associated with flooding.

While local agencies operate and maintain many flood control facilities, funding for the construction of such facilities often is shared among Federal, State and local agencies. In addition, local agencies independently fund many local projects without financial assistance from the Federal or State governments. The cost of maintaining the facilities is a local responsibility.

National Flood Insurance Program (NFIP)

Owners of all structures within the projected inundation area of the 100-year flood (Special Flood Hazards Area, SFHA) are required to purchase and maintain flood insurance as a condition of receiving a Federally related mortgage or home equity loan on that structure. Over the course of a 30-year mortgage, structures located in SFHAs have a 26 percent chance of being flooded, while the likelihood that the building will catch fire is about 4 percent. Yet homeowners in SFHAs are far more likely to carry fire insurance (90%) than flood insurance (25%). Floods do not just occur in SFHAs where flood insurance coverage is required by law. About 20 to 25 percent of the NFIP's claims come from structures located outside a designated SFHA.

Flood Protection Measures

Flood protection can involve a variety of changes to structures and property that can vary in complexity and cost. Basic improvements may be done by individuals. However, complicated or large-scale changes, and those that affect the structure of the house, its electrical wiring or plumbing, should be carried out only by a professional contractor licensed to work in the County.

The Future of Flood Hazard Mitigation

Substantial changes to flood hazard mitigation methods are taking place. These changes are a result of environmental legislation, and improvements in the understanding and analysis of flood hazards in arid environments. Nationwide, there is a move to leave nature in charge of flood control. The advantages include lower cost, preservation of wildlife habitat and improved recreation potential. However, this type of flood mitigation is difficult to implement in areas where development has already occurred, as well as regions susceptible to sheet flow. Where water spreads across broad areas, mitigation without channels or culverts is problematic. Flood control structures have often been built

piecemeal over the years, and new development may funnel water into older systems without enough capacity. These issues have been mitigated in recent years by the preparation of Master Plans by local storm control agencies.

Environmental legislation that protects rare and endangered species will continue to make construction of flood control structures difficult. In arid environments, twice as many species and about 250 percent more plant cover are associated with natural wash areas, compared with surrounding land. The County should consider a "Flood-prone Land Acquisition Program" that will reduce costs of flooding and mitigation. Developers will still be able to profit from leaving wash corridors intact, as home buyers will pay premiums to live by these open spaces.

Wetlands

As part of its Eastside Reservoir project, the Metropolitan Water District purchased 9,000 acres for the Southwestern Riverside County Multi-Species Reserve. Behind Prado Dam in Riverside County, the Orange County Water District operates 465 acres of constructed freshwater wetlands.

National Pollutant Discharge Elimination System (NPDES)

The County of Riverside participates in the National Pollutant Discharge Elimination System, or NPDES Program. On October 29, 1999, Phase II of the NPDES was signed into law. Phase II lowers the population threshold for permit requirements from 100,000 to 50,000, and drops the threshold for construction site permits from 5 acres to 1 acre. Based on observations of extensive erosion at construction grading sites during the 1992-93 storms, the new construction site NPDES permit requirements are warranted.

Conflicts with Environmental Legislation

Flood control programs and methods are currently undergoing dramatic change. Softer, non-structural solutions utilizing flood plain management principles are replacing concrete-based structural measures of the past. But millions of citizens of Riverside County still rely on the existing flood control systems that have been constructed to ensure protection of their lives and property.

In order to participate in the National Flood Insurance Program, the Federal Emergency Management Agency (FEMA) requires that Riverside County and its incorporated cities, maintain the carrying capacity of all flood control facilities, and floodways. Communities which fail to meet their maintenance responsibility are subject to expulsion from the

National Flood Insurance Program, loss of other Federal aid, and even exposure to suits by FEMA for recovery of flood insurance and disaster payments.

Yet, maintenance of flood control systems has been complicated by the regulatory activities of several Federal agencies including the U.S. Army Corp of Engineers, the Environmental Protection Agency, and the U.S. Fish and Wildlife Service, under authority of the Federal Clean Water Act (CWA) and the Federal Endangered Species Act (ESA).

The Riverside County Flood Control District (District) is the largest agency in Riverside County that is responsible for flood control. Proper operation and maintenance of their flood control system is critical to protect lives, properties, economic activity and transportation corridors in western Riverside County.

District director Zappe (1997) argues that reform of environmental laws, particularly the Endangered Species Act, is necessary to ease a regulatory burden on local government, and ensure safety of existing systems of flood control. Zappe (1997) cites many examples of threats to health and safety as a result of regulation. He recommends several specific reforms to the Endangered Species Act. In particular, he calls for a categorical exemption involving routine maintenance and emergency repair of all existing flood control facilities.

Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

CHAPTER 4: WILDLAND FIRE HAZARDS

4.1 Overview

Major wildland and earthquake-induced fires can overwhelm local emergency response resources and are an ongoing threat in Riverside County, which has suffered six fire disasters since 1970. This study rates much of the County as potential wildland fire area, a finding that is in agreement with the State of California Department of Forestry and Fire Prevention. In such areas, special State statutes govern development, property owners must do preventative maintenance, and, in general, planning and preparedness are required to avoid disasters.

Wildland fire, also called chaparral or brush fire, is typically associated with the indigenous vegetation in the mountain and foothill areas of southern California. This vegetation has a very high oil content that creates severe fire danger. Wildland fires can also occur in suburban and rural areas of the County, which juxtapose developed lands with uncultivated lands, undeveloped lands, timber, range, watershed, brush or grasslands.

At present, more than 8 million people have homes and businesses in California's wildland areas. In Riverside County, as elsewhere, more people than ever are living and playing in wildland intermix areas. Wildland-urban interfaces create extremely dangerous and complex fire conditions which pose a tremendous threat to public and firefighter safety. Often, as wildland fires meet structural developments, vegetation ceases to burn but catastrophic fire continues, for a mile or more, sustained by structures igniting.

Wildland fire is a serious and growing hazard, posing a great threat to life and property, particularly when it spreads into developed areas. However, wildland fire is also a natural process. In the past, the presumption has been that all fire is bad and should be extinguished promptly. This has caused fire-starved vegetation to grow more dense, which weakens vegetation in a struggle for living space and increases destruction by pests and disease. Dead and dying plants add fuel for fire. In addition, in many areas, the absence of fire has altered or disrupted the cycle of natural plant succession and the wildlife habitats. Recognizing this, land management agencies are now committed to finding ways, such as prescribed burning, to reintroduce fire into natural ecosystems, while acknowledging the continued importance of fire-fighting and suppression.

Fires in fire-starved areas burn more intensely. They are more costly to control and create greater risk of losses to the people, resources, and improvements in wildland areas. In

addition, many other factors are contributing to make wildfires hotter and more destructive. California has extended droughts, which increase dead and dying vegetation, volumes of dry fuel per acre, and the number of days of low humidity. Federal policy that sets aside federal lands, without an aggressive pre-fire management program, further limits fuel management and adds ignition sources. Then, in many portions of Riverside County, fire danger can be worsened by steep, rugged topography, which allows wildland fire to spread quickly and makes it more difficult to fight.

Santa Ana winds greatly increase fire danger. Named by the early settlers at Santa Ana, these hot, dry winds typically develop when a strong, but stalled, high-pressure system near Idaho and Salt Lake (the Great Basin High) meets a weak, low-pressure system just off shore in southern California (Chen, 2000). In these conditions, the easterlies (winds from the east) are turned north and south, where they are channeled and thus strengthened by the many canyons in the Great Basin. The result is hot, powerful, and very dry winds that blow across southern California, especially through the mountain passes.

The greatest demands on fire suppression resources occur when there are multiple ignitions. Thus, widespread fires following an earthquake, coupled with Santa Ana winds, constitute a worst-case fire suppression scenario. Because of dry vegetation and recurring Santa Ana winds, the fire danger for Riverside County is considered extremely high during 25% of each year, throughout the months of August, September and October. Because of many large, active faults in Riverside County, the probability of a major earthquake is high, year-round. Therefore, there is a statistically significant chance that this worst-case fire suppression scenario could occur.

The Oakland Hills fire of October, 1991 (the "Tunnel" fire, Table 4-1) demonstrates the seriousness of multiple ignitions. The Oakland Hills fire was a firestorm. When fires grow into firestorms, we have catastrophes. Insurance companies define a catastrophe as an event that triggers at least $25 million in claims or more than 1,000 individual claims. Riverside County may develop a different definition. Regardless of such fine points, the Safety Element of the General Plan exists to avoid such incidents.

During the Oakland Hills fire, numerous single- and multi-family residential structures were simultaneously ignited by burning cinders that were fanned by winds. In this mode of fire spread, termed "branding", wind can transport burning cinders a mile or more. Roofs are the most vulnerable portion of a building or structure to branding. Wood-shingle roofs are particularly fire-prone, thus current code prohibits the use of untreated wood shingles or shakes for new or replacement roofing. Wood-shingle roofs are prevalent in residential areas of Riverside County.

As can be seen in Table 4-1, disastrous wildland fires start in many ways. The most common cause of urban and wildland fires is man. However, the effectiveness of current fire safety efforts, and the extent of loss during fire disasters, can be readily evaluated using an earthquake scenario. Thus, this chapter provides loss estimation scenarios for major earthquake-induced fires, with and without Santa Ana winds.

Using an earthquake to model worst-case fire scenario hazards may also help us to remember a key point. Fire prevention and suppression are not the only services provided by fire departments. Other obligations, like search and rescue, can reduce fire suppression resources after a catastrophe, and this must be factored into emergency preparedness planning.

4.1.1 Previous Fire Disasters

Unfortunately, damaging fires are a fact of life throughout California. In 1994 alone, more than 525,000 acres were destroyed in California wildland fires, making it one of many billion dollar pay-out years for insurers. In 1995, the California Department of Forestry and Fire Prevention (CDF) battled 6,621 blazes that damaged or destroyed 121 structures. To date, the most destructive fire in California history was the fast-moving 1991 Oakland Hills fire, called the "Tunnel" fire (Table 4-1).

Table 4-1 lists the twenty largest California wildland fires, their locations, causes and extent of devastation. They are ranked according to number of structures lost. Note the great variation in acres burned. Many of the older fires on this list would be far more devastating today, as area populations have grown.

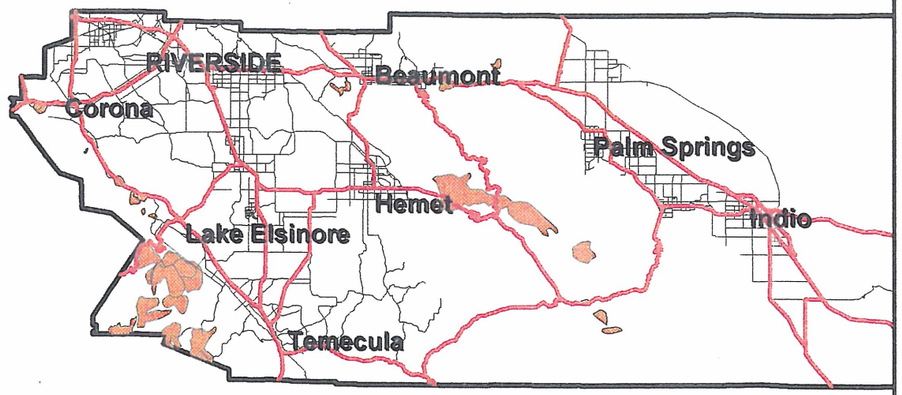
In Riverside County, the most severe fire disaster to date occurred in October 1993, Powerlines knocked down by Santa Ana winds started a fire that destroyed 107 homes and burned 25,100 acres in Riverside County (Table 4-1 and 4-2). Gubernatorial Proclamations of a State of Emergency and Presidential Major Disaster Declarations (Office of Emergency Services, 2000) affecting Riverside County have been declared on that and five other occasions in the last 30 years (Table 4-2). Historical fires and their locations within the County are illustrated on Figure 4-1.

Figure 4-1: Historical Wildland Fires in Riverside County

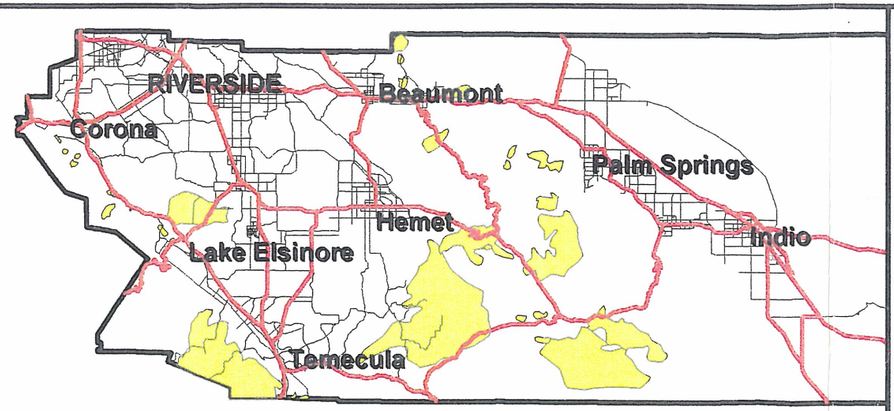
Scale: 1:1,000,000

10 0 10 20 30

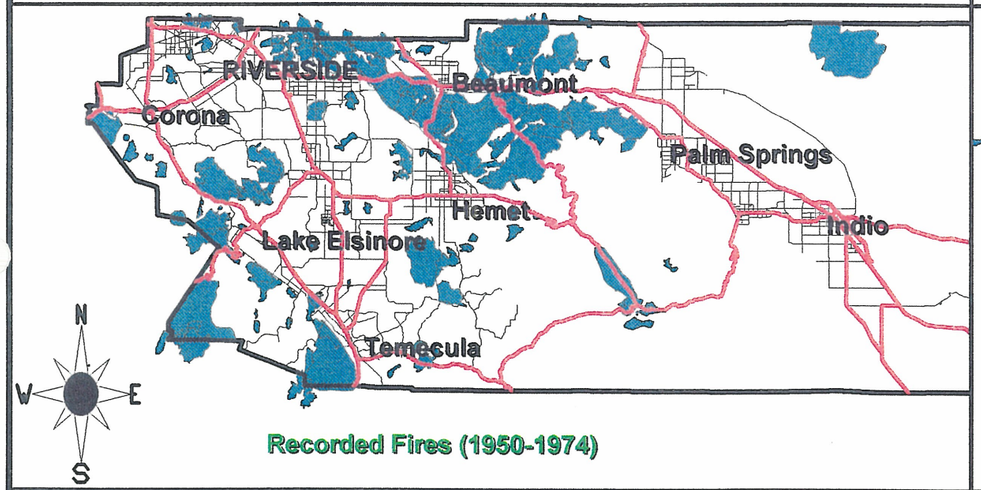
Miles



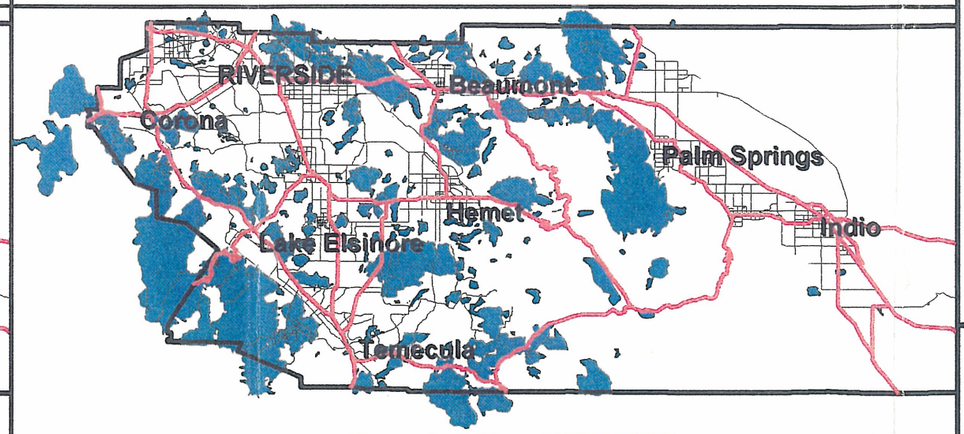
Recorded Fires (1900-1924)



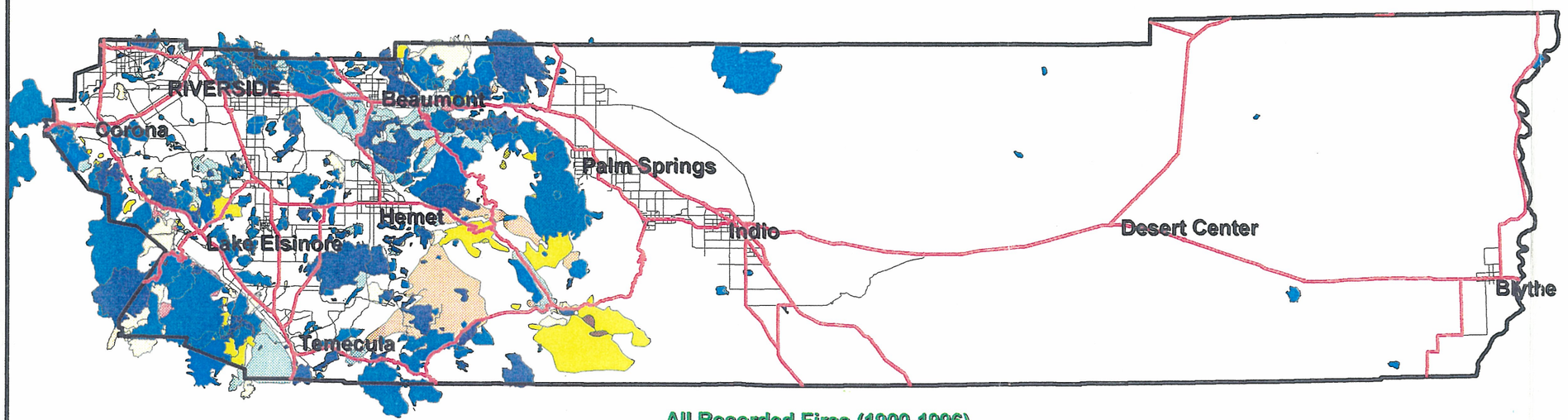
Recorded Fires (1925-1949)



Recorded Fires (1950-1974)



Recorded Fires (1975-1996)



All Recorded Fires (1900-1996)

Earth Consultants International

Year of Last Burn

- 1990-1996
- 1980's
- 1970's
- 1960's
- 1950's
- 1940's
- 1930's
- 1920's
- 1910's
- 1900's

Highways

Major Roads

Table 4-1: Twenty Largest California Wildland Fires (Ranked By Structures Lost)

Rank	Name *(Cause)*	Date	County	Acres	Structures Lost	Deaths
1	Tunnel *(Rekindle)*	Oct. 1991	Alameda	1,600	2,900	25
2	Paint *(Arson)*	Sept. 1990	Santa Barbara	4,900	641	1
3	Fountain *(Arson)*	Aug. 1992	Shasta	63,960	636	0
4	Berkeley *(Powerlines)*	Sept. 1923	Alameda	130	584	0
5	Bel Air *(Undetermined)*	Nov. 1961	Los Angeles	6,090	484	0
6	Laguna *(Powerlines)*	Sept. 1970	San Diego	175,425	382	5
7	Laguna *(Arson)*	Oct. 1993	Orange	14,437	441	0
8	Panorama *(Arson)*	Nov. 1980	San Bernardino	23,600	325	4
9	Topanga *(Arson)*	Nov. 1993	Los Angeles	18,000	323	3
10	49ER *(Burning Debris)*	Sept. 1988	Nevada	33,700	312	0
11	Sycamore *(Kite)*	July 1977	Santa Barbara	805	234	0
12	Kannan *(Arson)*	Oct. 1978	Los Angeles	25,385	224	0
13	Old Gulch *(Equipment Use)*	Aug. 1992	Calaveras	17,386	170	0
14	Kinneloa *(Campfire)*	Oct. 1993	Los Angeles	5,485	196	1
15	Mt. Tamalpais *(Smoking)*	July. 1929	Marin	2,500	117	0
16	**California *(Powerlines)***	**Oct. 1993**	**Riverside**	**25,100**	**107**	**0**
17	Harlow *(Arson)*	July 1961	Mariposa	41,200	106	2
18	Wright *(Burning Debris)*	Sept. 1970	Los Angeles	27,952	103	0
19	Hanly *(Smoking)*	Sept. 1964	Napa	52,770	102	0
20	Coyote *(Burning Debris)*	Sept. 1964	Santa Barbara	67,000	94	1

source: California Department of Forestry and Fire Prevention (CDF)

Table 4-2: Disaster Declarations Impacting Riverside County

Date	Affected Counties	Damage Summary
Fall '70	Declared: City of Oakland (Alameda County 9/24/70), Los Angeles, Ventura, San Diego (9/28/70), Kern (10/1/70), San Bernardino (10/2/70), Monterey, ***Riverside (10/20/70)***, San Bernardino (11/14/70)	Damage: public-$52,862,000; watershed-$24,826,000; private-$145,923,000 TOTAL-$223,611,000; 576,508 acres, 19 deaths, 722 bldgs.
December 1970	Declared: ***Riverside (12/22/70)***	Damage $3.2 million
November 1980	Declared: San Bernardino (11/25/80), Los Angeles, Orange, ***Riverside (11/18/80)***	Damage: public-$13,982,700; private-$50,812,500; TOTAL-$64,795,200. San Bernardino—65 buildings, 5482 acres destroyed, Additionally, 355 buildings, 41,472 acres destroyed.
August 1987	Declared: Colusa, Del Norte (9/10/87), Butte, Fresno, Humboldt, Inyo, Kern, Lake, Lassen, Mariposa, Mendocino, Modoc, Mono, Nevada, Placer, Plumas, ***Riverside***, San Bernardino, Shasta, Sierra, Siskiyou, Trinity, Tulare, Tuolumne (9/3/87)	Damage: $18 million (estimated); 1,070 fires. 534,661 acres burned, 835 sq. miles, 3 deaths (firefighters), 76 injuries (firefighters) 38 homes destroyed
June 1990	Declared: Los Angeles, Santa Barbara (6/28/90), ***Riverside***, San Bernardino (6/29/90)	Damage: $300 million+; 3 deaths (1 civilian, 2 firefighters), 89 injuries (46 civilians, 43 firefighters) 22,500 blackened acres, 492 homes destroyed, 28 apartments destroyed, 15 businesses and 10 public buildings destroyed, plus 30 additional structures.
October 1993	Declared: Los Angeles, Ventura (10/27/93), San Diego, Orange (10/27/93), ***Riverside (10/27/93)***, San Bernardino (10/28/93)	Damage: total property estimate-$1 billion; 4 deaths, 162 injuries, 1078 destroyed structures, 193,814 acres destroyed. Fires: arson (12), power lines (6), campfires (2)

source: California Governor's Office of Emergency Services

4.2 Fire Safety Regulations

The fire safety provisions denoted in the Safety Element should be prepared and adopted in conjunction with fire safety regulations issued by the State Board of Forestry (Irwin, 1989). Public Resources Code section 4290 requires minimum statewide fire safety standards pertaining to:

- Road standards for fire equipment access;
- Standards for signs identifying streets, roads, and buildings;
- Minimum private water supply reserves for emergency fire use;
- Fuel breaks and greenbelts.

With certain exceptions, all new construction after July 1, 1991 in potential wildland fire areas has been required to meet the statewide standards. The State requirements, however, do not supersede more restrictive local regulations.

As defined by the California Department of Forestry and Fire Protection (CDF), wildland areas may contain substantial forest fire risks and hazards. These areas are also called "State Responsibility Areas" (SRAs). They consist of lands exclusive of cities, and Federal lands regardless of ownership. The primary financial responsibility for preventing and suppressing fires belongs to the State. However, it is not the State's responsibility to provide fire protection services to any building or structure located within the wildlands unless the CDF has entered into a cooperative agreement with a local agency for those purposes pursuant to Section 4142 of the Public Resources Code. Wildland areas require disclosure for real estate transactions, and owners of properties in wildland areas are subject to the maintenance requirements of Section 4291 of the Public Resources Code.

Every fifth year beginning July 1, 1991, the CDF must provide maps identifying the boundaries of lands classified as SRAs to the Riverside County assessor. The CDF is also required to notify Riverside County of any changes to SRAs within the County resulting from periodic boundary modifications approved by the CDF.

Government Code Section 51178 specifies that the Director of the CDF, in cooperation with local fire authorities, shall identify areas that are Very High Fire Hazard Severity Zones (VHFHSZ) in Local Responsibility Areas (LRAs), based on consistent statewide criteria and the expected severity of fire hazard. This requirement is based on the Bates Bill (Assembly Bill 337, adopted September 29, 1992) that was initiated following the 1991 Oakland Hills "Tunnel" fire (Table 4-1). VHFHSZ consider fuel loading, slope, fire weather and other relevant factors. Under Assembly Bill 3819, passed in 1994 (AB 3819 – Willie Brown), "Class A" roofing, minimum clearances of 30 feet around structures, and other fire defense improvements are required for these zones.

Per Government Code Section 51178, a local agency may, at its discretion, exclude from the requirements of Section 51182 an area within its jurisdiction that has been identified as a VHFHSZ, if it provides substantial evidence in the record that the requirements of Section 51182 are not necessary for effective fire protection within the area. Alternatively, local agencies like Riverside County may include areas not identified as VHFHSZ by the CDF, following a finding supported by substantial evidence in the record that the requirements of Section 51182 are necessary for effective fire protection within the new area. According to Section 51182, such changes made by a local agency shall be final and shall not be rebuttable by the CDF.

During adoption of the 1997 Uniform Fire Code, the County of Riverside Board of Supervisors (1999) found that additional requirements and standards of fire hazard reduction were needed to properly protect the health, safety, and welfare of the existing and future residents and workers of Riverside County. They based these finding on:

- ***Climate***: Generally, Riverside County is arid. Annual rainfall varies from three inches in Blythe to over thirty inches in Pine Cove. Hot, dry Santa Ana winds are common and necessitate increased fire protection. Added protection includes but is not limited to, on-site protection such as sprinklers. On-site protection supplements normal Fire Department response, and provides immediate fire protection for life and safety of multiple-occupancy structures.

- ***Geography and Topography***: Riverside County includes deserts, mountains, brush-covered wildlands, and agricultural lands. Elevations range from three hundred feet below sea level (Salton Sea) to ten thousand feet above it. In areas of habitable land, slopes range from flat to 25% (*Slope measures variation from the horizontal. A flat terrain is 0% and a vertical cliff is a 100% slope.*). Traffic and congestion in urban areas, and great travel distances in rural and wildland areas, often hinder Fire Department response time. Thus, enhanced on-site protection for property occupants is necessary.

- ***Geology and Societal Realities***: Several major earthquake faults bisect the County, including the San Andreas, the San Jacinto and the Elsinore. Numerous minor active faults add to the hazard. There are many areas within Riverside County at risk from landslides, wind erosion, blowing sand, flooding, and wildfires. Most of these disasters can also be triggered by earthquakes. Placement of multiple-occupancy buildings, location of arterial roads, and State revenue limits all complicate fire department efforts. Locations of fire stations and numbers of staff may be insufficient to control fires in multiple locations simultaneously. Thus, enhanced on-site, built-in protection is necessary.

4.2.1 Real Estate Disclosure and Maintenance Requirements

Assembly Bill 6 (AB6) requires disclosure in real estate transactions for two types of fire hazard areas.

- *Wildland Areas that may contain substantial forest fire risks and hazards (Wildland Areas)*
- *Very High Fire Hazard Severity Zones (VHFHSZ)*

Thus, AB6 fire maps are prepared by the California Department of Forestry and Fire Prevention (CDF).

Civil Code Section 1103(c)(6) requires real estate sellers to inform prospective buyers whether or not a property is located within a Wildland Fire Area that could contain substantial fire risks and hazards. The latest update to these requirements occurred in 1999 with the passage of Assembly Bill 248 (Torlakson). This disclosure has actually been required for Wildland Fire Areas since 1990, pursuant to Public Resources Code (PRC) Section 4136. The State Board of Forestry identifies those lands where the California Department of Forestry and Fire Protection (CDF) has the primary duty for wildland fire prevention and suppression. Many people know these lands as "State responsibility areas" or "SRA" lands. The CDF sends maps to the affected counties, and county officials must post notices at the offices of the county recorder, the county assessor, and the county planning agency that explain where the CDF maps are available.

Current Real Estate disclosure requirements ask two yes or no questions concerning fire hazards, which are formatted as follows:

THIS REAL PROPERTY LIES WITHIN THE FOLLOWING HAZARDOUS AREA(S):

- A VERY HIGH FIRE HAZARD SEVERITY ZONE pursuant to Section 51178 or 51179 of the Government Code. *(The owner of this property is subject to the maintenance requirements of Section 51182 of the Government Code.)*
- A WILDLAND AREA THAT MAY CONTAIN SUBSTANTIAL FOREST FIRE RISKS AND HAZARDS pursuant to Section 4125 of the Public Resources Code. *(The owner of this property is subject to the maintenance requirements of Section 4291 of the Public Resources Code. Additionally, it is not the State's responsibility to provide fire protection services to any building or structure located within the wildlands unless the Department of Forestry and Fire Protection has entered into*

a cooperative agreement with a local agency for those purposes pursuant to Section 4142 of the Public Resources Code.)

This study's digital Wildfire Susceptibility Map (Plate 4-1) should replace the CDF mapping, as it provides more accurate and complete natural hazards disclosure in Riverside County, and thus provides current and future buyers of County real estate with an estimation of the wildland fire risk associated with the property.

The hillside terrain of the County of Riverside is predominantly mapped as having a substantial fire risk. Therefore, much of the County of Riverside is subject to Public Resources Code, Section 4291-4299, which requires property owners in these areas to conduct maintenance to reduce the fire danger. Public Resources Code, Section 4291-4299 affects any person who owns, leases, controls, operates, or maintains any building or structure in, upon, or adjoining any mountainous area or forest-covered lands, brush-covered lands, or grass-covered lands, or any land which is covered with flammable material. That person shall at all times do all of the following:

- Maintain around and adjacent to such building or structure a firebreak made by removing and clearing away, for a distance of not less than 30 feet on each side thereof or to the property line, whichever is nearer, all flammable vegetation or other combustible growth. This subdivision does not apply to single specimens of trees, ornamental shrubbery, or similar plants which are used as ground cover, if they do not form a means of rapidly transmitting fire from the native growth to any building or structure.

- Maintain around and adjacent to any such building or structure additional fire protection or firebreak made by removing all brush, flammable vegetation, or combustible growth which is located from 30 feet to 100 feet from such building or structure or to the property line, whichever is nearer. Grass and other vegetation located more than 30 feet from such building or structure and less than 18 inches in height above the ground may be maintained where necessary to stabilize the soil and prevent erosion.

- Remove that portion of any tree which extends within 10 feet of the outlet of any chimney or stovepipe.

- Maintain any tree adjacent to or overhanging any building free of dead or dying wood.

- Maintain the roof of any structure free of leaves, needles, or other dead vegetative growth.

- Provide and maintain at all times a screen over the outlet of every chimney or stovepipe that is attached to any fireplace, stove, or other device that burns any solid or liquid fuel. The screen shall be constructed of nonflammable material with openings of not more than one-half inch in size.

- A person is not required under this section to maintain any clearing on any land if that person does not have the legal right to maintain the clearing, nor is any person required to enter upon or to damage property that is owned by any other person without the consent of the owner of the property.

4.3 Development of a GIS Wildland Fire Susceptibility Map for Riverside County

As part of this study, a Geographic Information Systems coverage was developed for Riverside County that used vegetation, weather, slope and proximity to urbanization to estimate the relative susceptibility zones in a digital format (Figure 4-2). The GIS mapping is generally accurate to 1:100,000. The susceptibility zones are represented at 1:250,000 on Plate 4-1, and summarized on Figure 4-3. The zones on Plate 4-1 are defined as:

- Very High
- High
- Moderate
- Low
- Very Low
- None

One use of this map would be to restrict roofing material based on relative hazard. For example, "Type A" materials should be required in Very High, High and Moderate zones, while "Type B" materials can be required in Low, Very Low and None susceptibility zones. In addition, defense zones can be increased based on increasing fire hazard susceptibility. Plate 4-1 should replace existing maps (such as the CDF map described in 4.4.2), as Plate 4-1 provides a more accurate and complete hazard assessment for Riverside County.

Fire hazard potential was determined by evaluating vegetation density and type, slope, and their relation to urbanization. Vegetation data were obtained from the California Gap Analysis Project (CGAP) at the University of California Santa Barbara. These data consist of land coverage and vegetation information for the State of California, including canopy dominant species, canopy density, presence of regional endemic species, and inclusion of wetland habitats (Table 4-3). All reference and attribute information for this dataset may be found at this website:

http://www.biogeog.ucsb.edu/projects/gap/data/meta/landcovdd.html#section1

CGAP vegetation data were evaluated by identifying the primary, secondary and tertiary vegetation community types for each digital polygon and then rating the potential fire hazard based on fuel loading (Table 4-3), in accordance with the HUD Study System (1973) and the Bates Bill Process (AB337, 1992). These methods are described below.

Initial assignments of fuel hazard ratings for grasslands, shrublands, and woodlands consisted of light, medium, and heavy, respectively. The ratings were then normalized based on the primary, secondary and tertiary types of vegetation communities. Some data were further modified based on degree of urbanization and angles of slope (0-40%, 41-

60%, and over 60%). Increasing slope increases fire spreading potential. Modifications to the initial fuel hazard ratings produced seven fire hazard potential ratings of none, very low, low, moderate-low, moderate, high, and very high (Table 4-3).

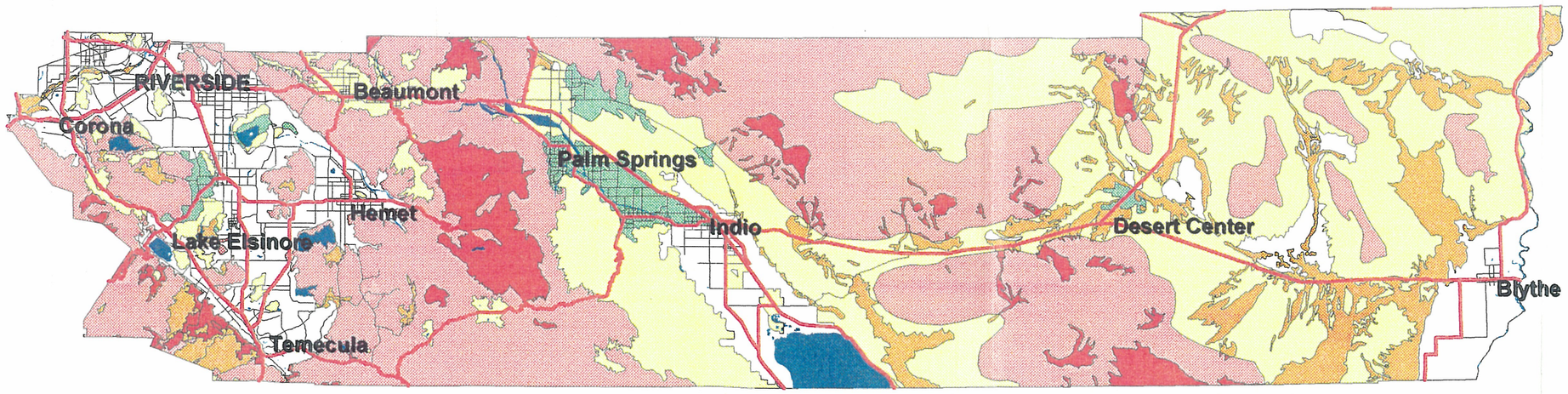
Figure 4-3:

Wildfire Susceptibility

Riverside County

California

(Summary of GIS Data, for additional detail see Plate 4-1 in-pocket)



Earth Consultants International

Wildfire Zones

- Very High
- High
- Moderate
- Low
- Very Low
- None

Water Bodies

- Lake, Pond, Sea

Highways

Major Roads

N

W E

S

Scale: 1:1,000,000

10 0 10 20 30

Miles

Table 4-3: Rating Systems Used for Development of GIS Map

VEGETATION DATA, LISTING BY CALIFORNIA GAP ANALYSIS PROJECT U.C. SANTA BARBARA	HUD* Study System	Bates* Bill Process	Wildfire Potential	Wildfire Potential Rating
URBAN OR BUILT-UP LAND	0	0	low	2
AGRICULTURAL LAND	0	0	low	2
ORCHARDS AND VINEYARDS	0	0	low	2
PERMANENTLY-FLOODED LACUSTRINE HABITAT	0	0	none	0
SANDY AREAS OTHER THAN BEACHES	0	0	none	0
BARE EXPOSED ROCK	0	0	none	0
STRIP MINES, QUARRIES AND GRAVEL PITS	0	0	none	0
DESERT DUNES	0	0	none	0
VENTURAN COASTAL SAGE SCRUB	8	2	high	4
VENTURAN COASTAL SAGE SCRUB	8	2	high	4
DIEGAN COASTAL SAGE SCRUB	8	2	high	4
RIVERSIDEAN SAGE SCRUB	8	2	high	4
SONORAN CREOSOTE BUSH SCRUB	8	2	low	2
SONORAN DESERT MIXED SCRUB	8	2	low	2
MOJAVE CREOSOTE BUSH SCRUB	8	2	low	2
MOJAVE MIXED WOODY SCRUB	8	2	low	2
MOJAVE MIXED STEPPE	8	2	moderate-low	3
MOJAVE MIXED WOODY AND SUCCULENT SCRUB	8	2	low	2
BLACKBUSH SCRUB	8	2	low	2
BIG SAGEBRUSH SCRUB	8	2	low	2
DESERT SALTBUSH SCRUB	8	2	low	2
SOUTHERN MIXED CHAPARRAL	8	2	high	4
CHAMISE CHAPARRAL(CHAMISAL)	8	2	high	4
REDSHANK CHAPARRAL	8	2	high	4
SEMI-DESERT CHAPARRAL	8	2	high	4
MIXED MONTANE CHAPARRAL	8	2	high	4
MONTANE CEANOTHUS CHAPARRALS	8	2	high	4
BUCK BRUSH CHAPARRAL	8	2	high	4
HOARY-LEAFED CHAPARRAL	8	2	high	4
BIG POD CHAPARRAL	8	2	high	4
SCRUB OAK CHAPARRAL	8	2	high	4
INTERIOR LIVE OAK CHAPARRAL	8	2	high	4
UPPER SONORAN MANZANITA CHAPARRAL	8	2	high	4
COASTAL SAGE-CHAPPARAL SCRUB	8	2	high	4
VALLEY NEEDLEGRASS GRASSLAND	1	1	very high	5
NON-NATIVE GRASSLAND	1	1	very high	5
ALKALI PLAYA	0	0	very low	1

VEGETATION DATA, LISTING BY CALIFORNIA GAP ANALYSIS PROJECT U.C. SANTA BARBARA	HUD* Study System	Bates* Bill Process	Wildfire Potential	Wildfire Potential Rating
COASTAL AND VALLEY FRESHWATER MARSH	1	2	low	2
SOUTHERN COAST LIVE OAK RIPARIAN FOREST	16	3	moderate-low	2
SOUTHERN COTTONWOOD-WILLOW RIPARIAN	16	3	moderate-low	2
DESERT DRY WASH WOODLAND	16	3	low	2
SOUTHERN SYCAMORE-ALDER RIPARIAN	16	3	low	2
MULE FAT SCRUB	8	2	moderate	3
COAST LIVE OAK WOODLAND	16	3	moderate-	3
DENSE ENGELMANN OAK WOODLAND	16	3	moderate-	3
MOJAVEAN PINYON AND JUNIPER WOODLANDS	16	3	moderate-	4
PENINSULAR PINYON AND JUNIPER WOODLANDS	16	3	moderate-	4
COAST LIVE OAK FOREST	16	3	moderate-	4
CANYON LIVE OAK FOREST	16	3	moderate-	4
COULTER PINE FOREST	16	3	high	4
BIGCONE SPRUCE-CANYON OAK FOREST	16	3	high	4
WESTSIDE PONDEROSA PINE FOREST	16	3	high	4
SIERRAN MIXED CONIFER FOREST	16	3	high	4
JEFFREY PINE-FIR FOREST	16	3	high	4
SOUTHERN CALIFORNIA WHITE FIR FOREST	16	3	high	4
SOUTHERN CALIFORNIA SUBALPINE FOREST	16	3	high	4
No secondary or tertiary type	0	0	NA	0

*: descriptions of the rating systems are summarized in the sections below, additional detail may be found at: http://www.prefire.ucfpl.ucop.edu

4.3.1 HUD Study System

As a result of concerns about fire hazards in California, in April of 1973 the California Department of Forestry and Fire Protection (CDF) published a study funded by the Department of Housing and Urban Development (HUD) under agreement with the Governor's Office of Planning and Research. As is often true, it came as a response to a disaster; in this case the September and October 1970 wildfires which burned more than 580,000 acres in 773 fires. The HUD study uses fuel loading, fire weather, and slope as rating factors.

Fuel loading includes three classes of vegetation based on U.S. Geological Survey (USGS) life forms. These types can easily be determined from USGS maps, and thus a fairly accurate determination of fuels can be made without undertaking a major vegetation mapping project. The vegetative types are considered accurate to the nearest acre.

Light fuels occupy the uncolored areas on the USGS maps and include flammable grass and annual herbs. *Medium* fuels are shown as "scrub" on the USGS maps and include brush and other perennial shrubs less than six feet tall and with a crown density of 20 percent or more. *Heavy* fuels are shown as "woods-brushwood" on the USGS maps and include the heavier brush species, woodland types, and timber types over six feet tall with a crown density of 20 percent or more. HUD weights fuel loading in these vegetative types as follows:

- *Light* (grass): average of 2.22 tons/acre; *Fuel Severity Factor* = 1
- *Medium* (scrub): average of 17.33 tons/acre; *Fuel Severity Factor* = 8
- *Heavy* (woods, brushwood): average of 36.96 tons/acre; *Fuel Severity Factor* =16.

The vegetative types are considered accurate to the nearest acre. This system was developed because the three types listed above could easily be determined from the USGS maps, and they represented a fairly accurate description of fuels found in California without having to undertake a major vegetation mapping project.

Fire Weather Severity is based on the California Wildland Fire Danger Rating System (CWFDRS). There are three classes of severity distinguished by the annual average frequency of critical fire weather days. To determine this, from June through December, fire weather ratings were analyzed in the State's 3 Fire Danger Rating Areas over a 10-year period. In the *Low* class (Class I) are Fire Danger Rating Areas which have experienced fire weather in the "very high" or "extreme" ranges an annual average of less than one day. In the *High* class (Class II) is an annual average of 1 to 9.5 days, and the *Extreme* class (Class III) has an annual average of more than 9.5 days. The fire weather severity weights are defined as follows:

- *Low*, Class I (<1 day per year); *Fire Weather Severity Factor* = 1
- *High,* Class II (1-9.5 days per year); *Fire Weather Severity Factor* = 2
- *Extreme*, Class III (>9.5 days per year); *Fire Weather Severity Factor* = 8.

To test the predictive powers of these ratings, analyses were made at 354 stations throughout California, in all 151 Fire Danger Rating Areas for the time period 1959-1969. During this time, there were 678 fires of 300 acres or more, and 75% of these occurred in Class III areas. For the 109 fires that burned at least 5,000 acres, 79% occurred in the same areas. HUD listed Fire Weather Severity for each of the USGS Quadrangle maps for California.

Slope: Like Fire Weather Severity, slope classes are taken from the CWFDRS. Each class covers a range of slopes: 0-40 percent, 41-60 percent, and over 60 percent. Because an increase in slope produces an increase in the rate of fire spread, slope often determines how a wildland fire is fought. The slope class weights are assigned as follows:

- *Class I* (>40%); *Slope Severity Factor* = 1.0
- *Class II* (41-60%); *Slope Severity Factor* = 1.6
- *Class III* (>60%); *Slope Severity Factor* = 2.0.

Once the severity factors are assigned to the fuel loading, fire weather, and slope classes the values are multiplied together to determine a numerical rating, the Fire Hazard Severity Scale. The fire severity hazard defined by the HUD Study System is as follows:

- Moderate Hazard, 1 - 12.8 Points
- High Hazard, 16 - 32 Points
- Extreme Hazard 51 - 256 Points.

Numerical gaps between categories exist because multiplying the factors does not produce all numbers. The slope can be either mechanically calculated or automatically calculated with a software program containing the USGS Quadrangle data (e.g. TopoScout©).

4.3.2 Bates Bill Process

The Bates Bill Process determines Very High Fire Hazard Severity Zones (VHFHSZs) in Local Responsibility Areas (LRAs). Assembly Bill 337 (the Bates Bill) was a direct result of the great loss of lives and homes in the Oakland Hills Tunnel Fire of 1991. It gave the California Department of Forestry and Fire Prevention (CDF) the responsibility-but not the resources-to map Very High Fire Hazard Severity Zones (VHFHSZs). The CDF formed a working group, comprised of State and local representatives. They devised a weighting system that considered fuel, slope, weather, and dwelling density. The raters were usually one local representative and one CDF or County representative. They could reduce the score by one point for certain mitigation measures, and increase the score one point for certain factors known to contribute to fire spread. Scores can range from 1-16 points. To qualify as a Very High Fire Hazard Severity Zone (VHFHSZ), an area had to score 10 or more points. The recommended system was given extensive field tests by different members of the working group before implementation. A copy of the rating form is found in Table 4-4 below.

4.3.2.1 Classification Points for Basic Factors

A. Fuel: A Fuel Hazard Rating is assigned based on the predominant fuel type.

- Small, light fuels (Grass, Weeds, Shrubs) +1
- Medium fuels (Brush, Large Shrubs, Small Trees) +2
- Heavy fuels (Timber, Woodland, Large Brush, Heavy Planting of Ornamentals) +3.

B. Topography—Slope: A Slope Hazard Rating is chosen to best represent the predominant slope range.

- Flat to Mild Slope (0-9.9%) +1
- Mild to Medium Slope (10-19.9%) +2
- Medium to Moderate Slope (20-39.9%) +3
- Moderate to Extreme Slope (40% +) +4.

C. Dwelling Density: Local ordinances regarding dwelling density must be checked before setting this factor.

- Low (less than one structure per 10 acres) +1
- Medium (one structure per 5 to 10 acres) +2
- High (one structure per 0 to 5 acres) +3.

D. Weather: This information is obtained for each county by using the Burning Index (BI). Weather is a major part of the BI system, BI data come from weather stations throughout the state.

- Moderate +1
- High +2
- Very High +3.

For these basic factors, points can range from 4 to 13 points. Ten (10) or more points are required to designate a Very High Fire Hazard Severity Zone.

4.3.2.2 Additional Weighting Factors

Downgrading Hazard: A local agency may use the mitigation measures outlined below to reduce a zone's rating:

- Infrastructure—meets or exceeds minimums of ISO 8, NFPA 1231, PUC 103, or PRC 4290 -1
- Ordinances in place regarding housing, roofing (Class A, B, or better roof), sprinklers, firesafe construction, or fuel modification. -1
- PRC 4291 ordinance or better (Natural Resource Protection) -1.

Upgrading Hazard:

- Rough topography with steep canyons or draws that would impede responding personnel and equipment. +1
- Area with a history of relatively high fire occurrence, because of heavy lightning, railroad fires, debris burning, arson, etc. +1
- Area subject to severe fire weather (such as strong winds and lightning) or recurring seasonal weather patterns that can increase fire activity (such as the Santa Ana winds) +1
- Heavy concentration of flammable ornamentals or vegetation introduced by humans +1.

The various factors are tallied on the form illustrated in Table 4-4 to determine whether or not an area is a Very High Fire Hazard Severity Zone.

Table 4-4: Sample Form for Bates Bill Process Determination of Very High Fire Hazard Severity Zone.

TOTAL POINTS_____
VERY HIGH FIRE HAZARD SEVERITY ZONE ? YES / NO
DESCRIPTION OF ZONE:
1. LATITUDE AND LONGITUDE_____
2. TOWNSHIP, SECTION, RANGE_____
3. NARRATIVE OF ZONE_____
_____
_____
DATE_____
SIGNATURE OF RATER_____

The Bates rating system could be adopted as is, or with minor modifications, in most of California. The fuel types are easy to determine using the descriptions provided. The slope can be ascertained with field work or maps from planning departments, the USGS of the CDF. The minimum size of the rated area could be reduced from 640 acres to, say, 320 acres, or even the size of a subdivision. The weather component could be adjusted to reflect local conditions rather than county-wide conditions. Currently some coastal areas get rated too high and other areas, too low. Of greater concern is subjectivity in the rating process. For example, in Riverside County the most recent CDF map (January 6, 2000) illustrates very few VHFHSZs, yet it identifies VHFHSZs in areas which this study rates as having no susceptibility. However, topography and weather could be mapped using remote sensing to increase objectivity and thus uniformity.

Although the Bates system can make hazard maps that are useful to individual jurisdictions, and has the advantage of being applicable statewide, a large number of local agencies decided not to acknowledge it. Thus the actual number of Very High Fire Hazard Severity Zones is much higher than total provided as part of the original Bates review.

4.4 Previous Fire Hazard Maps for Riverside County

In addition to the comprehensive County map done for this study, two other fire hazard maps exist for the western portion of Riverside County.

4.4.1 Environmental Hazards Map for Riverside County

The ***Environmental Hazards Map*** for Riverside County, dated June 10, 1997, scale 1"=6 miles, was prepared by the County of Riverside, Transportation and Land Management Agency. This map illustrates "Highfire Areas" for the portion of Riverside County west of the Coachella Valley, and is cited by the County Board of Supervisors in the adoption of Ordinance 787, the amended 1997 Uniform Fire Code (Riverside County, 1999). The map is applicable to real estate disclosure requirements for fire hazards, but does not include a more detailed severity ranking.

Riverside County (1999) amended the 1997 Uniform Fire Code to define "Hazardous Fire Areas". The Hazardous Fire Areas are delineated on the Environmental Hazards Map and defined as land which is covered with grass, grain, brush, or forest, whether privately or publicly owned, which is so situated or is of such inaccessible location that a fire originating upon such land would present an abnormally difficult job of suppression or would result in great and unusual damage through fire or resulting erosion. Such areas are designated on the maps entitled "Hazardous Fire Areas of Riverside County" on file in the office of the Fire Chief (County of Riverside, Transportation and Land Management Agency, 1997). The hazardous fire areas shall be reviewed from time to time to determine whether any changes in classification are appropriate.

4.4.2 California Department of Forestry and Fire Protection Fire Hazard Mapping

The California Department of Forestry (CDF) and Fire Protection Map of West Riverside County, ***Natural Hazard Disclosure (Fire)***, dated January 6, 2000, available from http://www.fire.ca.gov/ab6/ab6lst.html in Arcview© or Adobe Acrobat© formats. It defines "Wildland Areas" and "Very High Fire Hazard Severity Zones" within the western portion of Riverside County including the Coachella Valley.

4.5 Prefire Management

Over time, all California's wildlands *will* burn. Just as certainly, there are conditions and behaviors that will increase the likelihood that fires will occur; that will make them larger, more intense and more damaging, and thus more costly to fight; and that will take a higher toll. Not all of these factors can be controlled, but most can be anticipated and mitigated.

Riverside County's extreme diversity and complex patterns of land use and ownership require equally diverse and complex techniques to effectively manage the fire environment. Some options fall under the jurisdiction of State, Federal and local governments; others fall to private citizens or businesses; most are joint responsibilities. Custom strategies can be created through combinations of prefire management, suppression, and postfire management. They should lessen the costly impacts of future wildfires. As a starting point, the California Department of Forestry and Fire Prevention (2000) prefire management initiative includes a systematic application of risk assessment, fire safety, fire prevention and fire hazard reduction techniques.

The County has many fire fighting allies. For example, numerous Federal Agencies have roles in fire hazard mitigation, response and recovery, including:

- Fish and Wildlife Service
- National Park Service
- U.S. Forest Service
- Bureau of Land Management
- Bureau of Indian Affairs
- Office of Aviation Services
- National Weather Service
- National Association of State Foresters.

4.5.1 Fire Prevention

Firefighters often repeat that "it is not if, but when, fire will burn through an area, and, there are not enough fire engines to protect every house". Therefore, firefighters need help in reducing the fire danger.

Comprehensive programs to reduce fire risk and hazard consist of engineering, education and law enforcement contributions. Of key importance is a planning process focused on ignition management and loss reduction. Tactics include biomass harvesting, fire resistant landscaping, mechanical and chemical fuels treatments, building construction standards, infrastructure, and land use planning.

The single most important mitigation strategy for structures is fire- safe landscape, which creates a defensible space around structures.

4.5.2 Vegetation Management

Before European settlement began, vegetation in California's Mediterranean climate was dominated by a complex succession ecology of more, smaller and less damaging wildfires. The evolution of fire suppression since then has produced these results:

- Increased losses to life, property, resources and ecology.
- Difficulty of fire suppression, increased safety problems for firefighters and reduced productivity by fire crews on perimeter lines.
- Longer periods between recurring fires in many vegetation types by a factor of 5 or more.
- Increased volumes of fuel per acre.
- Increased fire intensities.
- Increased taxpayer costs and asset losses.

Recognition of these problems has led to vegetation management programs.

Since 1981, prescribed fire has been the primary means of fuels management. Approximately 500,000 acres — an average of 30,000 acres a year — have been treated with prescribed fire under the vegetation management program throughout the State. However, a recent program review by the CDF has identified needed changes, with focus on citizen and firefighter safety and the creation of wildfire safety and protection zones.

In the past, the typical vegetation management project targeted large wildland areas without assessing all of the values protected. Now, increasing population and development often preclude the use of large prescribed fires. The CDF proposes:

- A shift in emphasis to smaller projects closer to new developments, and to alternatives to fire, such as mechanical fuel treatment. In some instances, programs may be limited to providing wildland safety and protection zones around high value assets.

- Emphasis on quality over quantity of acres treated. Projects will be chosen to provide the most cost-effective means of protecting assets at risk from disastrous wildfires.

- The Board of Forestry and the State Air Resources Control Board will develop a joint policy on the use of prescribed fire. The policy will recognize the value of prescribed fire in reducing air emissions of wildfire during the high-impact summer period.

4.5.3 Fire-Safe Construction and Land Use Planning

The ultimate objectives of fire-safe planning and construction are to (1) improve the ability of communities and other high-value assets to survive a large, high-intensity wildfire with minimal fire suppression effort and (2) provide for improved citizen and firefighter safety.

State and local authorities must implement clearance laws, zoning, and related fire safety requirements that address these factors:

- **Fire-resistant construction standards**: The increases in people and structures provide extra ignition sources for fire which can spread into nearby wildland. Building construction standards for such items as roof covering, opening protection and fire resistant materials must protect the structure from external fires *and* contain internal fires for longer periods.

- **Hazard reduction near structures (defensible space)**: Emphasis should be on defensible space that provides natural landscape compatibility with wildlife, water conservation and ecosystem health. Immediate benefits of this approach include improved aesthetics, increased health of large remaining trees and other valued plants, and enhanced wildlife habitat.

- **Infrastructure**: Effective fire protection cannot be accomplished solely through the acquisition of equipment, personnel and training. The area's infrastructure also must be considered, including adequacy of nearby water supplies, routes or throughways for fire equipment, addresses and street signs, and maintenance.

4.5.4 Greenness Mapping

Since the early 1990's, the EROS Data Center (EDC) in Sioux Falls, South Dakota, has produced weekly and biweekly maps for the 48 contiguous states and Alaska. These maps display plant growth and vigor, vegetation cover, and biomass production, using multispectral data from satellites of the National Oceanic and Atmospheric Administration (NOAA). EDC also produces maps that relate

vegetation conditions for the current 2-weeks to average (normal) 2-week conditions during the past 7 years. EDC maps provide comprehensive growing season profiles for forests, rangelands and grasslands, and agricultural areas. With these maps, fire and land managers can assess the condition of all vegetation throughout the growing season, which improves planning for fire suppression, scheduling of prescribed burns, and study of long-term vegetation changes resulting from human or natural factors.

4.5.5 Fire Potential Index

The Fire Potential Index (FPI) is a valuable fire management tool that has been collaboratively developed by the U.S. Geological Survey and U.S. Forest Service. The FPI characterizes relative fire potential for forests, rangelands, and grasslands, regionally and locally. It combines multispectral satellite data from NOAA with geographic information system (GIS) technology to generate 1-km resolution fire potential maps. Input data include the total amount of burnable plant material (fuel load) derived from vegetation maps, the water content of the dead vegetation, and the fraction of the total fuel load that is live vegetation. The proportion of living plants is derived from the greenness maps described above. Water content of dead vegetation is calculated from temperature, relative humidity, cloud cover, and precipitation. The FPI is updated daily to reflect changing weather conditions.

Fire management staffs in California use the FPI daily to supplement traditional information sources. They use these data to establish regional prevention priorities that will reduce the risk of wildland fire ignition and spread; and to improve the allocation of suppression forces, which can lead to quicker control of fires in areas of high concern.

4.5.6 Riverside Fire Laboratory

An excellent local resource for Riverside County is the Riverside Fire Laboratory (RFL) of the U.S. Forest Service. Located in the city of Riverside, the laboratory researches:

- Air Pollution and Climate Impacts on Western Forest Ecosystems
- Meteorology for Fire Severity Forecasting
- Wildland Recreation and Urban Cultures

- Prescribed Fire and Fire Effects
- Fire Management in the Wildland/Urban Interface.

Good fire management planning requires fire weather predictions on time scales ranging from hours to months. Fire weather forecasts that extend beyond a few days are generally unavailable. However, research at the RFL aims to provide forecast tools for the medium-range (10-15 days), extended-range (30 days), and seasons (90 days). Because the accuracy of weather forecasts varies with season, location, and other factors, the RFL is exploring the addition of forecast reliability maps.

Monthly fire weather forecasts provide fire managers with a quick and easy planning tool. Although scientifically based, these long-range forecasts are inherently less accurate. Thus, the user must consider the impact of variable forecast accuracy. Also, average weather conditions may vary rapidly over short distances, as happens in complex terrain. The scale of these forecasts may be too coarse to capture such variations accurately.

The RFL is developing a computer model to help minimize risk to structures from wildland Fires. Houses in areas of flammable wildland fuel are often not located, constructed, or maintained to minimize the risk posed by wildfires in surrounding vegetation. The model assesses the potential for structures to ignite from wildland fire. The model is based on site-specific characteristics, surrounding fuels, and the planned or existing structure. Information from this assessment will help guide developers and home owners in the construction, maintenance and protection of homes in wildlands.

The RFL is investigating methods to forecast management impacts. Fire and resource managers must make decisions based on the complex interaction of resource, environmental, social, political, economic, and fire behavior parameters. Technology such as geographic information systems, expert systems, risk analysis, and modeling methods allows us to improve the availability and test the usefulness of complex data. The RFL is investigating how population growth and changes in land use patterns will affect fire management. The objective is to improve future zoning, residential development, fuels management, and planning.

4.5.7 Prescribed Fire

Fire ecologists now recognize that fire is as vital to the health of a forest as water. They have suggested that crown fires -- the spectacular tree-consuming infernos that make headlines -- should be intentionally set in wilderness areas to help restore a healthier patchwork of trees of different ages. Yet many find the notion of "prescribed fire" difficult to accept. For the last 100 years, humans have suppressed and battled fires. As a result, more acres will someday burn in uncontrollable blazes, or die of disease, unless fire is reintroduced to the landscape in measured doses with carefully crafted goals.

A prescribed fire is deliberately set under controlled and monitored conditions. The purpose is to remove brush and other undergrowth that can fuel uncontrolled fires. Prescribed fire is used to alter, maintain or restore vegetative communities, achieve desired resource conditions, and to protect life, property, and values that would be degraded by wildland fire. Prescribed fire is only accomplished through managed ignition and should be supported by planning documents and appropriate environmental analysis.

Prescribed fire carries its own risk, as recent experiences in New Mexico and Arizona prove. The Cerro Grande fire began when a prescribed burn escaped destroying several hundred homes in Los Alamos, New Mexico and burned more than 50,000 acres. It will likely lead to revisions of guidelines for performance of prescribed burns. An interagency investigative team will assist in understanding what went wrong and in determining whether current prescribed fire policy and procedures are sound.

The Bureau of Land Management (2000) recommends the following guidelines for prescribed burn projects:

- The safety of firefighters and the public is the number one priority when planning and implementing a prescribed fire project.
- All prescribed fire projects should have an approved prescribed fire plan prior to ignition.
- All prescribed fire plans should contain measurable objectives, a predetermined prescription, and an escaped fire contingency plan to be implemented in the event of an escape.
- All prescribed fire projects should be conducted in compliance with Federal and State regulations.

Based on Bureau of Land Management (2000) standards, three prescribed fire complexities are possible. Each may require different procedures, precautions, and numbers of assigned personnel:

- **High**: Prescribed fires (other than pile burning) in the wildland/urban interface. The wildland/urban interface is more than a area or zone where structures meet or intermingle with wildland fuels. It is a set of conditions where structures and/or other improvements are reasonably within the reach of an escaped prescribed fire. This determination must take into account fuel type, fire behavior prescription, topography and containment opportunities.

- **Moderate:** All aerial ignitions must be classified as at least moderate complexity.

- **Low:** These types of operations typically would require few personnel, have a very low threat of escape, and present a minimal risk to the people involved in the operation.

4.5.8 Hazardous Fire Area Designation

Based on drought and other conditions, it may become necessary to close an area to the public due to extreme fire hazard potential. Riverside County (1999) outlines the procedures for "Hazardous Fire Area Designation" as follows:

> The chief is given the authority to officially determine and publicly announce the closure of any hazardous fire area or portion thereof. However, any closure by the chief for a period of more than fifteen (15) days must be approved by the Board of Supervisors within fifteen (15) days of the chief's original order of closure. No person is permitted in any hazardous fire area, except on public roadways and inhabited areas, during such time as the area is closed to entry. This shall not prohibit residents or owners of private property within any closed area, or their invitees, from going in or being upon their lands. This does not apply to any entry, in the course of duty by a peace officer or any other duly authorized public officer, member of any fire department, or member of the U.S. Forest Service or California Department of Forestry and Fire Protection, nor does it apply to National Forest Land in any respect. During periods of closure, the chief shall erect and maintain at all entrances to the closed areas sufficient signs giving adequate notice of closure.

4.5.9 Hazard Abatement Notices

Each spring, the California Department of Forestry and Fire Protection (CDF) and Riverside County Fire Department distribute hazard abatement notices. These notices, which currently go to about 30,000 County citizens, request that property owners reduce the fuels around their property. Requirements for hazard reduction around improved parcels (those with structures) are set forth in Riverside County Ordinance No. 787, and Public Resources Code Section 4291. A minimum 30 foot clearance is required around all structures, which can be extended to 100 feet in areas where severe fire hazard exists. On unimproved parcels as set forth in Riverside County Ordinance No. 695, the property owner is required to disc or mow 100 feet along the perimeter of the property.

4.5.10 Fire Flow

Riverside County uses the Uniform Fire Code, Division III, Appendix III-A for establishing fire flow, duration and pressure requirements for fire flow. The requirements are a function of building size, type, material, purpose, location, proximity to other structures, and the type of fire suppression systems installed. The various water districts in the County are required to test fire protection capability for the various land uses per the flow requirements of the Uniform Fire Code (Table 4-5).

Table 4-5: Uniform Fire Code Minimum Fire Protection Flows

Land Use	Flow (gallons per minute)	Duration (hours)	Fire Suppression Storage (million gallons)	Residual Pressure (psi)
Residential Single-Family	2,000	4	0.48	20
Residential-Estate, Single Family Frontier	2,500	4	0.60	30
Residential Multi-Family	3,000	4	0.72	20
Commercial/Industrial	4,000	4	0.96	20
Schools	3,500	4	0.84	20

Emergency Storage is required in the event of an interruption of the Metropolitan Water District (MWD) primary supply. MWD recommends a seven day emergency storage supply.

4.5.11 Model Fire Hazard Reduction Ordinance

To assist local jurisdictions in adopting ordinances to reduce fire hazard, the State Fire Marshal, Fire Engineering Division has developed a model ordinance checklist. This development was required by Assembly Bill 3819, on September 27, 1994. The model ordinance checklist addresses the following standards:

- Road Standards for Fire Equipment Access (Table 4-6)
- Structural Standards (Table 4-7)
- Fuel Modification Standards (Table 4-8).

Table 4-6: Road Standards for Fire Equipment Access

Width	Two 9' lanes
Surface	40,000 lb. Load
Grades	Not to exceed 16%
Horizontal Inside Radius	No less than 50'
Vertical Curves	100'
Turnarounds	Required, 40' from center
Hammerhead/"T"	Top of "T" 60' long
Turnouts	10' x 30'
	25' taper each end
Roadway Structures (Bridges)	Load and clearance per Vehicle Code Sections 35550, 35750, 35250
Bridge Signage	Load, clearance, one-way, single lane
One-way Roads	One 10' lane
	Must connect to 2 lanes at each end
	Serve no more than 10 dwellings
	Not to exceed 2640'
	Turnout at midpoint
Dead-end Roads	Not to exceed:
<1 acre parcels	800'
1-4.99 acre parcels	1320'
5-19.99 acre parcels	2640' with turnaround at 1320' interval
20+ acre parcels	5280' with turnaround at 1320' intervals
Driveways	10' wide, 15' vertical clearance
If >150' but <800'	Turnout at midpoint
If >800'	Every 400'
If >300'	Turnaround w/in 50' of all building sites
Gate Entrances	2' wider than lane
	30' from roadway

developed by the Office of the State Fire Marshal, Fire Engineering Division

Table 4-7: Structural Standards

Eaves	1 hour fire rated
	Fascias required, must be backed by 1 hour or 2" lumber
Roofs	Class B or better
Underfloor Areas	Enclosed to ground
Exception	If exposed materials are 1 hour rated
Unenclosed Accessory Structures	Non-combustible or 1 hour rated
Exception (If 100' defensible space)	patio roofs > 2"x4" or open lattice > 2"x2" is OK
Underfloor Areas (Attached Structure)	If over a descending slope, enclose within 6" of ground
Windows	Tempered or multi-layered glass
Doors	Non-combustible or solid core > 1-3/4"
Attic Openings	Not to exceed 144 square inches
	Noncombustible corrosion-resistant mesh < 1/4" holes
	Not to be in soffits, eave overhangs, etc.
	Gable/dormer vents 10' from property line
Walls	Any habitable space must be 1 hour rated
Underfloor Areas (Detached Structure)	If over a descending slope, enclose within 6" of ground

Table 4-8: Model Ordinance Checklist, Fuel Modification Standards

Clearance (Structure)	30' on each side or to property line
Additional Clearance	30'-100' when needed
Trees	10' from chimney
Dead or Dying Wood	Remove if overhangs structure
Accumulated Vegetation	Clear roof
Chimney and Stovepipe	Screen <½" holes
Setback If >1 acre	30'
If <1 acre	Same practical effect
Disposal	Prior to acceptance
Greenbelts	Locate strategically-must be approved

developed by the Office of the State Fire Marshal, Fire Engineering Division

4.6 Earthquake-Induced Fires

Fires following earthquakes can cause severe losses. These losses can sometimes outweigh the total losses from direct damage (such as collapse of buildings). The most dramatic United States example occurred when much of San Francisco was destroyed by fire following the 1906 earthquake.

Many factors affect the severity of fires following an earthquake, including ignition sources, types and density of fuel, weather conditions, functionality of water systems, and the ability of fire-fighters to suppress the fires. Casualties, debris and poor access can all limit fire-fighting effectiveness. Water availability in Riverside County following a major earthquake would likely be curtailed due to breaks in water lines across faults, in liquefiable regions and in areas susceptible to landslides. (See Chapter 1 – Earthquake Hazards.) In addition, above-ground reservoirs are vulnerable and damage to them would also affect fire flow.

Earthquake-induced fires make extraordinary demands on fire suppression resources because of multiple ignitions (as discussed in 4.1). The principal causes of earthquake-related fires are open flames, electrical malfunctions, gas leaks, and chemical spills. Downed power lines may ignite fires in the unlikely event the lines do not automatically de-energize. Unanchored gas heaters and water heaters are common problems, as these readily tip over during strong ground shaking. State law now requires new and replaced gas-fired water heaters to be immobilized.

The California Division of Mines and Geology Newport-Inglewood Earthquake Scenario (Toppozada and others, 1988) indicates that fire units should prepare for thousands of damaged and leaking mains, valves, and service connections including broken pipelines. These will occur along, and adjacent to, fault rupture. The Southern California Gas Company has prepared by replacing distribution supply pipelines with resistant (flexible) plastic polyethylene pipe, and has an overall ability to isolate and shut off sections of supply lines when breaks are serious.

4.6.1 Natural Gas Fires -- Northridge Earthquake

The moderately-sized, M_W 6.7 Northridge earthquake of 1994 caused were 15,021 natural gas leaks. In the aftermath of the earthquake, 122,886 meters were closed by customers or emergency personnel. The majority of the leaks were small and could be repaired at the time of service restoration. The Southern California Gas Company (1994) reported 35 breaks in its natural gas transmission lines and 717 breaks in distribution lines. About 74% of its 752 leaks were corrosion related.

Natural gas leaks in the Southern California Gas Company service area resulted in three street fires, 51 structure fires (23 of these caused total ruin) and the destruction by fire of 172 mobile homes. In one incident, the earthquake severed a 22-inch transmission line and a motorist ignited the gas while attempting to restart his stalled vehicle. Response to this fire was impeded by the earthquake's rupture of a water main. Five nearby homes were destroyed. Elsewhere, one mobile home fire started when a ruptured transmission line was ignited by a downed power line. In many of the destroyed mobile homes, fires erupted when inadequate bracing let them fall from foundations, severing gas lines and igniting fires. There was a much greater incidence of mobile home fires (49.1 per thousand) than other structure fires (1.1 per thousand). Earthquake-induced fires greatly threaten Riverside County, in part due to the County's large number of mobile homes.

4.6.2 Earthquake-Induced Fire Scenarios for the Riverside County Area using HAZUS

HAZUS™, a standardized methodology for earthquake loss estimation based on a geographic information system (GIS), is a project of the National Institute of Building Sciences, funded by the Federal Emergency Management Agency (FEMA). HAZUS, and the earthquake threat to Riverside County, are discussed at length in Chapter 1 – Earthquake Hazards. This section reports on earthquake-induced fire loss estimation made with HAZUS.

Loss estimation is an invaluable tool, but must be used with discretion. Loss estimation results are best taken as broad indications of a disaster's severity. For example, a fire station with 60% functionality has clearly fared better than one at 30% functionality, but that 30% is probably equivalent to one at 20%.

Loss estimation is a new methodology. Our data and thus understanding of fires following earthquakes are limited. Furthermore, a fully accurate, fire-following-earthquake evaluation requires extensive knowledge of the level of readiness of local fire departments, as well as the types and availability (functionality) of water systems. For all these reasons, there will undoubtedly be future improvements in forecasting ability.

Based upon current data and best judgment, it is estimated that about 70% of all earthquake-induced fire ignitions occur immediately, as the fire is discovered within a few minutes of the earthquake. The remaining ignitions occur about an hour to a day after the earthquake. A typical cause of later ignitions is the restoration of electric power. When power is restored, short circuits caused by the earthquake

become energized and can start fires. Also, items which have overturned, fallen onto stove tops, etc., can ignite. If no one is present at the time electric power is restored, ignitions can grow to fires requiring fire department response.
HAZUS loss estimations were made using two scenario earthquakes, listed in Table 4-9 and described in Chapter 1. Two wind velocities were used for each scenario earthquake. A velocity of 30 miles per hour (mph) was assigned to evaluate fire spread as a result of Santa Ana winds. A value of 10 mph was used to model normal wind conditions.

Table 4-9: Scenario Earthquakes for Riverside County

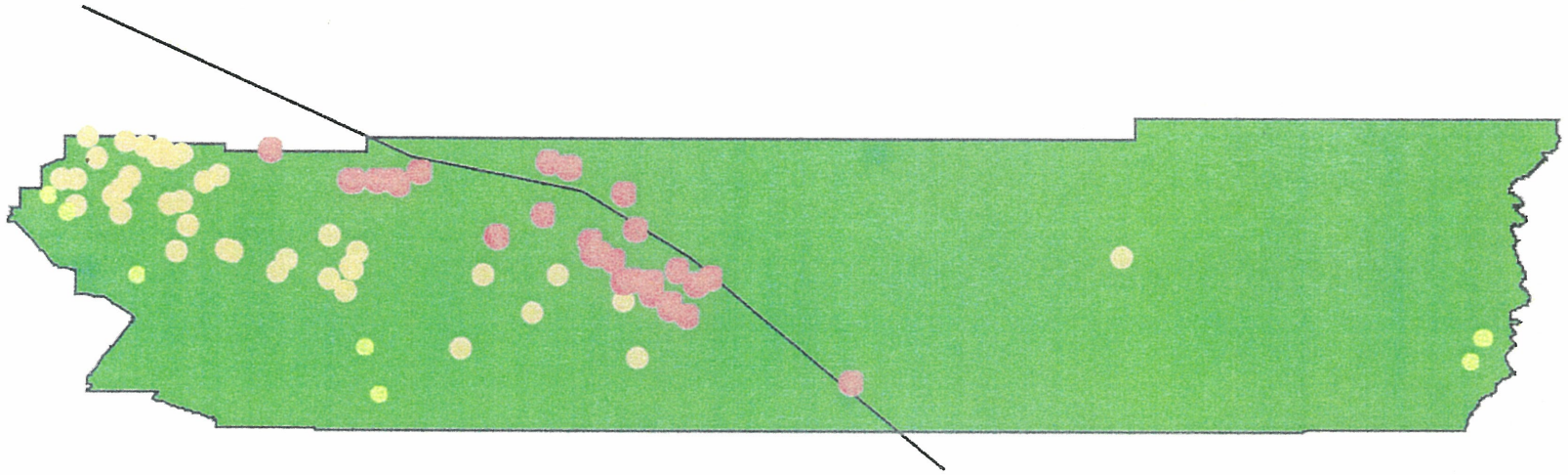
Event	Location	Size	Description
Maximum Credible Earthquake (MCE)	San Andreas fault	M_W 7.9	Based on a rupture of the entire segment between Cajon Pass and the Salton Sea (probably the worst-case scenario for Riverside County, see Chapter 1)
Maximum Probable Earthquake (MPE)	San Jacinto fault, San Jacinto Valley segment	M_W 6.9	Rated most likely fault segment in southern California to produce a large earthquake (44% probability in 30 years, see Chapter 1)

A summary of loss estimation results is presented In Table 4-10. Note that Santa Ana wind conditions cause a substantial, 4- to 6-fold increase in losses. For each scenario earthquake, the relative likelihood of emergency response facilities to be exposed to at least moderate damage is illustrated on Figures 4-4 and 4-5.

An estimate of County-wide fire station functionality is included in Table 4-10. Estimates for the functionality at each station in the HAZUS database are presented in Table 4-11. Here, functionality is based entirely on building damage due to estimated peak ground accelerations at each station. Note that the HAZUS loss estimation does not consider effects of reduced water pressure due to breaks in the water distribution system. These are expected to be widespread where ground failure occurs, such as due to fault rupture or liquefaction, and could further reduce functionality at some stations.

While the fire station database requires updating, the functionality estimates provide credible guidelines for response planning and exercises.

Probability (in %) of at least moderate damage as a result of a Mw 7.9 Southern San Andreas Earthquake



Map Explanation

Riverside County Boundary

San Andreas Fault

Probability of Moderate Damage

0-35%

35-65%

65+%

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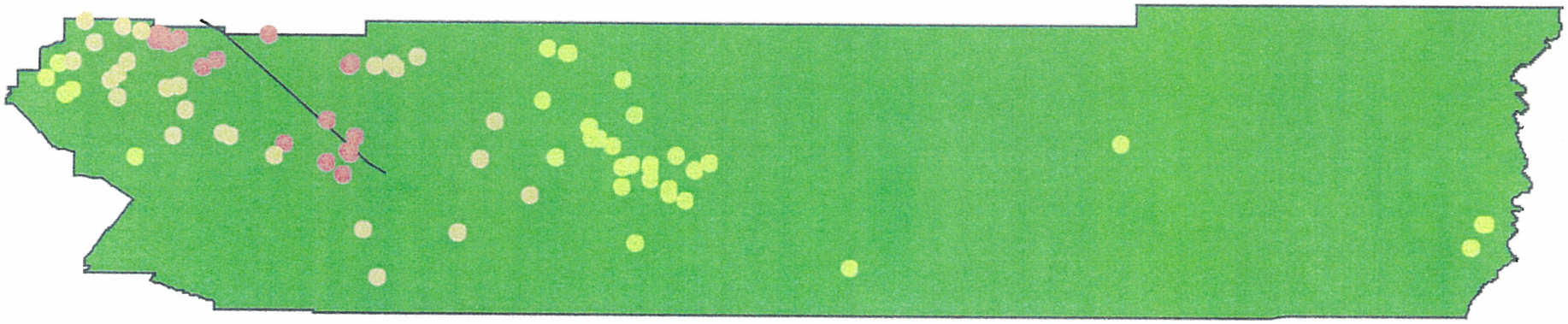
Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

Emergency Response Facility Damage Based on Mw 7.9 San Andreas Scenario Earthquake

Figure 4 - 4

Probability (in %) of moderate or greater damage as a result of a Mw 6.9 San Jacinto Valley Earthquake



Map Explanation

Riverside County Boundary

San Jacinto Valley Fault

Probability of Moderate or Greater Damage

- 0-13%
- 13-32%
- 32+%

Earth Consultants International

Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

Emegency Response Facility Damage Based on Mw 6.9 San Jacinto Valley Scenario Earthquake

Figure 4 - 5

Table 4-10: Earthquake Induced Fire Losses in Riverside County HAZUS Scenario Earthquakes

Event	No. of Ignitions	Population Exposed *(Wind Velocity of 10 mph)*	Population Exposed *(Wind Velocity of 30 mph, Santa Ana Conditions)*	Value Exposed *(Wind Velocity 10 mph)*	Value Exposed *(Wind Velocity 30 mph, Santa Ana Conditions)*	Fire Station Functionality*
Mw 7.9 San Andreas Earthquake	74	832	3,663	$50,713,000	$209,658,000	25%
Mw 6.9 San Jacinto Earthquake	43	358	2,225	$18,640,000	$116,238,000	44%
*: estimate of County-wide fire station functionality at 24 hours after earthquake						

Table 4-11: Estimated Functionality (in percent) of County Fire Response Facilities Based on Scenario Earthquakes at One Day After Event

NAME/LOCATION	San Jacinto M_w 6.9	San Andreas M_w 7.9
ANZA VOLUNTEER FIRE & RESCUE, 56520 HWY 371	36	30
BANNING FIRE DEPARTMENT ALTERN, 172 N MURRAY ST	30	7
BANNING FIRE DEPARTMENT BUSINE, 3900 W WILSON ST	27	8
BEAUMONT FIRE DEPT BUSINESS OF, 628 MAPLE AVE	20	9
BLYTHE FIRE DEPT, 201 N COMMERCIAL ST	100	72
BLYTHE FIRE DEPT BUSINESS CALL, 201 COMMERCIAL ST	100	70
CALIFORNIA OFFICE OF EMERGENCY, 2524 MULBERRY ST	18	15
CORONA FIRE DEPT BUSINESS	63	39
DESERT HOT SPRINGS FIRE DEPT B, 65958 PIERSON BLVD	77	6
FIRE DEPT, BLYTHE	100	70
FIRE SPRINKLER SERVICE CO, RIVERSIDE	19	15
HEMET FIRE DEPARTMENT, 220 N CARMALITA ST	10	22
HEMET FIRE DEPARTMENT, 220 N JUANITA ST	10	22
HIGHGROVE VOLUNTEER FIRE DEPT, 910 W CENTER	19	15
HOME GARDENS FIRE STATION, 1148 E 6TH ST, CORONA	58	36
IDYLLWILD FIRE DEPT, 54160 MARANATHA DR	87	68
INDIAN WELLS FIRE DEPT BUS CAL, 44950 EL DORADO DR	84	7
INDIO FIRE DEPT FIRE STATION N, 43715 JACKSON ST	91	6
INDIO FIRE DEPT FIRE STATION N, 46621 MADISON AVE	90	6
LA QUINTA FIRE DEPT BUSINESS C, AVE 52	87	9
LA QUINTA FIRE DEPT BUSINESS C, PGA WEST	88	9
LAKE TAMARISK , 43880 LAKE TAM. DR, DESERT CENTER	99	26
MORONGO FIRE DEPT, 11581 POTRERO RD, BANNING	40	6
NORCO FIRE DEPT BUSINESS AND I, 3367 CORYDON AVE	57	34

PALM DESERT FIRE DEPT, 44400 TOWN CENTER WAY	80	8
PINE COVE FIRE DEPT, 24419 HWY 243, IDYLLWILD	31	14
RIVERSIDE FIRE DEPARTMENT EMER, PERRIS	45	33
RIVERSIDE FIRE, 20320 TEMESCAL CANYON RD, CORONA	62	43
RIVERSIDE FIRE, CAJALCO FI, 17650 CAJALCO RD PERRIS	33	26
RIVERSIDE FIRE, EDGEMONT, 22055 COTTONWOOD AVE, MORENO VALLEY	18	17
RIVERSIDE FIRE, 4080 LEMON ST, RIVERSIDE	21	17
RIVERSIDE FIRE DEPT EMERGENCY, 3601-9TH, RIVERSIDE	21	16
RIVERSIDE FIRE, 132 S SN JACINTO AVE, SAN JACINTO	8	18
RIVERSIDE FIRE, 24220 JUNIPER FLATS RD, HOMELAND	19	25
RIVERSIDE FIRE DEPT, 24919 MARION RDGE DR, IDYLLWILD	31	14
RIVERSIDE FIRE DEPT, 25175 FAIRVW AVE, HEMET	15	27
RIVERSIDE FIRE, 25730 SULTANAS RD, HOMELAND	25	29
RIVERSIDE FIRE DEPT FIRE STNS, 25954 STANFRD, HEMET	15	27
RIVERSIDE FIRE, 36850 STETSON AVE, HEMET	15	26
RIVERSIDE FIRE DEPT FIRE STNS, 37381 SAGE RD HEMET	27	38
RIVERSIDE FIRE, 44422 SAGE RD, AGUANGA	47	50
RIVERSIDE FIRE DEPT FIRE STNS, 56560 HWY 371, ANZA	36	30
RIVERSIDE FIRE DEPT FIRE STNS, 59200 MORRIS RANCH RD, MOUNTAIN CENTER	51	17
RIVERSIDE FIRE DEPT GLEN AVON, 10400 SAN SEVAINE WAY, MIRA LOMA	43	24
RIVERSIDE FIRE DEPT LAKE HILLS, 17452 LAKEPOINTE DR	47	30
RIVERSIDE FIRE, 9270 LIMONITE AVE, MIRA LOMA	41	25
RIVERSIDE FIRE DEPT PERRIS HDQ, 210 W SAN JACINTO	31	28
RIVERSIDE FIRE, RUBIDOUX F, 3590 RUBIDOUX BLVD	24	17
RIVERSIDE FIRE, 23770 SUNNYMEAD, MORENO VALLEY	14	15
RIVERSIDE FIRE WEST RIVER, 7545 MISSION BLVD	29	19

RIVERSIDE FIRE WOODCREST, 17800 VAN BUREN BLVD	31	23
SAN JACINTO FIRE DEPARTMENT BU, 160 W 6TH ST	8	19

4.7 Postfire Effects

Wildfires leave problems behind. An intense wildfire may destroy all vegetation; also, the organic material in the soil may be burned away or decompose into water-repellent substances that prevent water from percolating into the soil. As a result, even normal rainfall can cause exceptional erosion or flooding from a burned area; heavy rain can produce destructive debris flows.

In 1997, wildfires charred many areas of southern California, leaving them bare before the next winter's heavy El Niño rainfall. Of the 25 large southern California wildfires, ten produced debris flows after the first major winter storm, and flooding plagued eight other areas. Only four burn areas showed little erosion or runoff. This study has compiled digital databases to depict the relative importance of topography, vegetation conditions, and geologic engineering properties. These should be used to help mitigate post-fire debris flow hazards.

Fires can also hurt watersheds of Riverside County. The loss of ground-surface cover and the chemical transformation of burned soils make watersheds more susceptible to erosion from rainstorms. Erosion in turn impairs water quality.

4.8 Fire Response Resources

Any discussion of fire hazard reduction hinges on the County's efforts to prevent fires and to suppress them once they have started. Fire-fighting readiness can be partially gauged by the following:

- **Minimum Safety Standards for Peak Load Water Supply, Road Width, and Turning Radius:** These function as safeguards to ensure public safety and prevent unsafe development. Peak load water supply standards ensure sufficient water flow is available to fight fires. Peak water flow requirements are based on building type, design, and use.

- **Planning:** The National Board of Fire Underwriters recommends a three-day emergency supply of water, while the Metropolitan Water District of Southern California recommends a seven-day emergency water supply.

- **Fire and Building Code Enforcement:** The County of Riverside presently administers the 1997 Uniform Fire Code (UFC) and Uniform Building Code (UBC); updated versions are adopted every three years. Some relevant fire safety code standards and programs include:

    - Section 8109.2 requires that buildings or structures more than three stories or 30 feet in height, or more than 15,000 square feet, shall be provided with an approved fully automatic sprinkler system. In addition, buildings or structures of more than 5,000 square feet to be used primarily for public assembly shall be provided with a fully automatic sprinkler system. Installation of sprinkler systems is also required in existing buildings where emergency access for fire apparatus or equipment is restricted. These requirements apply to existing as well as future developments.

    - New construction restrictions for Class B roofing materials. As defined in the Uniform Building Code, Class B roofs are pressure treated, wood-shake shingles. They are not as resistant to fire as Class A roofs, which include generally non-flammable products.

4.8.1 California Department of Forestry

The State agency with the greatest number of resources for firefighting capabilities is the California Department of Forestry and Fire Protection (CDF). CDF is primarily a wildland fire protection agency with the legal responsibility for protection

of approximately 33 million acres of private and State lands in California. The Riverside Ranger Unit of CDF (with headquarters in Perris) provides direct protection for 1,070,000 acres of "wildland." These vegetation-covered, watershed lands are designated by the State Board of Forestry as State Responsibility Areas. This is generally private land, outside of the cities and federal land where protection is at maximum strength during the declared "fire season".

The CDF has extensive ground forces, including a volunteer prisoner population, and an air force that includes: 15 Grumman S-2A 800 gallon airtankers, four S-2T 1200 gallon airtankers, two 2,000 gallon contract airtankers, 11 Super Huey Bell UH-1H helicopters, six O-2A air attack aircraft, 11 OV-10A air attack aircraft, and one C-26B fire mapping airplane. From 13 air attack and nine helitack bases located statewide, aircraft can reach any California fire within 20 minutes. The air attack planes fly overhead directing the airtankers and helicopters to critical areas of the fire for retardant and water drops. The retardant used to suppress fires is Di-Ammonium Phosphate + Iron Oxide which acts as a fertilizer as well as suppressant.

4.8.2 Riverside County Fire Department

The County of Riverside contracts with the State of California for fire protection. Public Resources Code (PRC) 4142 affords legal authority for the California Department of Forestry and Fire Protection to enter into agreements with local government entities to provide fire protection services with the approval of the Department of General Services. By virtue of this authority, CDF administers the Riverside County Fire Department.

The Riverside County Fire Department (RCOFD) provides fire suppression, emergency medical, rescue, and fire prevention services. It is one of the largest regional fire service organizations in California. The Department responded to 73,999 incidents during the 1998 calendar year. It is staffed with 696 career and 1,225 volunteer personnel, and currently serves approximately 800,000 residents in an area of 7,004 square miles. This service area consists of the unincorporated county areas and fifteen contract cities (Banning, Beaumont, Calimesa, Canyon Lake, Coachella, Desert Hot Springs, Lake Elsinore, Indian Wells, Indio, La Quinta, Moreno Valley, Palm Desert, Perris, Rancho Mirage, San Jacinto, and Temecula). The assessed value of real property in the area served exceeds $40.8 billion.

The RCOFD operates out of fire department headquarters in the city of Perris. It is organized into two operational areas and six divisions, which currently contain

16 battalions and 85 fire stations. The equipment used by the department has the versatility to respond to both urban and wildland emergency conditions. The RCOFD inventory includes structural engines, brush engines, telesquirts, trucks, paramedic units, a helicopter, hazardous materials unit, incident command units, water tenders, fire crew vehicles, mobile communications centers, breathing support units, lighting units, power supply units, fire dozers, mobile training vans, and mobile emergency feeding units.

The RCOFD is the Operational Area Coordinator for the California Fire and Rescue Mutual Aid System for all fire service jurisdictions in the County of Riverside. It also has several mutual and automatic aid agreements with other city jurisdictions as well as the adjacent National Forests. The Operational Area is responsible for controlling and suppressing all unwanted fires in the department's jurisdiction. RCOFD/CDF personnel frequently respond to large-scale emergencies. Recent examples include the Landers, Loma Prieta and Northridge earthquakes, the Dunsmuir hazardous materials spill/train derailment at Lake Shasta, the 1997 and 1998 California Floods and the Oakland Hills, Yellowstone, and Yosemite fires. Response to large-scale emergencies or disasters is managed by twelve Major Incident Management Teams located throughout the state.

Riverside County Fire Department Responsibilities:

Fire Control: Due to increasing population the County Fire Department is faced with a growing structural fire problem, and it is one of the most active wildland fire counties in the state.

Air Attack Program: The CDF and the U.S. Forest Service (USFS) operate a joint air tanker base at the Hemet/Ryan Airport. Ryan Air Attack Base is statistically the most active in the nation, deploying one CDF. and two USFS air tankers. Two air coordination aircraft and one CDF helicopter are stationed at Ryan Air Attack Base.

Fire Protection-Planning and Engineering: Fire protection specialists review plans for all new developments, commercial and industrial buildings located within the contract cities and unincorporated areas of Riverside County. Requirements are established to provide a high degree of life safety and property protection. Common requirements include the installation of fire hydrants, sprinkler systems, early warning fire detection systems, and fire safety zones in remote areas.

Emergency Services: Disaster and recovery planning are the key elements. The Emergency Services Division maintains two underground Emergency Operation Centers with communications, for government use during major events.

4.9 Fire Safety

Individuals can make an enormous contribution to fire hazard reduction and need to be educated about their important role. Homeowners are generally especially easy to enlist.

4.9.1 Homeowners Checklist to Reduce Fire Risk

Design and install a firewise landscape. Be sure to consider:

- Local area fire history;
- Site location and overall terrain;
- Prevailing winds and seasonal weather;
- Property contours and boundaries;
- Native vegetation;
- Plant characteristics and placement (water and salt retention ability, aromatic oils, fuel load per area, and size);
- Irrigation requirements.

The primary goal of a fire-resistant landscape is fuel reduction. It helps to assign zones:

- **Zone 1**: This well-irrigated area encircles the structure for at least 30' on all sides, providing space for fire suppression equipment in the event of an emergency. Plantings should be limited to carefully spaced fire resistant species.
- **Zone 2**: Fire-resistant plant materials should be used here. Plants should be low-growing, and the irrigation system should extend into this section.
- **Zone 3**: Place low-growing plants and well-spaced trees in this area, remembering to keep the volume of vegetation (fuel) low.
- **Zone 4**: Furthest from the structure is a natural area. Thin vegetation selectively here, and remove highly flammable vegetation.

Always remember to:

- Leave a minimum of 30' around the house to accommodate fire equipment, if necessary.
- Carefully space the trees you plant.
- Take out the "ladder fuels" — vegetation that serves as a link between grass and tree tops. It can carry fire to a structure or from a structure to vegetation.
- Give yourself added protection with "fuel breaks" like driveways, gravel walkways, and lawns.

When maintaining a landscape:

- Keep trees and shrubs pruned. Prune all trees 6' to 10' from the ground.
- Remove leaf clutter, and dead and overhanging branches.
- Mow your lawn regularly.
- Dispose of cuttings and debris promptly, according to local regulations.
- Store firewood away from the house.
- Be sure the irrigation system is well maintained.
- Use care when refueling garden equipment and maintain it regularly.

- Store and use flammable liquids properly.
- Dispose of smoking materials carefully.
- Become familiar with local regulations regarding vegetative clearances, disposal of debris, and fire safety requirements for equipment.
- Follow manufacturers' instructions when using fertilizers and pesticides.

When building, selecting or maintaining a home, remember:

- Slope of terrain. Be sure to build on the most level portion of the land, since fire spreads rapidly, even on minor slopes.
- Ridges and cliffs. Keep a single-story structure at least 30 feet away from edges; increase distance if structure exceeds one story.
- Use construction materials that are fire-resistant or non-combustible whenever possible.
- For roof construction, recommended materials are Class-A asphalt shingles, slate or clay tile, metal, cement and concrete products, or terra-cotta tiles.
- Constructing a fire-resistant sub-roof can add protection, as well.
- On exterior wall cladding, fire-resistive materials such as stucco or masonry are much better than vinyl which can soften and melt.
- Consider size and materials for windows; smaller panes hold up better in their frames than larger ones; double-pane glass and tempered glass are more effective than single pane glass; plastic skylights can melt.
- Cover windows and skylights with non-flammable screening shutters.
- To prevent sparks from entering your home through vents, cover exterior attic and underfloor vents with wire mesh no larger than 1/8 of an inch.
- A driveway should provide easy access for fire engines, be at least 12 feet wide with a vertical clearance of 15 feet and a slope that is less than 12 percent. The driveway and access roads should be well-maintained, clearly marked, and include ample turnaround space near the house.
- So that everyone has a way out, provide at least two ground level doors for safety exits and at least two means of escape (doors or windows) – in each room.
- Keep gutters, eaves, and roof clear of leaves and other debris.
- Occasionally inspect your home, looking for deterioration such as breaks and spaces between roof tiles, warping wood, or cracks and crevices in the structure.
- Also, inspect your property, keep 30 feet around your house clear of dead and dense vegetation. Move firewood away from the house and its attachments, like fences or decks.
- If an all-wood fence is attached to your home, a masonry or metal protective barrier between the fence and house is recommended.
- Use non-flammable metal when constructing a trellis and cover with high-moisture, non-flammable vegetation.
- Prevent combustible materials and debris from accumulating beneath patio deck or elevated porches. Screen, or box in, areas that lie below ground level with wire mesh no larger than 1/8 of an inch.
- Make sure an elevated wooden deck is not located at the top of a hill where it will be in the direct line of a fire moving up slope. Consider a terrace instead.

4.10 Summary

Much of the County of Riverside is rated as a potential wildland fire area by the State of California Department of Forestry and Fire Prevention and this study. A significant portion of the County of Riverside is undeveloped and consists of rugged topography with potentially highly flammable indigenous vegetation. As a result, State and County Statutes apply to development and maintenance in these regions.

Fire potential for Riverside County is typically greatest in the months of August, September and October, while dry vegetation combined with offshore dry Santa Ana winds coexist.

The threat of earthquake induced fire is emphasized because widespread fires following an earthquake, coupled with Santa Ana winds, essentially constitute a worst-case fire suppression scenario for the County of Riverside. Despite the fact that the most common cause of urban and wildland fires is man, fire safety can be readily gauged using such a scenario as a standard.

Water availability in Riverside County following a major earthquake would likely be curtailed due to breaks in water lines across major fault systems, liquefiable regions or areas susceptible to landsliding. In addition, above ground reservoirs have been shown to be vulnerable in recent earthquakes, which would also impact fire flows.

Mobile home fires erupted at a greater rate (49.1 per thousand) than other structure fires (1.1 per thousand) as a result of the Northridge earthquake. Because the County of Riverside has a large number of mobile homes, earthquake induced fires may occur at a greater rate.

The hillside terrain of the County of Riverside is predominantly mapped as having a substantial fire risk. Therefore, much of the County of Riverside is subject to codes that requires property owners to conduct maintenance to reduce the fire danger.

Emergency water storage in the County will be more that doubled by the completion of the East Side Reservoir, south of Hemet. However, the County's aqueducts cross major fault systems at numerous locations, which will decrease the availability of new water following a major earthquake disaster. This and other reservoir projects are discussed in more detail within Chapter 3-Flood Hazards of this Technical Background Report.

Government Code Section 51178 specifies that the Director of the California Department of Forestry (CDF) shall identify areas in the state that are Very High Fire Hazard Severity Zones (VHFHSZ) utilizing consistent statewide criteria and based on the severity of fire

hazard that is expected to prevail in those areas. VHFHSZ are based on fuel loading, slope, fire weather, and other relevant factors. Riverside County, however, can change areas designated as VHFHSZ by the State, following a finding supported by substantial evidence.

General Conditions: During adoption of the 1997 Uniform Fire Code, the County of Riverside Board of Supervisors (1999) found that additional requirements and standards of fire hazard reduction were needed to properly protect the health, safety, and welfare of the existing and future residents and workers of Riverside County.

- ***Climatic Conditions***: Generally Riverside County has an arid climate. Annual rainfall varies from three to over thirty inches. Hot, dry Santa Ana winds are common to areas within Riverside County. These winds constitute a contributing factor that cause small fires to spread quickly and create the need for an increased level of fire protection.

- ***Geographic and Topographic***: Riverside County includes deserts, mountains, brush covered wildlands, and agricultural lands. Traffic and circulation congestion in urban areas and extreme travel distances in rural and wildland areas, often place Fire Department response time to emergencies at risk.

- ***Earthquake Potential***: There are several major earthquake faults which bisect the County, including southern California's most active, the San Andreas and the San Jacinto.

Riverside County Fire Disasters: Gubernatorial Proclamations of a State of Emergency and Presidential Major Disaster Declarations affecting Riverside County have been declared on six occasions.

Development of a GIS Wildland Fire Susceptibility Map for Riverside County: As part of this study, a Geographic Information Systems coverage was developed for Riverside County that used vegetation, weather, slope and proximity to urbanization to estimate the relative susceptibility zones in a digital format. Roofing material restrictions can be assigned based on relative hazard. For example, "Type A" materials should be required in Very High, High and Moderate zones, while "Type B" materials can be required in Low, Very Low and None susceptibility zones. In addition, defense zones can be increased based on increasing fire hazard susceptibility.

Remote Sensing: Mapping wildland fire susceptibility using remote sensing techniques might assure objectivity and uniformity. This system could produce a much more accurate hazard assessment. The information could then be used by local agencies, perhaps with additional criteria, to produce hazard maps that are useful to individual jurisdictions.

Prefire Management

Over time, all California's wildlands *will* burn. However, various factors contribute to increased risks that fires will occur; that they will be larger, more intense and more damaging; that fighting them will cost more; and that they will take a higher toll (in economic and non-economic terms). The County's extreme diversity and complex pattern of land use and ownership require equally diverse and complex techniques to effectively manage the fire environment. Custom strategies for each situation can be created through combinations of prefire management, suppression, and postfire management. They should lessen the costly impacts of future wildfires and offer alternatives to continually increasing suppression forces.

Prescribed Fire: Prescribed fire is the term used for occasions when a fire is deliberately set, under carefully controlled and monitored conditions. The purpose is to remove brush and other undergrowth which can provide fuel for naturally occurring fires. Fire is an essential ecological process in many ecosystems. However, the recent experiences in New Mexico and Arizona with prescribed burns escaping and destroying several hundred homes in Los Alamos, New Mexico (Cerro Grande fire) and more than 50,000 acres, will likely lead to revisions of guidelines for performance of prescribed burns.

Real Estate Disclosure: Civil Code Section 1103(c)(6) requires real estate sellers to inform prospective buyers whether or not a property is located within a Wildland Fire Area that could contain substantial fire risks and hazards. The digital Wildfire Susceptibility Map developed for this study should replace the CDF mapping in providing for more accurate natural hazards disclosure in the County. The mapping associated with this study provides current and future buyers of real estate in the County an estimation of the wildland fire risk associated with the property. In addition, the entire County is covered by this mapping, rather than just the western portion.

Wildland/Urban Interface: The wildland/urban interface is more than a geographic area or zone where structures meet or intermingle with wildland fuels. It is a set of conditions where flammable structures exist within the reach of ignition sources, primarily firebrands, from burning wildland and structural fuels. The potential exists in areas of wildland/urban interface conditions for extremely dangerous and complex fire conditions which pose a tremendous threat to public and firefighter safety.

Santa Ana Winds: Named by the early settlers at Santa Ana, the "Santa Ana Winds" enhance the fire danger throughout southern California. Channeled by the many canyons in the Great Basin and getting stronger, the hot, intense and very dry winds break through and blow through southern California, especially through the mountain passes.

Hazardous Fire Area Designation: Based on drought and other conditions, it may become necessary to close an area to the public due to extreme fire hazard potential. The Riverside County Fire Chief is given the authority by the County Board of Supervisors to officially determine and publicly announce the closure of any hazardous fire area or portion thereof.

Hazard Abatement Notices: Each spring, the California Department of Forestry and Fire Protection (CDF) and Riverside County Fire Department distribute hazard abatement notices currently to about 30,000 County citizens. These notices request that property owners reduce the fuels around their property. Requirements for hazard reduction include a minimum of 30 foot clearance around all structures, which can be extended to 100 feet in areas where a severe fire hazards exist. On unimproved parcels the property owner is required to disc or mow 100 feet along the perimeter of the property.

Fire Response Resources

Riverside County Fire Department: The Riverside County Fire Department (RCOFD) is one of the largest regional fire service organizations in California. The Department is staffed with 696 career and 1,225 volunteer personnel, and currently serves approximately 800,000 residents in an area of 7,004 square miles. The assessed value of the real property in the area served is in excess of $40.8 billion.

Postfire Effects

Fire and Debris Flows: Wildfires leave problems behind them, even when the last ember is extinguished. During an intense wildfire, all vegetation may be destroyed; also the organic material in the soil may be burned away or may decompose into water-repellent substances that prevent water from percolating into the soil. As a result, even normal rainfall may result in unusual erosion or flooding from a burned area; heavy rain can produce destructive debris flows. The relative importance of topography, vegetation conditions, and geologic engineering properties underlying the County of Riverside have been compiled into digital databases as a result of this study, and should be used to assist in the mitigation of post-fire debris flow hazards.

Effects of Fire on Watersheds: The watersheds of Riverside County may also be negatively affected by fire. The loss of ground-surface cover, and the chemical transformation of burned soils make watersheds more susceptible to erosion from rainstorms, and impairs water quality.

Earthquake-Induced Fires

An earthquake-induced fire and fire associated with Santa Ana winds pose the most extraordinary demands on fire suppression resources because of potential for multiple ignitions. Riverside County is susceptible to both phenomena.

Natural Gas Fires as a Result of the Northridge Earthquake: As a result of the 1994 M 6.7 Northridge earthquake, there were 35 breaks reported in natural gas transmission lines and 717 breaks in distribution lines. About 74% of the 752 leaks were corrosion related. There were a total of 15,021 natural gas leaks as a result of the Northridge earthquake. Natural gas leaks resulted in three street fires, 51 structure fires (23 were totally destroyed), and the fire destruction of 172 mobile homes. Many of the mobile home fires erupted when inadequate bracing permitted them to fall from foundations, severing gas lines and igniting fires. Because the County of Riverside has a large number of mobile homes, earthquake induced fires may occur at a greater rate.

Earthquake Scenario Loss Estimations: A HAZUS loss estimation was run based on two scenario earthquakes, including a major San Andreas (Mw 7.9) and a major San Jacinto (Mw 6.9) earthquake. In addition, two wind velocities were used for each scenario earthquake for the fire-following model. A velocity of 30 mph was assigned to evaluate fire spread as a result of Santa Ana wind conditions and a value of 10 mph was used to model the normal wind. A substantial (4 to 6 fold) increase in the losses associated with earthquake induced fire is noted for earthquakes during Santa Ana conditions. Although the database of fire stations used in the analyses clearly requires updating, the general functionality estimates provide credible guidelines for response planning and exercises.

4.11 Recommended Programs

The County of Riverside should:

- require property owners to conduct maintenance to reduce fire danger in accordance with the property owner's checklist presented herein. The single most important mitigation measure for a single-family residence is to maintain a fire safe landscape, thereby creating a defensible space around structures. The width of these defense zones should be increased based on relative wildland fire susceptibility, as digitally mapped for this study.

- support the new State-level shift in its vegetation management program. Emphases are on smaller projects closer to new developments, and alternatives to fire treatment, such as weed abatement using mechanical treatments.

- develop education and mitigation strategies that focus on enhanced hazard in the months of August, September and October, when dry vegetation and Santa Ana winds coexist.

- evaluate specific fire hazard areas and adopt reasonable safety standards, covering such elements as adequacy of nearby water supplies, routes or throughways for fire equipment, clarity of addresses and street signs, and maintenance.

- adopt ordinances to reduce the fire hazard using the model ordinance checklist presented herein.

- require staff, as well as elected officials, to conduct earthquake-induced fire scenario exercises based on this study's HAZUS loss estimates.

- require review of its above ground reservoirs for structural safety in an earthquake.

- conduct an inventory of its mobile homes and require mitigation consisting of seismic bracing of foundation supports, automatic gas shut-off valves and flexible utility connections, as well as an earthquake-induced fire hazard education program for tenants of mobile homes.

Natural Hazard Mapping, Analysis, and Mitigation: a Technical Background Report in Support of the Safety Element of the New Riverside County 2000 General Plan

CHAPTER 5: POLICIES

A government is tasked with the protection of the health, safety and welfare of its citizens. The Safety Element is integral to this mandate. Traditionally, governments have provided emergency response and post-disaster assistance after a natural event devastated its citizens. As the causes of these disasters became better understood, governments undertook efforts to protect citizens through construction efforts designed to overcome and defeat the natural phenomenon. Unfortunately, what government designs, nature can overcome, often leading to a disaster even worse than had the construction never been attempted. The most sustaining form of government intervention in hazard prevention is landuse zoning and development restrictions. Each method has costs associated with it. Some costs are immediate, some are deferred. Government on behalf of its citizens, needs to make decisions on how to prioritize its resources to maximize return on protecting its citizens health, safety and welfare.

Planning and managing land use are essential to reduce the County's vulnerability to disasters. Land use planning enables Riverside County to analyze the suitability of land for development. This has also been known for a long time. In 1950, the Truman Administration developed flood mitigation recommendations that adjusted land use through zoning and other measures. Rather than trying to keep the flood out of people's way, the government would work to keep people out of the flood's way. It was simple to explain, but remains difficult to enact. For many reasons, from economic to aesthetic, hazardous areas have appeal. However desirable they may seem, though, policy makers and citizens must understand and accept the limitations of hazard-prone areas.

Flood control programs and methods are currently undergoing dramatic change. Softer, non-structural solutions utilizing flood plain management principles are replacing concrete-based structural measures of the past. But millions of citizens of Riverside County still rely on the existing flood control systems that have been constructed to ensure protection of their lives and property. However, environmental legislation that protects rare and endangered species will continue to make construction and maintenance of flood control structures difficult. In arid environments, twice as many species and about 250 percent more plant cover are associated with natural wash areas, compared with surrounding land.

A "Hazard-Prone Land Acquisition Program" may reduce the costs associated with hazards and mitigation, in addition, home buyers will often pay premiums to live near these open spaces.

5.1 STATE LAWS AND ADMINISTRATIVE GUIDELINES

A General Plan Safety Element provides a comprehensive local plan for mitigating the negative effects of earthquakes, landslides, fire, floods, tsunamis, toxic spills and other hazards. A Safety Element is one of seven mandatory elements in a General Plan, required by State law.

The County of Riverside is updating its Safety Element to reflect new knowledge and conditions. The updated Safety Element will enable the County to integrate the required subjects more completely, and thus provide a stronger base of public safety policy. Achieving a maximum degree of public safety is consistent with Riverside County's long-range vision for the future, represented by the General Plan as a whole.

5.1.1 Basic General Plan Law

Under California law, each city and county must prepare a comprehensive, long-range General Plan that serves as a guide to future development. The General Plan must include a Land Use Element that describes, in text and diagrams, the future distribution of land uses, population density and housing intensities. The General Plan must also include six other elements: Circulation, Housing, Conservation, Open Space, Noise and Safety.

All General Plan elements must be mutually consistent. As an example, if the Open Space Element designates land as a future nature preserve, the Land Use Element cannot designate it for high intensity commercial development. In addition, zoning must remain consistent with the General Plan. For instance, a county cannot adopt commercial zoning on land designated in the Land Use Element for single family homes, unless a General Plan amendment is adopted to redesignate the land. Therefore, recommendations associated with Safety Element hazard mitigation affect both land use and zoning.

A Safety Element can be broadly interpreted as:

- a statement of policy direction addressing the relationship between existing and potential hazards and future development;
- a source of guidance to other elements of the General Plan, most particularly the Land Use Element;
- a foundation for the legal reasoning behind zoning and other development regulations that are designed to constrain, mitigate or permit development because of existing or potential hazards; and,
- a database of geological conditions and associated hazard management zones within which mitigation policies are implemented.

5.1.2 Legislative Background

As presently written, Section 65302(g) of the Government Code requires a Safety Element to protect the community from unreasonable risks associated with the effects of seismic hazards, flooding and fire. The safety element must include maps of known seismic and other geologic hazards, such as seismically-induced surface rupture, ground shaking, ground failure, dam failure, slope instability and subsidence, as well as related phenomena such as tsunami, seiche, flooding, and wildland and urban fire hazards. It must address evacuation routes, peak load water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards. It also may address any other subjects that the local governing body considers pertinent to the physical development of the community.

First adopted by the California legislature in the early 1970s, General Plan Safety Element provisions originally addressed only earthquake-related hazards. Fire,, flood and other geologic hazards were not considered. Because of similarity of subject matter among these issues, in 1984 the California legislature required that they be combined into a single element.

5.1.3 State Safety Element Review

Before initiating a review and revision of its Safety Element, a local jurisdiction must consult with the California Division of Mines and Geology of the Department of Conservation (Division), as well as the Office of Emergency Services, to see if these agencies request pertinent information. Although the law is not explicit on this point, it implies that if either agency requests information to be included in a local Safety Element, then the local jurisdiction must include it.

At least 45 days prior to adoption of a Safety Element, a local jurisdiction must submit a draft of the Safety Element or its amendment to the Division, which then has 30 days after receipt of the draft to report its findings to the local jurisdiction. Prior to final adoption of the revision, the local jurisdiction must consider the Division's findings. If the Division's comments are not available within those 30 days after receipt, the local jurisdiction may consider the Division's findings during future amendments to the Safety Element.

5.1.4 Safety Element Guidelines

In addition to the mandatory provisions of General Plan law, to which local governments must adhere, the Governor's Office of Planning and Research also issues advisory guidelines to assist localities in the preparation of General Plans. The General Plan Guidelines include a variety of ideas for data, analysis and policy development, including suggestions on how to interrelate the Safety Element with other General Plan elements and with development regulations.

The General Plan Guidelines stress the importance of the Safety Element in reducing death, injuries, property damage, and economic and social dislocation from natural hazards. It is identified as the principal vehicle for relating local safety planning to local government land use decisions. It first provides routine administration of regulatory decisions relating to zoning, conditional use permits, subdivisions and building permits. It also establishes the technical and policy base to support and justify potentially controversial mitigation measures such as adoption and enforcement of a seismic retrofit ordinance.

The Guidelines stress that Safety Element revision represents an opportunity to address other relevant safety issues, such as crime, vehicular accidents, power failures, storm drainage and hazardous waste storage and spills. Some local governments chose to incorporate hazardous materials management planning within the framework of their Safety Elements. Some counties and cities address issues such as waste minimization and recycling. This Safety Element does not address hazardous materials issues in a thorough manner.

Dozens of Federal and State laws related to public safety have some bearing on the preparation and administration of a Safety Element. However, only a handful directly relate to Safety Element content. These are summarized in the next two sections.

5.1.5 Related Federal Laws

Two important pieces of Federal legislation are relevant to local Safety Element preparation. Public Law 93-288, amended in 1988 as the Stafford Act, establishes basic rules for Federal disaster assistance and relief. The Earthquake Hazards Reduction Act of 1977, amended in 1990, establishes the National Earthquake Hazards Reduction Program (NEHRP).

Stafford Act: The Stafford Act requires that 15% of the total assistance dollars be spent on disaster mitigation--with the hope of reducing the costs associated with future disasters. The Stafford Act briefly mentions "construction and land use" as possible mitigation measures to be used after a disaster to forestall repetition of damage and destruction in subsequent events. However, the Federal Emergency Management Agency (FEMA) that implements Section 409 of the Stafford Act (44 CFR Part 206, Subparts M and N) require post-disaster, State and local hazard mitigation plans. Preparation of these plans is a prerequisite for local governments to receive disaster assistance funds to repair and restore damaged or destroyed public facilities. A county or city must adopt a hazard mitigation plan acceptable to FEMA if it is to receive facilities restoration assistance authorized under Section 409 of the Stafford Act. In recent disasters, FEMA has recognized Safety Elements of California local governments as fulfilling Section 409 hazard mitigation plan requirements.

National Earthquake Hazards Reduction Act: The National Earthquake Hazards Reduction Act exists to reduce seismic risks to life and property, through activities such as: hazard identification and vulnerability studies; development and dissemination of seismic design and construction standards; development of an earthquake forecasting capability; preparation of national, State and local plans for mitigation, preparedness and response; conduct of basic and applied research into causes and implications of earthquake hazards; and, education of the public about earthquakes. Much of the recent advancement in earthquake-related scientific and engineering understanding comes from NEHRP-funded research. Such knowledge can then be used to improve Safety Elements. For example, the NEHRP has funded studies of Riverside County fault systems and earthquake hazards.

An important direct outgrowth of the National Earthquake Hazards Reduction Act was establishment of the Southern California Earthquake Center (SCEC) through a consortium of universities and National Science Foundation grants. SCEC specifically funds research pertaining to seismic conditions in the southern California region and its research results have directly aided this update of the Riverside County Safety Element.

Earthquake hazard research and preparedness in southern California received substantial boosts after the 1994 Northridge earthquake. As a result of the Stafford Act, 15% of the total Federal aid of more than $10 billion was spent on mitigation of future earthquake hazards. While Riverside County did not directly receive any of these mitigation funds, projects such as the TriNet network indirectly benefit Riverside County. TriNet is a collaborative project among the United States Geological Survey, California Division of Mines and Geology and the California

Institute of Technology to improve the real-time earthquake information system for southern California. TriNet incorporates new technologies to quickly provide vital, WEB-accessible information. Earthquake size, location, and maps of areas most likely to have sustained strong ground motion damage are available to emergency response personnel within minutes of an earthquake.

5.1.6 Related State Laws and Guidelines

At the state level, out of hundreds of safety related bills adopted over several decades, several stand out as relevant to Safety Element preparation.

The ***Alquist-Priolo Earthquake Fault Zone Act*** of 1971 requires the State Geologist to prepare maps showing study zones around active faults. Within Alquist-Priolo zones, local governments must require geological reports to be submitted for proposed development projects. The State must be provided copies of these geological reports. Note: When passed, the Alquist-Priolo Act was originally titled the Alquist-Priolo Special Study Zone Act. The name was later changed to the Alquist-Priolo Earthquake Fault Zone Act.

Seismic Hazards Mapping Act: A recent expansion of state legislation dealing with geological hazards is the Seismic Hazards Mapping Act of 1990 (S.B. 3897), which requires the State Division of Mines and Geology (DMG) to map areas with potential for strong ground shaking, liquefaction and seismically induced landslides. The DMG must also develop guidelines for the preparation of maps of seismic hazard zones. Within hazardous zones, as designated by DMG maps or guidelines, the Act mandates:

- submission of geotechnical reports for proposed development projects;
- adherence to State policy and criteria in determining appropriate hazard mitigation techniques or in waiving the requirement for geotechnical reports on individual projects;
- geotechnical reports and local actions in response to them must go through advisory review by the DMG.

No DMG mapping under the 1990 Act has yet been completed for Riverside County, nor is any funded in the near future (CDMG, 2000).

The California Earthquake Hazards Reduction Act of 1986 established the California Earthquake Hazards Reduction Program under the guidance of the Seismic Safety Commission. This umbrella program proposes overall policy and tracks progress in State earthquake hazard mitigation, preparedness, response and recovery programs geared to the objective of significantly reducing earthquake hazards in California by January 1, 2000.

The Building Earthquake Safety Act of 1986 requires all local governments to identify all potentially hazardous buildings within their jurisdictions and to establish a program for mitigation of identified hazards. It is the legislative basis for the inventory of hazardous unreinforced masonry buildings and Unreinforced Masonry Ordinances adopted by most counties and cities in California.

The Recovery (and) Reconstruction Act of 1986 authorizes local governments to prepare before a disaster for expeditious and orderly recovery and reconstruction afterward. It enables localities to prepare pre-disaster plans and ordinances which may include: an evaluation of the vulnerability of specific areas to damage from a potential disaster, streamlined procedures for appropriate modification of existing General Plans or zoning ordinances affecting vulnerable areas; a contingency plan of action; organization for post-disaster, short-term and long-term recovery and reconstruction; and, a pre-disaster ordinance to provide adequate local authorization for post-disaster activities.

Over time, this law will prove increasingly valuable, as more experience is gained in California from earthquakes and other major disasters. At present, only a few other jurisdictions are utilizing the provisions of this Act, including the cities of Los Angeles, Santa Monica and Whittier, as well as the counties of Los Angeles and San Bernardino. It is recommended that Riverside County prepare a recovery ordinance and adopt it in conjunction with this updated Safety Element.

Since 1979, Riverside County has had an ordinance (No. 538) that provides tax relief in disasters. If the damage to a property reduces its evaluation by more than $5,000, the County Assessor will tax the property based on the lower evaluation. The County should update this ordinance to provide tax and permit fee exclusions for rehabilitation or mitigation work.

5.2 INSURANCE PROGRAMS

Natural hazard insurance and voluntary mitigation successfully reduces harm to homeowners in risk-prone regions, and significantly reduces the cost to society. Yet only a small percentage of homeowners in risk-prone regions purchase hazard insurance or adopt mitigation measures voluntarily, even though the insurance is often offered at rates below actual cost (Li, 1998). Few private insurance companies provide coverage for natural hazards as part of their regular homeowners' package. Hazard insurance is highly limited in coverage and variety even among the private insurers who underwrite such service. This absence of supply and demand for natural hazard insurance will impose heavy costs on Riverside County in future disasters.

After the 1994, magnitude 6.7 Northridge earthquake, property owners could not buy homeowners insurance, because the insurers no longer wanted to sell earthquake insurance. Back in 1986, the California Legislature passed a law requiring every insurer selling homeowners insurance to offer earthquake insurance. The homeowner did not have to buy it, but the insurance company did have to offer it. This law was passed because of a court case. Although a higher court eventually overruled the court case, the law is still in effect (Roth, 1998). The only way an insurer can legally avoid selling earthquake insurance is to not sell homeowner insurance.

Also after the 1994 Northridge earthquake, California companies raised deductibles from 10 to 15 percent, lowered coverage for residential earthquake insurance, and increased the cost of premiums dramatically. The number of earthquake insurance policy holders dropped from an estimated 1.68 million in 1994 to approximately 1.3 in 1996 (McCarthy and others, 1998).

Loss estimation has improved sufficiently in the past decade, however, that some insurance companies are today better able to distinguish the level of risk by geographic area. Computerized methods, including Geographic Information Systems (GIS), have made it possible for some of the more sophisticated companies to model and forecast potential losses, based upon information gathered and maintained about localized areas and the structures now being insured. (The Federal Emergency Management Agency (FEMA) has sponsored a similar loss estimation software, HAZUS, which is designed for use by local government and other disaster planning and mitigation agencies. HAZUS is used in this Technical Background Report.) As insurance company uncertainties diminish, so should their reluctance to provide hazard insurance.

5.2.1 Challenges Faced by Private Insurers

There are many reasons why private insurance companies dislike hazard insurance, including earthquake coverage. Because of the uncertainties surrounding hazard analyses, insurance companies have found it difficult to reasonably estimate what maximum loss they might incur by insuring against a catastrophic disaster. Therefore, they cannot be sure that they can remain in business after such an event, since claims payments plus operating costs could far exceed premiums collected. The difficulties facing private insurers are summarized below:

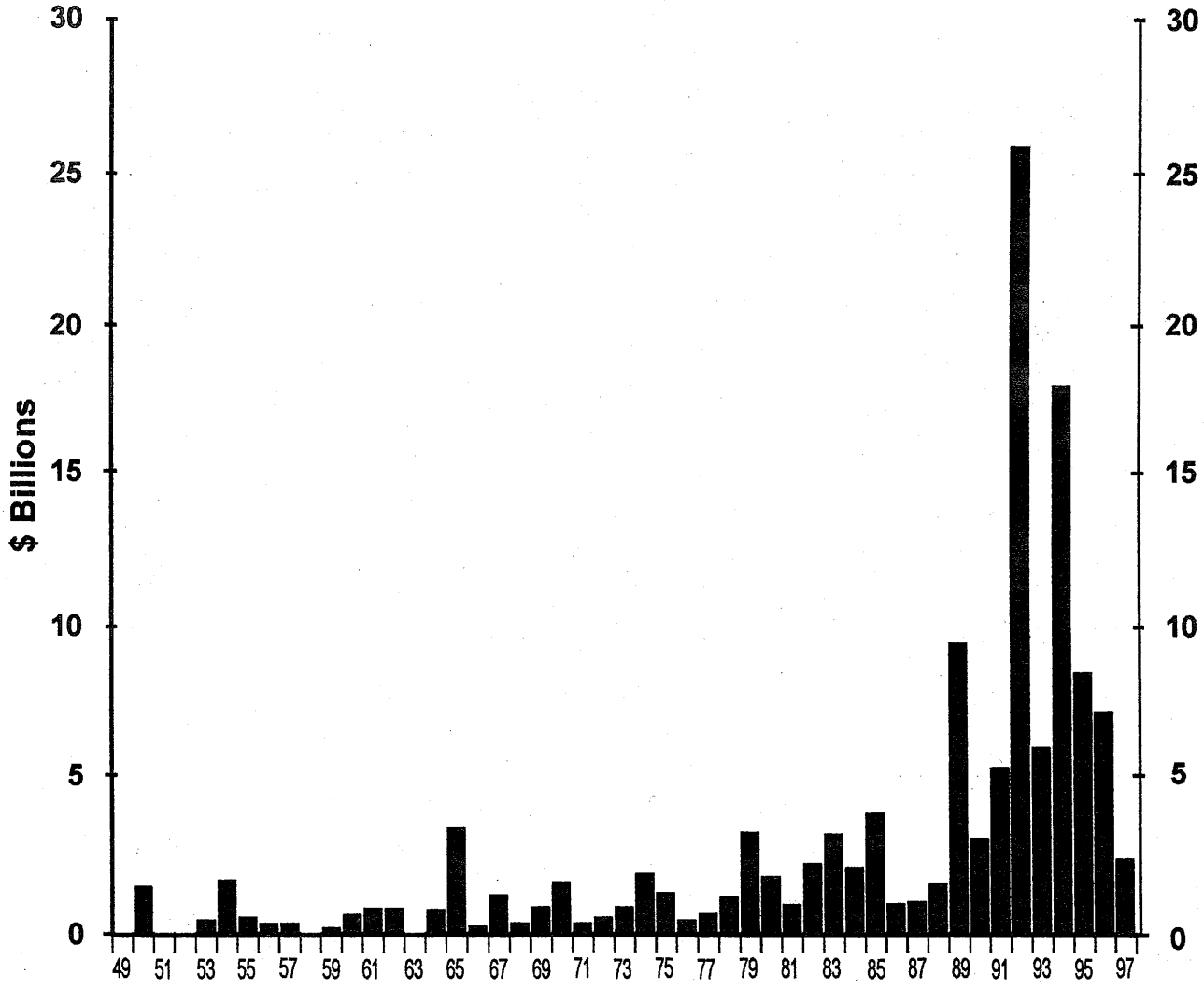
High Correlation of Claims from a Single Event - Because earthquakes are geographically focused events, when one occurs many claims are concentrated in a single area. Because losses from a single event can be tremendous, insurers are hesitant to offer many policies in an area facing the same hazard.

Low Probability/High Consequence Events - Major earthquakes seldom occur, but when they do, catastrophic consequences follow. Because of the limited data spanning a very short stretch of geologic time, scientific findings can be highly uncertain and ambiguous. For example, scientists forecast that there is a low probability that a catastrophic earthquake will occur in Riverside County. At some point in will definitely occur. However, no one can say if it will occur tomorrow, or in 50 years, or in 200 years.

Difficulty in Identifying What Losses May Occur - Although scientists are able to identify the probabilities of an earthquake occurring for a given location, and they can estimate the magnitude and duration of ground shaking, no one can accurately predicting the damage to any specific neighborhood or given structure. Homes adjacent to each other can sustain substantially different damage from the same earthquake. Specific site conditions and construction standards can cause wide variations. The large number of variables involved makes it difficult and expensive to more accurately estimate losses.

Lack of Incentive to Take Preventative Action - Because hazard insurance reduces the cost of rebuilding after an earthquake, it makes the homeowner feel more secure and less interested in adopting mitigation measures. This helps to explain the lack of voluntary loss prevention measures among the insured. For instance, after purchasing earthquake insurance, the owner of a wood-frame home may never get around to bolting the home to its foundation, nor adequately brace the water heater.

Adverse Selection - Higher-risk consumers often purchase policies at premiums more appropriate for lower-risk consumers. In the case of earthquake insurance, higher risk is associated with unbolted foundations, unfastened water heaters, and unbraced chimneys. Insurers set a rate schedule to capture the varying risk among policyholders. However, they often fail to differentiate the premium schedule widely enough, due to regulatory controls or other reasons. Therefore, insurers will still incur losses because the premium differential fails to separate out high-risk consumers.



Source: Insurance Services Office

Earth Consultants International

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Insured Catastrophe Losses in the United States from 1949 to 1997 in 1997 dollars

Figure 5 - 1

5.2.2 Need for Government-Assisted Earthquake Insurance

After every major disaster, the problem of financing recovery and reconstruction emerges. As urban settlement has expanded, disasters have been experienced with increasing frequency and publicity. Figure 5-1 illustrates how rapidly insured catastrophe losses are increasing in the United States. Private and public sector organizations need to plan for such contingencies.

Yet disaster relief and recovery resources are not consistently adequate or timely. Federal and State disaster assistance covers only a portion of the losses encountered in major earthquakes. Sometimes it is not received until long after the critical needs for such assistance are experienced. Consequently, many households, businesses and industries are significantly disrupted and many smaller enterprises go out of business after a major disaster.

The optimum solution is to build communities of strength and wise location, that can withstand the worst damage caused by natural disasters. Gradually, this goal will be approached, as older cities are renewed with rebuilding and reinvestment; and as newer cities develop with better codes and land use practices. But, given the experience of hazard mitigation to date, the slowness with which older communities are mitigated, the evolving state of scientific knowledge, and incomplete Federal and State disaster assistance, additional sources of financial support for post-disaster recovery and reconstruction will be needed for the foreseeable future. One possible source is earthquake insurance.

Less than a third of all property owners in earthquake-prone areas are estimated to have earthquake insurance. Moreover, sophisticated new loss estimation technology cannot soften the nationwide impact of a catastrophic event. When a key urban economy is hurt, many others will also suffer. This is a widely-recognized problem. However, destruction anticipated in various catastrophic earthquake scenarios is so large and difficult to estimate that a national program to cover seismically induced losses has been slow to evolve and faces serious difficulties in enactment. Estimated losses from a catastrophic event have varied, but have been in the tens of billions of dollars.

5.2.3 Federal Earthquake Insurance Proposals

In recent years, the insurance industry has approached the Federal government to enact legislation requiring 100% mandatory coverage in all homeowner and commercial risk insurance, backed by a Federally-sponsored reinsurance pool, to which loans could be made by the Federal government to offset losses incurred in

a catastrophic event. Such loans would be paid back through future premium receipts.

Passage of such legislation has been stalled by disagreement over whether Federally-required earthquake insurance should be accompanied by hazard mitigation in high-risk areas, to reduce the potential magnitude of losses over time. Similar principles underlie the Federal flood insurance program that has been in place for nearly two decades. That program has identified high-risk areas by issuance of Flood Insurance Rate Maps. Where the maps indicate high flood hazard areas, cities and counties must require hazard mitigation in their planning and zoning practices.

The argument in favor of mandatory mitigation says, those who are outside high-risk areas should not have to absorb costs of losses which might be avoided through proper hazard mitigation. The counter argument is that mandatory mitigation would increase local development costs in many communities where earthquake losses may not occur during the lifetime of those developments. Although the debate about required mitigation is far from over, as the probabilities of a catastrophic earthquake disaster increase each year, so does expectation that a compromise will be worked out.

5.2.4 State Earthquake Insurance

In 1996, the State legislature authorized formation of the California Earthquake Authority (CEA) to provide protection for homeowners' property. Total funding is $10.5 billion. Private insurers contribute up to $6 billion and the remainder comes from the reinsurance industry and Berkshire Hathaway (Kunreuther, 1999). With creation of the CEA, rates were raised and deductibles increased from 10% to 15%. This means that a homeowner who purchases insurance on a house valued at $200,000 would have to pay the first $30,000 in repairs. Under the CEA, the demand for insurance has declined dramatically, probably in part because of these changes. Market penetration of the CEA is estimated at one-quarter to one-half of the level prior to 1996. This raises questions about the cost of the CEA reinsurance, as it was based on assumptions of greater insurance sales and risk. According to the CEA, only 17% of California homeowner's have earthquake insurance. Regardless, as shown by the loss estimations prepared in Chapter 1 of this Technical Background Report, and those prepared for other scenarios (Shah, 1994), $10 billion coverage is inadequate.

5.2.5 Improvements Still Needed

Federal and State legislative trends toward establishing earthquake insurance programs hold out the promise of augmenting financial resources for disaster recovery. Such legislation could provide a valuable means by which to facilitate recovery and reconstruction. First, though, the efforts must be strengthened. There must be a pool of policyholders of adequate size to handle the problem of catastrophic losses; the pool must be expanded to include small businesses, and the programs must be directly or indirectly tied to structural retrofitting.

It benefits the County of Riverside to advocate strengthening of State and Federal earthquake insurance legislation. The County must understand that although California has in place a relatively comprehensive insurance plan, there must be Federal involvement to provide adequate catastrophic coverage. The County should track and seek passage of a version of the proposed Federal program, to be administered by the Federal Emergency Management Administration.

5.3 DISINCENTIVES TO UNSAFE DEVELOPMENT

In the past, development in hazardous areas occurred for economic or aesthetic reasons. For transportation, fishing and recreation, early settlements grew on oceanfront land susceptible to liquefaction or flooding. Many cities are built along waterways, and thus on flood plains. Residential developments cover faulted or geologically unstable hillsides where the views can be spectacular.

Sometimes, the hazards were known and ignored. In other instances, the historical record of disaster was fragmented or nonexistent, and the presence of the hazard was revealed long after initial settlement. In yet other cases, the hazard eluded understanding, such as variability of earthquake shaking intensity across different geographic locations. Sometimes an undiscovered hazard is belatedly, tragically revealed. A large number of reinforced masonry buildings failed during strong ground shaking in the 1933 Long Beach earthquake, which led to the first important seismic updating of the building codes.

Good progress has been made in regulating new development to withstand strong ground shaking. Progress has been much slower in mitigation of other natural hazards and in strengthening of older buildings constructed under less stringent standards.

As the threat of a catastrophic earthquake in southern California has become clearer, it is equally apparent that many communities need to accelerate mitigation of natural and structural hazards. This is more easily accomplished in relatively new, suburban communities where development frequently occurs on raw land. It is more desperately needed in existing communities where land use and construction decisions did not recognize the hazards at hand.

A public policy framework is needed that offers economic incentives for natural and structural hazard mitigation as well as disincentives to unsafe construction. Use of incentives and disincentives has grown in recent decades as scientific, engineering and public policy research have focused on better hazard mitigation and loss reduction techniques. The following discussion outlines a variety of regulatory and economic disincentives and incentives, some of which are in use, under consideration, or appropriate in Riverside County.

5.3.1 Seismic Design Codes

Within the framework of local government, disincentives are sometimes indirect, i.e., unmodified and implemented through written or unwritten policy. Yet most significant reduction of building damage and casualties in earthquakes comes from written and adopted building codes. A discussion of the improvements associated

with the 1997 Uniform Building Code (UBC) and the proposed 2000 International Building Code are presented in Chapter 1 of this Technical Background Report.

When the number of Northridge earthquake insurance claims were compared to ages of structures, there is less damage in structures governed by UBC improvements. For the UBC, 1940 and 1970 are benchmark years when code changes were implemented. Figure 5-2 illustrates these comparisons, from which several important observations can be made:

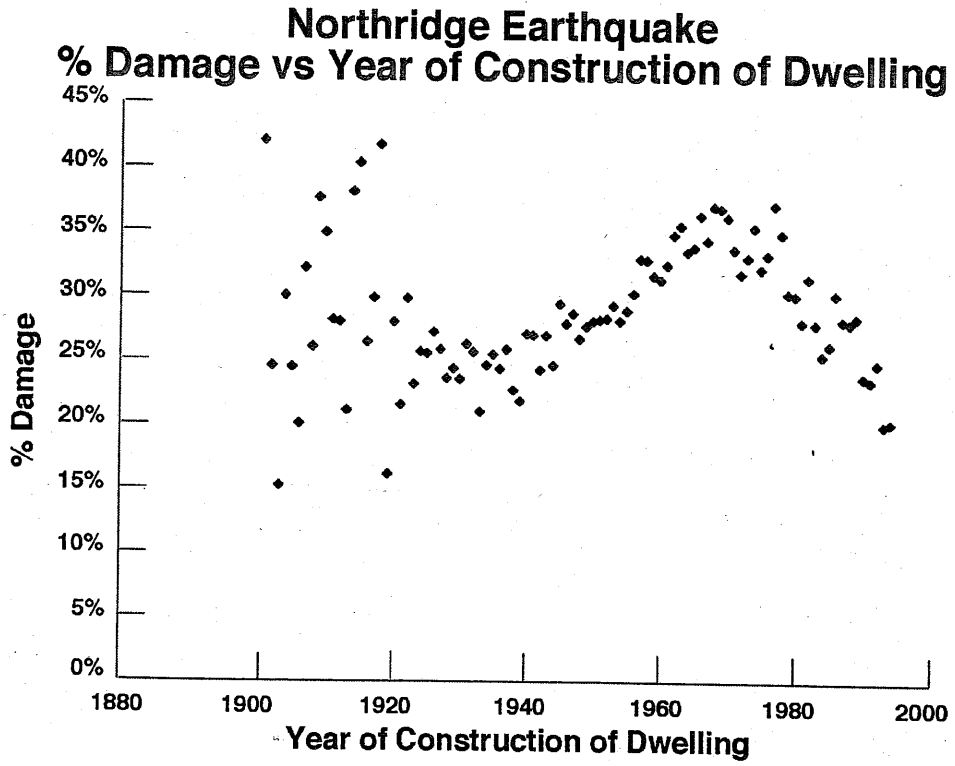

Figure 5-2: Insurance Claims versus Age of Structure as a Result of the 1994 Northridge Earthquake (modified from Roth, personal communication 1999).

Performance of pre-1940 buildings varies widely, from worst- to best-performing structures. This is likely related to a wide variation in construction quality, as well as the influence of other earthquake damage factors, such as ground motion variability.

Prior to 1971, a steady decrease in damage is observed with age. This is counter-intuitive, and may be attributable to changes in architectural home design such as cathedral ceilings and other features that performed more poorly in earthquakes and were more expensive to repair.

Consistently good performance is observed for structures that benefitted from the Code improvements of the early 1970s.

There is a time lag between code improvement and building performance improvement. Many projects are already planned or in progress when codes change, and are often exempted from the changes.

In matters involving public safety, disincentives tend to be regulatory to establish a legally defensible basis for substantial limitations on private activity. The most commonly disincentives to unsafe development practices are building codes, grading codes, soils analysis requirements and zoning restrictions.

The State of California has intervened in various aspects of seismic safety codes. Shortly after the Long Beach earthquake of 1933, the legislature passed the Riley Act, which established the first lateral force standards for structures, and the Field Act, which created structural standards for public schools. Subsequently, laws were passed requiring seismic design standards for dams, hospitals and other critical facilities. Hospitals (1972) addressed hospital seismic safety, Garrison (1969) mandated further seismic upgrade of public schools, and the Education Code (1986) required that new private schools meet seismic design regulations. In 1986, the State legislature enacted S.B. 547 requiring all local governments to inventory potentially unsafe buildings, establish a mitigation program and provide a copy to the Seismic Safety Commission. Because of the relatively small number of URMs in the unincorporated areas of Riverside County, the County has not addressed their mitigation through an ordinance.

To provide for minimum standards of safety in new development, about every four years the County has adopted updated versions of the Uniform Building Code (UBC), and has enforced the codes through the County Department of Building and Safety. UBC requirements set minimum standards for resistance to lateral force from ground shaking. In order to reduce their large inventories of URM buildings, cities like Long Beach and Los Angeles have adopted and implemented separate ordinances requiring structural strengthening through mandatory retrofit provisions.

The County of Riverside can do more. There are other buildings that also pose substantial risk, such as various older concrete buildings. The County should ensure that no structures will collapse in an earthquake. The County needs to

inventory unsafe buildings, and require seismic upgrading at reasonable junctures such as changes in occupancy. Notice of substandard condition should be recorded on titles of buildings not meeting the requirements of the State Riley Act, or other standards set by the County to determine potentially unsafe buildings.

5.3.2 Geological Hazards Mapping

Another disincentive to seismically unsafe construction lies with geologic hazards mapping, such as the Alquist-Priolo Earthquake Fault Zones along active faults. Zoning of active fault systems in Riverside County is described in Chapter 1 of this Technical Background Report and GIS mapping has been provided with this study.

Disincentives are also built into 1990's Seismic Hazards Mapping Act, which extends State intervention into areas of potential liquefaction, strong ground shaking and earthquake-induced landsliding. To date, no State mapping has been completed in Riverside County, which reflects realities of funding, not degree of hazard. This study provides detailed GIS mapping and hazard evaluation within the Technical Background Report.

Riverside County can continue to reduce hazards by refining these maps as new data become available. Several important ground motion studies are in progress in southern California, with results germane to Riverside County. Also, while it would be prohibitively expensive to go out and map the whole County at finer scale, required geotechnical reports can be compiled and used to improve zonation in portions of each map. The expense of these detailed studies, combined with the expense of mandated mitigation measures, might push new development into safer areas.

5.3.3 Density Restrictions

Using seismic, ground instability, flood and fire hazards maps provided in this Technical Background Report, restrictive changes can be made to zoning and General Plan land use designations to limit densities and land use intensities within hazardous areas. Such disincentives are more readily administered in communities having remaining vacant lands. Depending upon the nature of the policy adopted in the revised Safety Element, the County could choose to revise land use designations on the Land Use Element and modify zone boundaries to reflect new density restrictions.

These broad-brush General Plan and zoning restrictions are best used in combination with a more specific approach to require extra measures in overlay zones that delineate known or suspected geologic hazards. Developments within overlay zones must make geotechnical reports, which could lead to mitigation measures such as structural strengthening, special site preparation or site plan modification. Restriction of on-site density will also be justified in some cases.

5.3.4 Impact Fees

Overlay zones are based on best available information, and thus their boundaries will be adjusted with time. This raises questions about adjoining land. Should there be design or density restrictions on other nearby parcels? An equitable way to answer this and minimize the cost of geological investigation to get answers is for the County to sponsor such studies through collection of an impact fee.

The fee could be levied as a service charge on all properties within a given distance from an overlay zone. In this scenario, a geologic hazards assessment district would be formed around each overlay zone. Or, a fee could be exacted on proposed development within the defined, adjoining area. Separate developer fees may act as a disincentive to any development, leaving the exact nature of any geologic threat unresolved.

The principal constraint on use of impact fees is the statutory requirement that any fee collected have its basis in identifiable and justifiable local governmental costs. The County is prohibited from establishing a fee to serve only as a disincentive to development. It may create such fees only when a public service related to a legitimate public goal - in this case, safety - can be measurably identified and financially described.

5.3.5 Proposition 218

This measure was adopted in November 1996 and dramatically revised local government finance. Previously, local elected officials had the power to establish new revenue sources, in addition to use fees. Proposition 218 requires voter or property owner approval. It has replaced representative democracy in local government finance with direct democracy.

Proposition 218 affects most local government revenues, including garbage collection fees, fire assessments, and utility user taxes. The only local revenues not affected directly by Proposition 218 are: fees for local services not related to property, gas and electric charges, fees collected as a condition of property development, and intergovernmental transfers (Colantuono, 1997).

5.4 INCENTIVES FOR SAFER DEVELOPMENT

Various economic and administrative incentives for safer development have been employed by other communities to induce voluntary compliance with safety objectives and standards. In theory, economic incentives hold out the promise of allowing local jurisdictions to avoid increased regulation. In practice, they tend to be used in combination with regulation in a "carrot-and-stick" approach. The following sections describe standard approaches as well as some innovative techniques that might be useful but require further exploration. Ultimately it all comes down to how strongly Riverside County wants to build a safe community.

5.4.1 Project Impact: Building Disaster Resistant Communities

This nationwide FEMA initiative, Project Impact, operates on this common-sense damage-reduction approach, basing its work and planning on three simple principles: preventive actions must be decided at the local level; private sector participation is vital; and long-term efforts and investments in prevention measures are essential. FEMA partnered with seven pilot communities across the country and was encouraged by the benefits seen and the determined commitment that flourished at the local level. This has been a unique experiment: FEMA has offered expertise and technical assistance from the national and regional level and included other Federal agencies and states in the equation. FEMA has used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. Now, FEMA has nearly 200 Project Impact communities, as well as over 1,100 businesses that have joined on as Project Impact partners.

There is no doubt that Project Impact is a common sense approach for the way communities deal with disasters. The incentive is clear: a disaster resistant community is able to bounce back from a natural disaster with far less loss of property and consequently much less cost for repairs. Moreover, the time lost from productive activity is minimized for both businesses and their employees. Indeed, FEMA estimates that for every dollar spent in damage prevention, two are saved in repairs.

5.4.2 Retrofit Financing Incentives

Some jurisdictions have used Federal Community Development Block Grant (CDBG) funds to create loans for retrofitting URM buildings. Sometimes such loans are available in the form of gap financing, which supplements loans obtained from

commercial banks and extends the amortization period. Reduced rates on CDBG loans lower the overall cost of borrowing money and lower payments as well. Most important, the loans have a pay-back period of seven to ten years rather than two or three years, which can make a significant difference to building owners and tenants.

5.4.3 Assessment District Formation

A recent application of assessment district financing is exemplified by the formation of a district and issuance of a bond by the County of Long Beach in 1991. This was done to cover$17.3 million in seismic upgrading to approximately 200 URM buildings. Retrofitting work was done by 1994, but assessment district payments are spread over 24 years, resulting in a low monthly cost. The program has been well-supported by property owners involved.

Another form of assessment district incentive is the Geologic Hazard Abatement Act. Adopted in 1979, this law spells out the procedures by which property owners may form a special assessment district to pay for abatement of a geologic hazard found on their properties. While there are a few successful applications of this law statewide, it has been difficult to implement due to stringent provisions and the emotion often encountered after property damage has occurred. The California Seismic Safety Commission is studying how to encourage property owners to apply in advance of damage.

5.4.4 Historic Preservation Incentives

Under the Mills Act, enacted by the State legislature in 1976 and amended in 1985, owners of historical properties can qualify for property tax relief by entering into a contract with a local government. Similar in many ways to the Williamson Act that is geared to agricultural land preservation, the Mills Act requires a mandatory ten-year contract. After one year, a notice of non-renewal provisions begins a nine-year phase-out of the contract. Mills Act contract procedures let the County choose which properties to include in the program and what seismic upgrading or other conditions to require, while at the same time providing property owners an incentive for offsetting retrofitting costs with property taxes saved.

5.4.5 Extended Nonconforming Rights

Some unsafe buildings also may be nonconforming to present zoning regarding

setbacks, height, parking or use. Repair and restoration of such buildings or uses following fire or earthquake can be tied to the owner's willingness to pursue seismic retrofitting. For example, where damage is less than 50% of replacement cost, nonconforming buildings or uses will be allowed to return to their "original condition" or "original state." However, where damage is beyond 50% of replacement costs, nonconforming buildings or uses must not be repaired or replaced. Such buildings and uses may also have set time limits for termination as a result of zone change. However, these provisions may serve as disincentives to reinvestment in older buildings and owners might be inclined to let them deteriorate or be demolished.

5.4.6 On-site Density Transfer Incentives

A commonly-used incentive for mitigating geologic hazards on individual project sites is density transfer. Where a site has known geologic hazards, General Plan and/or zoning densities are transferred from the part of the site with the hazard to the portions of the site where the hazard is minimally present or nonexistent. Density transfer is more difficult on smaller sites due to height and setback limitations, as well as more direct impacts on adjoining properties. However, provisions may be made in the zoning code for modification of height and setback provisions to enable density transfer, taking into account possible impacts on the neighborhood.

5.4.7 Transfer of Development Rights

Transfer of Development Rights (TDR) is a similar concept that extends the transfer incentive beyond property boundaries. With TDR, the unused increment of building bulk from a "donor" site is added to allowable maximum bulk at a "receiver" site, through County review of the transfer. The proceeds from purchase of the unused increment benefit the owner of the "donor" site, and the developer gains increased project value at the "receiver" site. The purchase transaction can be entirely private, regulated or public.

Because it is complex, difficult to administer and sometimes opposed by property owners neighboring the receiver, the TDR concept has not been widely used. However, it has been employed successfully in downtown Los Angeles, as a combined development and historic preservation incentive.

Certainly, Riverside County is an entirely different setting than downtown Los Angeles, yet the TDR concept might be useful, in three regards. First, TDR could provide unsafe building owners a source of income to offset costs of seismic upgrading. Second, it could be used to compensate property owners in geologically

hazardous areas for loss of future development potential. Third, TDR could provide an economic incentive for development in locations where it is desired, under terms defined by the County.

To implement TDR successfully, careful attention would need to be given to planning principles and procedures. The most common problems are to identify acceptable receiver areas and to create equitable standards for approval of transferred densities or floor area.

The principal drawback of TDR is that it is entirely market-dependent. Private sector interest is likely to wax and wane with economic fluctuations. Therefore, it cannot be applied as a single solution incentive.

5.4.8 Severe Development Restrictions

The most significant court challenge of development restrictions involved Lucas vs. The State of California. In 1986, The State of California attempted to improve public access and visitor appreciation of its beaches by prohibiting development within 40 feet of the farthest landward extent of the coastline, based on old coastal photographs. A developer, David Lucas, found his lots to be completely within the setback zone, and sued the State for compensation, alleging an illegal takings. After several years and appeals, the US Supreme Court eventually found for Mr. Lucas, and The State purchased the lots from him for $1.5 million. While a loss to the environmental movement, a closer reading of the Supreme Court decision makes it apparent that the Court ruled strictly on the basis of economic issues. The State of California regulation was based on improving the tourism industry, not in improving public safety. Two aspects of the Court's decision are worthy of consideration in Riverside County. First, the Court differentiated between a taking that eliminated all value, verses regulations that only diminish value. Diminution does not necessarily require compensation. Second, the Court indicated that taking of a property to prevent harm does not require compensation. It is in the government's mission to protect the health, safety, and welfare of its citizens. Development prohibition based on natural hazards may be required under this mission.

While it is a difficult course to steer, there are a few steps to take to fall within the decision in the Lucas Case:

- do not eliminate all economic value of a property;
- identify other, more appropriate land uses based on public safety considerations;
- work with adjoining property owners to transfer development rights

from impacted properties to less impacted properties;

- be prepared to defend a more public utilization of the property based also on public safety considerations; and,
- be very accurate and forth right with the basis for the hazard delineation

5.4.9 Property Acquisition

Perhaps one of the most far-reaching solutions to promote safer development is to prohibit development through public acquisition of unsafe properties. Parcels thus acquired could be turned to public uses that are more in harmony with the natural hazards inherent in the property. Open space and habitat protection are ideal uses for properties in high wildfire, floodplain, landslide, or active fault hazard zones. While initially more expensive, the costs associated with property acquisition will be less that the costs of the disaster after the natural hazard event occurs.

5.5 HAZARD INFORMATION MANAGEMENT SYSTEMS

Advances in electronic media and computer technology are revolutionizing the manner in which information is prepared and maintained in all walks of life, including business, industry, government and individual households. The public and private sectors now increasingly rely on automated data management for day-to-day operational needs. Computerized methods of information storage and retrieval, previously thought to be prohibitively expensive, are coming within range of local government budgets.

Automated information management has been shown to substantially increase productivity, efficiency and levels of service. Primary obstacles appear to be initial outlays for computer hardware, system design, data input and staff training. Once functioning and maintained, such systems can enhance the effectiveness of various organizations.

5.5.1 Geographic Information System

Among the advances in computer technology is the growing development of Geographic Information Systems (GIS) as a technical tool for planning, engineering, geology, emergency management and a variety of other disciplines upon which efficient government management relies. New GIS applications encompass a variety of purposes, from conversion of simple road maps and commercial atlases to demographic analyses that shape marketing and political redistricting decisions. Improved scanning of data from remote sensing and aerial photographic sources has increased efficiency of natural resource and land use mapping. Hardware diversification and software improvements have decreased dependence on mainframe computers. User-friendly software is opening up GIS applications to professionals and technicians in many fields, especially with the proliferation of personal computers.

The two great values of GIS development have been in improved mapping efficiency and flexibility, and in the new capability to link mapped data to statistical and written records. GIS enables users to quickly compare mapped features such as vegetation, topography, slope, soils, drainage, housing, land use, transportation and utilities to aid in planning, engineering, emergency management, environmental review and community development decision-making. It also allows for quantitative data to be generated from mapped features and vice versa. Once the data are entered, it is a matter of seconds to determine, for example, the number of day cares housed in URMs, or the locations of residences in high risk fire areas that have changed owners since the last fire, and thus are in most need of education about wildfire safety.

Traditional cartography is tied to tedious photographic methods of map scale modification, whereas GIS offers instantaneous portrayal of mapped features at variable scales. A tremendous amount of public domain data is available in GIS formats. Additionally, automated storage enables a variety of users, including the public, to quickly obtain desired information through computer video display terminals stationed at strategic locations such as public information counters, or through electronic transmission including modem access.

Also important is the relative ease of maintenance. Updates can be made in GIS databases at relatively low unit costs. This enables GIS users to track changing information about local conditions that may be of concern. With regard to public safety, GIS enables communities to accurately track progress on abatement of hazards and to shape policy direction for improvements in emergency management.

5.5.2 Riverside County's Land-Based Data Systems

Preparation of this Safety Element and Technical Background Report, we have developed a GIS for storage, management, and retrieval of data on natural hazards and other features important to planning, building, community development, engineering, police and fire functions. This GIS provides an excellent foundation for a digitally mapped emergency management database. Now is an excellent time to phase out the manual methods of information management.

The Riverside County Transportation and Land Management Agency (TLMA) is responsible for the County's Land Management System (LMS) and Geographic Information System (GIS). The Transportation and Land Management Agency consists of three departments: Building & Safety, Planning and Transportation.

At the core of the County's GIS is the parcel base that is used to reference property information. More than 400,000 Assessor Parcel Numbers (APNs) have been entered. The type of data that may be viewed from an internet browser associated with the APN includes: County Supervisor district and name, zoning, acreage, owner and mailing address, assessment and/or district information, legal description, sub-division and lot.

A primary purpose of the system is to develop a common mapping base, thus reducing duplication of labor in all county departments that produce maps. The County's map base is organized into five major libraries including: Book, Census, Quad, County, and Township. Each of these libraries contains multiple layers that include the graphic and attribute data necessary to create both reports and maps. For example, the Township library presently contains four active layers: Contour

(topography), Monument, Slope, and Survey (section, township, and range). Over 100 layers of information are available for County departments (Riverside County TLMA, 2000). Many applications have been developed from the common base including: community plans, special district mapping, transportation improvement plans, environmental mapping, and parcel information for research and public information.

The County TLMA also has online an Environmental Hazards Map, illustrating general fire, faulting, and liquefaction. The GIS data generated for preparation of this Safety Element provides an opportunity to update the hazards data for the County. In addition, the County could improve its interface, from a system where tax assessor parcel numbers are required, to a graphical interface. For example, Louisville, Kentucky (http://www.lojic.org/ims/standard1024.html) provides a graphical interface with hazard layers and progressively more detail as users zoom in to an area of interest.

For the most part, information on Riverside County's geography, topography, land use, utilities, emergency management and hazardous conditions (including structural, geologic, flood, fire and toxics) is developed and maintained in a variety of manual records. As is true in many, similar-sized communities, many County maps were prepared with painstaking, hand-drawn cartographic methods that relied on photographic enlargement, reduction and reproduction processes. Such maps cannot be generated from, nor directly correlated with, numerical databases or written records, or vice versa. Moreover, separately mapped features cannot be readily compared with each other without the use of clumsy plastic or vellum overlays.

5.5.3 Implementing an Emergency Management GIS

The County has a functioning GIS mapping system with relational databases. A variety land-based data files are in use, and are updated by this study. Now is the time to create an emergency management GIS.

Among the data layers prepared in conjunction with this Safety Element are a series of maps describing natural hazards. Hazardous conditions include fault zones, shaking intensity zones, areas susceptible to liquefaction, landslide and settlement areas, flood and wildland fire hazard areas. The HAZUS database utilized in the earthquake scenario loss estimations prepared for this Technical Background Report includes hazardous materials sites, bridges, dams, fire stations, police stations, Emergency Operation Centers, hospitals, as well as estimates about general building stock. This inventory can be overlain on ground shaking maps,

including TriNet (SHAKE) maps that are computer-generated based on instrumental recordings of southern California earthquakes. The County has the capability to conduct near-real-time loss estimation. This can be a great aid in distributing resources and responding to a disaster. To make and keep this capacity, the County GIS inventory must be kept current and an interface established with the near-real-time TriNet data.

If all these available data were integrated and used, the Safety Element database would be one of the most ambitious automated local government emergency management GIS programs in California, and would set a model for other jurisdictions to follow. As is true for all major undertakings, a great deal of investigation and analysis is needed to make this possibility a reality. Issues requiring attention include careful review of long-range system development priorities, future hardware and software enhancements, sequencing of data inputs, and a user-based review of database integration requirements.

5.5.4 User Responsive System Development

A common complaint about computer system applications is that they overlook specific user needs. Great effort has been expended in recent years to include users in the design of the database and other details of development and maintenance. This is a healthy trend that does not just apply to commercial software. As the County automates various Safety Element data layers and designs an emergency management GIS component, responding to ongoing user input will guarantee the most effective system.

To determine emergency management GIS system development priorities, it is important that developers and potential users consider both the worst-case, long-term disaster scenarios, for which the community will be conducing long-range mitigation, as well as short-term, critical data requirements which would be needed should a disaster occur tomorrow. For example, in a long-term scenario, the County might want to decide among retrofit compliance periods, say, three years versus seven, by analyzing inventories of unsafe structures in conjunction with geographic shaking intensity predictions to project the likely locations and degrees of loss associated with each time frame. A critical data requirement, on the other hand, might be the establishment of a basic street network layer, including vulnerable bridges, which would allow on-line routing of emergency vehicles and recording and updating of actual damage conditions during the critical hours following a disaster.

Such priorities cannot be determined by systems analysts alone, whether County staff or expert consultants. Some priorities will depend on the revised Safety

Element itself. All priorities must be examined with the full involvement of all departments that will use the emergency management GIS data. This should be done, even if it involves greater short-term costs, to enhance the system's credibility among prospective users, and, more importantly, because it will be more expensive later to face costs associated with loss of life or property damage and system revisions, should such critical priorities be overlooked now.

5.6 HAZARDS OVERLAY ZONES

Hazardous conditions vary greatly in character and geographic distribution. Structural hazards, such as URM buildings, may be scattered through a community or concentrated within a few blocks, depending upon historical building patterns. Flood hazards are often widespread. Fault rupture hazards are localized, while strong ground shaking potential may be extensive. Contamination from chemical spills can be highly localized, while releases of hazardous gases can affect entire neighborhoods. Sometimes, these hazard conditions are found in combination and may interact. For example, a hazardous spill can dump toxics into a river during a flood.

Whether separate or combined, such structural, geological and technological hazards all call for specific types of mitigation or abatement procedures. Mitigation measures required for one type of hazard may have no relation to those needed for another. Liquefaction potential might require special foundation treatment, but if the site is on a flood plain, perhaps the development should not occur at all.

Similarly, mitigation measures needed to abate a certain type of hazard might not be reasonable if applied on all properties throughout the jurisdiction. It would be impossible, for instance, to justify the cost of adding foundation requirements to offset liquefaction effects in areas not susceptible to that condition.

In a trend toward more sophisticated regulatory practice, many cities have adopted special hazard-specific regulations, in addition to normal zoning, building, and subdivision codes and ordinances. Special measures needed to mitigate a given hazard cannot help other hazards, cannot be required in situations where such hazards do not exist, and should not be imposed upon all properties in the jurisdiction. Specialized mitigation measures tailored to each hazard in each area, such as special site preparation, setbacks, site layout, or structural design, would be applied only to the locations described by overlay zone boundaries.

- Overlay zones applied to hazard zone mapping can reduce the hazard through several routes:

- Special investigation requirements that may lead to a recommendation of mitigation measures.

- Land use zoning policy recommendations. For example, no- or low-density land uses would be appropriate for fault special study zones, where building setbacks may have to be implemented.

- Real estate disclosure. Disclosure of potential hazardous conditions can be attached to the property title.

- Flexible means of amendment. Preliminary studies leading to the initial definition of boundaries can be supplemented over time as understanding grows.

- Contribution to the state of scientific knowledge. Studies required within overlay zones can help advance understanding of the hazard.

- Public education. Overlay zones flags conditions of which citizens should be aware for their own education, preparedness and well-being.

Adoption of overlay zones may require more planning and zoning guidance, additional staffing and sometimes, greater controversy. The alternative is to impose jurisdiction-wide mitigation standards that deal with specific hazards as they are encountered, case-by-case. The following discussion explores these alternative approaches.

5.6.1 Overlay Zones as a Planning Tool

Section 65852 of the California Government Code requires local jurisdictions to apply zoning so that it is "uniform for each class or kind of building or use of land throughout each zone." This means, for example, that an additional requirement to set-back a house from a fault surface rupture cannot be enforced unless the zoning ordinance specifically sets forth fault setback provisions applicable to any property in that zone facing such hazard.

The overlay zone concept has become popular among local governments seeking to regulate specific problems applicable only to certain portions of their jurisdiction. It enables a County to isolate an issue, such as the scenic quality of a road or neighborhood, and "overlay" regulations dealing specifically with that feature.

Precise provisions and boundaries of the overlay zone are adopted by ordinance after public hearings before the Planning Commission and County Council. Provisions may be geared toward aesthetics, urban design or public safety purposes, which are described in the ordinance.

Overlay zones allow a County to meet three fundamental objectives:

1. Create restrictions on development that are geared specifically toward solving a particular problem or protecting an identifiable and/or measurable resource;

2. Avoid placing unreasonable additional restrictions and costs on development of properties where the problem does not exist or the resource is not present;

3. Identify precisely, through a public review process, the applicability of additional development restrictions to specific parcels of land.

Although overlay zones add regulations and therefore additional complexity to the development process, they are simpler to deal with than across-the-board amendments to the zoning ordinance. In the latter approach, a host of special restrictions to the zoning ordinance are added to each applicable zone. It becomes the burden of the parcel developer to conduct a multiple-hazard assessment. This tends to create additional "shotgun" requirements on ill-defined problem areas. It also increases the possibility of the problem being overlooked in cases where zone boundaries are not precisely defined. Such oversights can be extremely costly and expose the County to legal liability if the problem arises later, or worse, results in injury or severe property damage. This has been the experience of some jurisdictions with landslides.

5.6.2 Hazards Management Zoning

The same principles and procedures used in adoption and application of other overlay zones can be extended for use in creating hazards management zones. Many jurisdictions have adopted overlay zones to manage specific types of hazards, such as fault surface rupture. For example, the County of San Bernardino has adopted and applied a Safety-Geologic (SG) overlay zone for active fault areas, defined as "those delineated on the Alquist-Priolo Earthquake Fault Zone Act maps or maps within the County General Plan." Special development standards applicable within that overlay zone include the mandatory minimum setback from the fault trace of fifty (50) feet for all structures used for human occupancy and one hundred fifty (150) feet for critical facilities.

5.6.3 State Seismic Overlay Zones

The Alquist-Priolo Earthquake Fault Zones Act maps have functioned as a de facto form of overlay zoning since the first maps were issued in 1973. Although the Act only applies to about 84 cities and 33 counties, or 23% of all local jurisdictions in the state, and to a small percentage of the state's total land area, it has kept structures off fault lines throughout the state.

State geologic hazards mapping was expanded as a result of the Seismic Hazards Mapping Act of 1990. The new hazard maps are to show strong ground shaking, liquefaction and seismically-induced landslide potential.

Because of the significantly greater land area covered by these hazards, many more cities will be affected. Over a period of time, State mapping will require a growing number of cities and counties to administer the provisions of the Act. For any project proposed within seismic hazards study zones boundaries, mapped on USGS quad sheets at a 1:24,000 scale, developers must submit geotechnical reports and local jurisdictions must review them. Localities wishing to waive the required geotechnical reports will have to justify such waivers to the State. The geotechnical reports must describe geology and soils conditions, and address mitigation measures that might appropriately handle the identified hazard.

The relatively small scale and generalized mapping will require local interpretation to determine the specific boundaries of the State seismic hazards zones, so that individual parcels of land can be determined to be included or excluded. Rather than attempt this case-by-case, local jurisdictions may prefer to adopt local overlay zones. These provide clear procedures for local interpretation. By delineating State-mapped hazard zone boundaries in relation to local land parcels, the requirements for geotechnical reports may be more efficiently administered.

5.6.4 Disadvantages of Local Safety Overlay Zoning

Adopting and applying overlay zones may generate controversy from the objections of property owners, builders and developers. Opposition may derive from many sources. Concern for short-term profitability rather than uncertain, long-term negative consequences; lack of confidence in scientific appraisals of hazard; or fear about potential devaluation value of the land may all contribute.

There will also be opposition to additional hazard mitigation costs. Short-term costs would be offset in the long-term by reduced losses in future disasters. However,

those bearing the short-term costs may not be the same people receiving long-term safety benefits. Adding to frustration are the uncertainty in scientific forecasting of disasters, imprecision of mapping many geologic features because precision requires costly site-specific investigation, and questions about the effectiveness of certain mitigation measures, usually due to incomplete data.

Using hazards management overlay zones could add additional cost of implementation. The most obvious costs would relate to processing new development applications in the overlay zones. Such costs could be passed along to the development through application processing fees, thus avoiding an additional cost to the general taxpayer.

Perhaps the toughest policy question is retroactive abatement of nonconforming buildings and uses. This issue would need careful consideration during the preparation and adoption of such an overlay zone. However, the hazard exists regardless. Having an overlay zone simply forces the community to decide on acceptable levels of risk *before* a disaster strikes.

5.7 RECOVERY AND RECONSTRUCTION

Need for Recovery Planning: After major disasters around the world, local governments have been beset with pressures to act quickly to put their communities back together and restore normalcy. Businesses and governments alike are generally unprepared to deal efficiently and wisely with the flood of decisions about how best to recover and reconstruct. Poor timing of disaster assistance leads to failure of businesses that might otherwise survive. Buildings are rebuilt in an unsafe way or in hazardous locations so that similar destruction is likely to reoccur.

Hard experience from recent California earthquakes has demonstrated the importance of preparing in advance of disaster for actions taken after. Local government has a major responsibility to prepare in advance to handle community recovery efficiently and wisely. Delays and confusion are caused by competing priorities for action and resources and can be diminished by planning. Management systems and policies must confront pre-event hazard mitigation as well as post-event short-term recovery and long-term reconstruction actions.

5.7.1 The Safety Element and Recovery Planning

As a comprehensive policy framework for community hazard reduction, the Safety Element provides an ideal foundation for pursuing recovery and reconstruction issues. Pre-event mitigation of structural and natural hazards directly reduces post-event expenditure of human and financial resources for emergency response, and then recovery and reconstruction. The State's General Plan Guidelines encourage local governments to include "contingency plans for immediate post-earthquake response and longer term reconstruction activities in areas potentially subject to significant damage." Moreover, incorporation of disaster recovery and reconstruction policies in local Safety Elements can help communities to see their critical importance.

It is necessary to face the reality that all known hazards will not be fully mitigated by the time disaster strikes. To the extent that a County has prepared itself to deal with the sudden onslaught of emergency, recovery and reconstruction requirements,, it will be in a good position to facilitate restoration of normalcy. All levels and departments of County government must be willing to look beyond the more familiar emergency response functions to the less well-known recovery and rebuilding issues. There will probably be a need for staff guidance and training.

A Safety Element cannot fully equip a community to perform well in recovery from a real disaster. That requires more in-depth planning and a comprehensive study

of real disaster recovery experiences, worldwide. A Safety Element can set the stage and provide the informational and policy foundation for more detailed recovery and reconstruction planning and training. A Safety Element can also assign post-event recovery and reconstruction organization and duties.

5.7.2 Status of Recovery Planning in Riverside County

In recent years, the County of Riverside has expanded its emergency preparedness planning. The County is required under State law to prepare and maintain a Standardized Emergency Management System (SEMS) Multihazard Functional Plan. The California Governor's Office of Emergency Services (OES, 1999) has extensive guidelines outlining the requirements of the County SEMS. These guidelines establish policies and procedures and assigns responsibilities to ensure the effective management of emergency operations under the SEMS. Effective management depends on the emergency management structure and how the emergency management team is activated.

The SEMS does not address long-range recovery planning issues.

5.7.3 Recovery Planning Issues

Among the many, specialized post-event issues and operations that must be considered are recovery organization, extraordinary powers, temporary and replacement housing, business and industrial resumption, fiscal reserves, Federal and State disaster assistance, damage assessment, hazards evaluation, expedited permit processing for repairs, nonconforming rights, illegal uses, moratorium procedures, handling of damaged historical buildings, restoration of infrastructure, rebuilding plans, redevelopment procedures, General Plan revisions, public review, and return to standard operating procedures.

Few of these issues are recognized in the standard operational guidance and training provided by State and Federal emergency agencies. Most such training deals with recovery operations in the first weeks or months after a disaster. Complete recovery and reconstruction planning, however, must anticipate issues and decisions for years after the event. For example, although pre-event hazard identification such as the Safety Element mapping can help local jurisdictions anticipate probable damage patterns, no one really knows the actual damage until the event happens. Thus, the exact geographic distribution of repair and rebuilding needs cannot be foreseen. However, the general character, magnitude and probable distribution can be anticipated, which enhances the community's response.

In Riverside County, it can be anticipated that a major earthquake would produce severe damage in areas of liquefiable sediments topped by high-population-density buildings constructed of older, inadequate design (such as URMs, tilt-up concrete wall, nonductile concrete frame or soft story construction). While we cannot predict which ground will liquefy, nor which particular buildings will fail catastrophically, we can guarantee that evacuation and reoccupancy of such buildings are issues that will arise.

During the short-term recovery period, which can last up to two years, decisions would have to be made about demolition vs. repair and the financing found to do either. As was the case with the community of Santa Cruz, which was heavily damaged by the 1989 Loma Prieta earthquake, discussions will be heated when considering demolition or repair of buildings of historic value. Equally as difficult is branding whole neighborhoods as too damaged to repair. Restoration of infrastructure can also be a long-term concern.

Long-term reconstruction issues emerge early in the short-term recovery period, but characteristically continue for several years. In a heavily-damaged community, major rebuilding can last up to ten years. During such periods, County personnel and leadership will see greater than normal job turn-over, accelerated by the early and sustained stress of recovery decisions. In Santa Rosa, after a major earthquake in the 1960's that leveled 20 blocks in the downtown area, a number of top officials took early retirement and, in a few cases, were reported to have died from the stress. Santa Rosa ultimately rebuilt a better downtown area, but property owner lawsuits took years to settle.

For all of these things, a community can prepare. But such preparation requires commitment at the policy level to undertake such substantial pre-event planning effort. The new Riverside County Safety Element provides the policy framework for the initiation of such an undertaking.

5.7.4 Recovery Ordinance as a First Step

The California Disaster Recovery (and) Reconstruction Act of 1986 authorizes local governments to plan, organize and prepare in advance for speedy recovery and reconstruction after a disaster. Among the activities authorized is the pre-event adoption of an ordinance, to be activated with the declaration of emergency, which clearly spells out the recovery organization and the duties and responsibilities of its member departments and officials.

Such an ordinance can be extremely useful in organizing recovery efforts. It saves

time when time is at a premium, makes plans at a time when thinking is clearer, and provides a stronger legal basis for potentially controversial post-event decisions. The ordinance can dictate authorities and powers of different County officers, distribution of responsibility and accountability, authorization of extraordinary procedures for streamlining repair permit issuance and simplifying public notice, interim joint powers and contract procedures, criteria for establishing building moratoria, standards for expedited repair permit processing, criteria for restoration of standard operating procedures, and organization for planning and implementation of long-term reconstruction and redevelopment programs.

The new Safety Element should be accompanied by such an ordinance, for consideration by the County Board of Supervisors. This ordinance should structure the framework of a recovery and reconstruction planning effort as well as all post-event organization and duties that can be anticipated. There will still be many long hours required to work out and maintain a detailed recovery and reconstruction plan. The ordinance provides a springboard to a comprehensive emergency and disaster management strategy.

5.8 Summary

- Riverside County must adopt a hazard mitigation plan acceptable to the Federal Emergency Management Agency (FEMA) if it is to receive facilities restoration assistance authorized under Section 409 of the Stafford Act. In recent disasters, FEMA has recognized Safety Elements of California local governments as fulfilling Section 409 hazard mitigation plan requirements.

- Natural disasters are currently under-insured, and government assistance is incomplete. Insurers face many uncertainties with natural hazards coverage and have been resistant to supplying it. Instead, they have lobbied the government to create a Federally-sponsored reinsurance pool for earthquakes, to spread earthquake disaster costs over more manageable lengths of time and payees.

- The County has available a range of disincentives to unsafe development and incentives to mitigate natural and structural hazards. The choice of particular disincentives and incentives will depend on the direction and character of public safety policies adopted in the Safety Element. The most effective approach will probably be to use several in concert. Each has relative advantages and disadvantages, which must be weighed before implementation of them as a package.

- Digitized in an integrated GIS database, Safety Element hazard data provide a mechanism to: 1) present selected information at a variety of scales and formats; 2) facilitate availability of identical databases to all interested agencies, from a planning agency issuing permits, to a fire department accessing hazardous materials business emergency plans; 3) simplify update of the database with new information, such as newly identified or mitigated hazardous buildings, changes in occupancy of dependent facilities, or current river levels; and, 4) create an interactive, on-line emergency management GIS for use in disaster preparedness, response, recovery and reconstruction.

- An emergency management GIS system will be most useful to the widest array of County and other users if users are fully consulted in the system's formation and prioritization. This system can be further enhanced by data sharing and database development with regional entities, other local governments, and private organizations such as utilities. This will minimize costs and accelerate GIS development.

- Hazard overlay zones can be controversial but are a proven method of isolating and systematically dealing with problem areas. When evaluated from the standpoint of their prime purpose -- enhancement of public safety -- they provide a reasonable and equitable means of creating safer development and reducing hazards. Their prospective application and utility in Riverside County will be dependent upon the general thrust and character of policy in the revised Safety Element. Like all mitigation techniques, overlay zones are not perfect nor all-encompassing. They should be viewed as one in a group of useful hazard reduction tools, which together can strengthen safety and reduce the chance of unnecessary loss of life and property.

- Pre-event planning for post-disaster recovery and reconstruction is strongly advised. Emergency and disaster management literature, reflecting the experiences of communities around the world, demonstrate common patterns of recovery activity that can be fashioned into preventative planning. In preparing a Safety Element for adoption, Riverside County is well positioned to shape the overall directions of future recovery planning and action. A Recovery and Reconstruction Ordinance would be a solid step toward a comprehensive disaster preparedness, response and recovery program.

APPENDIX A
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APPENDIX B
GLOSSARY

100-year Flood Event- A flood that has a 1/100 chance of occurring in any one year, and a 26% chance of occurring during a typical 30 year home mortgage.

500-year Flood Event- A flood that has a 0.2 percent annual chance of occurring in any one year.

Abatement- Reduction or elimination of a hazardous condition, including but not limited to strengthening, occupancy restrictions, or demolition.

Acre- A measure of land area in the United States and England containing 43,560 square feet.

Active Fault- For implementation of Alquist-Priolo Earthquake Fault Zoning Act (APEFZA) requirements, an active fault is one that shows evidence of, or is suspected of having experienced surface displacement (relative movement of the two sides of a fault) within the last 11,000 years. APEFZA classification is designed for land use management of surface rupture hazards. A more general definition (National Academy of Science, 1988, states "a fault that on the basis of historical, seismological, or geological evidence has the finite probability of producing an earthquake" (see potentially active fault).

AEG- Association of Engineering Geologists. www.aegweb.org

Aftershocks- Smaller earthquakes following a greater one and originating at or near the same place; Frequency of aftershocks decreases with time.

Air Attack Program- The California Department of Fire (CDF) and the U.S. Forest Service (USFS) operate a joint air tanker base.

Alluvial Fan- An outspread, gently sloping mass of poorly compacted gravels, sand, silts, and clays deposited by a stream, especially in an arid or semiarid region where a stream issues from a narrow long, deep, steep-sided valley onto a plain or valley floor. Viewed from above it has a shape of an open fan, the apex or highest point being the valley mouth.

Alluvium- Surficial sediments of poorly consolidated gravels, sand, silts, and clays deposited by flowing water.

Alquist-Priolo Special Studies Zone Act (APSSZ)- The Alquist-PrioloSpecial Studies Zones Act was signed into law in 1972 (in 1994 it was renamed the Alquist-Priolo Earthquake Fault Zoning Act). The primary purpose of the Act is to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault (Hart and Bryant, 1997). The Act requires the State Geologist (Chief of the Division of Mines and Geology) to delineate "Earthquake Fault Zones" along faults which are "sufficiently active" and "well-defined." These faults show evidence of Holocene surface displacement along one or more or their segments (sufficiently active) and are clearly detectable by a trained geologist as a physical feature at or just below the ground surface (well defined). The boundary of an "Earthquake Fault Zone" is generally about 500 feet from major active faults, and 200 to 300 feet from well-defined minor faults. The Act dictates that cities and counties withhold development permits for sites within an Earthquake Fault Zone within their jurisdiction until geologic investigations demonstrate that the sites are not threatened by surface displacements from future faulting (Hart and Bryant, 1997). The Act addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as ground shaking or liquefaction.

fault rupture and is not directed toward other earthquake hazards, such as ground shaking or liquefaction.

Angle of Repose- The maximum slope or angle at which loose, cohesionless material remains stable. It commonly ranges between 33° and 37° on natural slopes (hillsides).

APEFZA- Alquist-Priolo Earthquake Fault Zoning Act. The new name for Alquist-Priolo Special Studies Zone Act (APSSZ).

APN- Assessor Parcel Numbers.

APSSZ- Alquist-Priolo Special Studies Zone Act.

Assessor Parcel Numbers (APN)- The type of data that may be viewed from an internet browser associated with the APN includes: County Supervisor district and name, zoning, acreage, owner and mailing address, assessment and/or district information, legal description, sub-division and lot.

Aquifer- Any water bearing formation; A geologic formation which contains sufficient saturated permeable material to yield significant quantities of ground water to a spring or well

Arid- Climate characterized by dryness; Defined as rainfall insufficient for plant life or for crops without supplying water by means of ditches, pipes or streams; Less than 25 cm of annual rainfall; or a higher vapor) rate than precipitation rate.

Aseismic Region- Said of an area that is not subject to earthquakes; Where no or only very low seismic activity has been registered, with the exception of some intraplate (mid-continent) earthquakes.

ASTM- American Society of Testing and Materials. www.astm.org

Atmosphere- The mixture of gases that surround the Earth: chiefly oxygen and nitrogen, with some argon and carbon dioxide and minute quantities of helium, krypton, neon, and xenon.

Basement Rock- Undifferentiated rocks, commonly igneous and metamorphic of Precambrian age or younger that underlie the rocks of interest, commonly sedimentary, in a given area.

Basin- A depressed area with no surface outlet. The term is applied to a lake basin, to a ground water basin, or to a shallow depression on the sea floor; The drainage area of a stream; A low area in the earth's crust, of tectonic origin, in which sediments have accumulated. Such features were drainage basins at the time of sediment accumulation but are not necessarily so today.

Bates Bill Process- The Legislation is utilized to determine Very High Fire Hazard Severity Zones (VHFHSZs) in Local Responsibility Areas (LRAs). The legislation was a direct result of the great loss of homes and lives in the Tunnel Fire of 1991 in the Oakland/Berkeley Hills. The California Department of Forestry and Fire Prevention (CDF), was given the responsibility but not the resources to carry out the state instruction, which included mapping of Very High Fire Hazard Severity Zones (VHFHSZs). The CDF formed a working group to determine how to proceed. The group, comprised of state and local representatives, decided upon a workable system involving fuel, topography (slope), weather, and dwelling density (definition below) as the foundation for the system, and added additional mitigation factors both plus and minus to adjust the score upward or downward. The basic system has a four-point minimum score with a thirteen-point maximum.

Becker Hammer System- Quantitative (susceptible of measurement) evaluation using a very large scale; of liquefaction resistance of sandy, silty and some gravelly soils based on in-situ penetration resistance.

Bedding- The arrangement of a sedimentary rock in beds or layers of varying thickness and character.

Bedding Plane- The division plane in sedimentary or stratified (deposits in layers) rocks, that separates each successive layer or bed from the one above or below. It commonly marks a visible change in the physical character of the rock or its color; A term commonly applied to a plane of discontinuity (interruption in sediment accumulation) along which a rock tends to split or break readily.

Bedrock- The solid rock that lies beneath soil and other loose surface materials; Designates hard rock that is in its natural intact position and underlies soil or other unconsolidated (loose) surficial material (deposits on earth's surface other than bedrock e.g. alluvial).

Bench- Modification of the natural landscape that refers to a relatively level step excavated into earth material on which man-made deposits of natural earth materials and waste materials (fill) is to be placed.

Biomass- The amount of any living plant or animal (organism) in a particular area, stated in terms of the weight or volume of organisms per unit area or of the volume of the environment.

Blind Thrust Fault- A thrust fault is a low-angle reverse fault (top block pushed over bottom block). A "blind" thrust fault refers to one that does not reach the surface.

BLM- Bureau of Land Management. www.blm.gov

Borehole (boring)- A circular hole made by drilling by the rotary motion of a cutting tool; A deep vertical hole of a small diameter, such as a shaft, a well, or a hole made to ascertain the nature of the underlying formations, to obtain samples of the rocks penetrated, or to gather other kinds of geologic information.

Boulder- A rock mass larger than a cobble (2.5- 10 inches), having a diameter greater than 256mm (10 inches- about the size of a volleyball) being somewhat rounded or otherwise distinctly shaped by abrasion in the course of transport.

Branding- The wind transport of burning debris (accumulation of loose material) outward from a fire. The debris can be carried a mile or more ahead of a fire.

Breached Dam- Rupture or breakage of a dam where water flows freely. Dams under State jurisdiction (e.g. over 50 feet in height or 50 acre-feet in storage capacity) are required to have inundation (flooding) maps that show the potential flood limits in the remote possibility a dam is catastrophically broken.

Bridge Scour- The process of renewal of stream bottom sediment during major flood events. Process could undermine bridge foundation supports if they are not emplaced deep enough below the scour depth.

Building Earthquake Safety Act (1986)- This Act requires all local governments to identify all potentially hazardous buildings within their jurisdictions and to establish a program for mitigation of identified hazards. It is the legislative basis for the inventory of hazardous unreinforced masonry buildings and Unreinforced Masonry Ordinances adopted by most counties and cities in California.

Bureau of Land Management (BLM) 2000 Standards- Suggested guidelines for prescribed burn projects that included: a)The safety of firefighters and the public is the number one priority when planning and implementing a prescribed fire project; b)All prescribed fire projects should have an approved prescribed fire plan prior to ignition; c) All prescribed fire plans should contain measurable objectives, a predetermined prescription, and an escaped fire contingency plan to be implemented in the event of an escape; d)All prescribed fire projects should be conducted in compliance with the Federal and State regulations.

Calcareous Soil- A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce or bubble visibly when treated with cold, dilute hydrochloric acid.

California Department of Forestry and Fire Protection Response Plan- The State agency with the greatest number of resources for fire fighting capabilities. The CDF have extensive ground forces, including a volunteer prisoner population, the CDF fields an air force that includes: 15 Grumman S-2A 800 gallon airtankers, four S-2T 1200 gallon airtankers, two 2,000 gallon contract airtankers, 11 Super Huey Bell UH-1H helicopters, six O-2A air attack aircraft, 11 OV-10A air attack aircraft, and one C-26B fire mapping airplane. From 13 air attack and nine helitack bases located statewide, aircraft can reach any fire within 20 minutes. The air attack planes fly overhead directing the airtankers and helicopters to critical areas of the fire for retardant and water drops. The retardant used to suppress fires is Di-Ammonium Phosphate + Iron Oxide which acts as a fertilizer as well as a suppressant.

California Earthquake Authority (CEA)- Authorized by the State Legislature in 1996 providing protection for homeowners' property. Total funding is $10.5 billion with private insurers providing up to $6 billion and the remainder from the reinsurance industry and Berkshire Hathaway (Kunreuther, 1999).

California Earthquake Hazard Reduction Act (1986)- This Act established the California Earthquake Hazards Reduction Program under the guidance of the Seismic Safety Commission.

California Earthquake Hazards Reduction Program- An umbrella program that proposes overall policy and tracks progress in state earthquake hazard mitigation, preparedness, response and recovery programs geared to the objective of significantly reducing earthquake hazards in California by January 1, 2000.

California Environmental Quality Act (CEQA)- Original legislation (1970) and amendments passed by State Legislature which set forth procedures for assessing the impact of a certain project or proposal on the physical, social, and cultural environment. Also defined the content of Environmental Impact Report (EIR), which discusses significant environmental impacts. Under CEQA, a county is required to prepare initial studies addressing potential adverse impact of proposed projects.

California Gap Analysis Project- Vegetation data obtained from the University of California Santa Barbara consisting of land coverage and vegetation information for the state of California, including canopy dominant species, canopy density presence of regional endemic species, and inclusion of wetland habitats. http://www.biogeog.ucsb.edu/projects/gap/data/meta/landcovdd.html#section1 Evaluation of the California Gap Analysis vegetation data was performed by identifying the primary, secondary and tertiary vegetation community type for each digital polygon and then assigning a rating

for the potential for fire hazard based on fuel loading, in accordance with the HUD Study System (1973) and the Bates Bill Process (AB337, 1992).

California Government Code Section 65852- Requires local jurisdictions to apply zoning in such a manner that it is "uniform for each class or kind of building or use of land throughout each zone." This means, for example, that an additional requirement for setting back a house a certain distance from an identified fault surface rupture on an R-1 zoned property cannot be enforced unless the zoning ordinance specifically sets forth fault setback provisions applicable to any property in that zone on which such a hazard condition is encountered.

California Wildland Fire Danger Rating System (CWFDRS)- Assigned Fire Weather ratings and slope classes for the HUD Study System.

Caliche- A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas.

California Department of Fire (CDF)- Primarily a wildland fire protection agency with the legal responsibility for protection of approximately 33 million acres of private and state lands in California. CDF is in charge of handing out hazard abatement notices, providing fire services, administering the Riverside County Fire Department, and identifying areas in the state that are Very High Fire Hazard Severity Zones (VHFHSZ).

Canals- An artificial watercourse of relatively uniform dimensions, cut through an inland area, and designed for navigation, drainage, or irrigation (artificial distribution of water over the ground surface) by connecting two or more bodies of water.

Canopy- High vegetation coverage such as large trees.

Canopy Density- The degree or a measure of the degree of foliation filled or occupied in an area.

Canyon- A long, deep, relatively narrow, steep-sided valley confined between lofty and precipitous walls in a plateau (flat area of great extent) or mountainous area, often with a stream at the bottom; characteristic of arid and semiarid areas where stream downcutting (stream erosion in a downward direction) greatly exceeding weathering or physical and/or chemical changes).

Carbonate- A sediment formed by the organic or inorganic precipitation from aqueous solution of carbonates of calcium, magnesium, or iron.

Catastrophic Earthquake- A great earthquake generally near Magnitude 8.0 or greater, capable of widespread tremendous damage in epicentral (point at the Earth's surface directly above where an earthquake originated) area accompanied by localized severe damage 100's of miles from earthquake source.

CDBG- Community Development Block Grant Program.

CDMG- Califormia Division of Mines and Geology. www.consrv.ca.gov/dmg

CDF- California Department of Fire.

Cementation- (sed) The diagenetic process by which coarse clastic sediments become lithified or consolidated into hard, compact rocks through the deposition or precipitation of minerals in the spaces among the individual grains of the sediment. (soil) The binding together of the particles of a soil by such cementing agents as colloidal clay (a mixture of humus and clay), hydrates (mineral compound in which water is part of the chemical composition) or iron or aluminum, or carbonates.

Census Tract Data- An official count of population.

CEA- California Earthquake Authority.

CEQA -California Environmental Quality Act.

Channel- The deepest portion of a stream, bay (inlet), or strait (narrow water way connecting two larger bodies of water).

Class A Roofs- As defined by the Uniform Building Code, a roof that is generally non-flammable, fire-resistant products.

Class B Roofs- As defined by the Uniform Building Code, a roof that is pressure treated, with wood-shake shingles. A Class B roof is not as resistant to fire as Class A roof.

Clay- Mineral particle in soil having a diameter less than 0.002mm; A rock or mineral fragment having a diameter less than 1/256 mm (4 microns, or 0.00016 in.); Any soft, adhesive, fine-grained deposit; As a soil textural class, a soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay Film (clay skin)- A thin coating of oriented clay on the surface of a soil ped or lining pores or root channels .

Claystone- A hardened clay having the texture and composition of shale (finely stratified sedimentary rock of clay, silt or mud), but lacking its fine lamination; A massive mudstone in which clay predominates over silt.

Climate- A characteristic condition of the various elements of weather of a given region, such as temperature, humidity, rainfall or other atmospheric elements that prevail in a given area.

Coarse Fragment- A mineral or rock particle larger than 2 mm in diameter.

Coarse-grained- (geol) Said of a sediment or sedimentary rock, and of its texture, in which the individual constituents are large enough to see with the naked eye (diameter > 2 mm). (soil) Said of a soil in which gravel and/or sand predominate.

Cobble- A rock fragment larger than a pebble and smaller than a boulder, having a diameter in the range of 64-256mm (2.5-10in-that of a size between a tennis ball and a volleyball), being somewhat round or otherwise modified by abrasion in the course of transport.

Cohesion- Shear strength in a sediment not related to inter-particle friction

Collapsible Soils- Typically found in arid environments and associated with Holocene-aged or slightly older deposits on alluvial fans collapsible soils, which have undergone settlement when exposed to development practices such as construction and artificial irrigation.

Colluvium- A general term applied to a loose, heterogeneous, and incoherent mass of soil material or rock fragments deposited chiefly by mass-wasting. Colluvium is usually at the base of a steep slope or cliff; deposited by unconcentrated surface runoff, sheet erosion or slopewash.

Community Development Block Grants (CDBG)- Grants awarded by the Federal Department of Housing and Urban Development to cities and counties to fund community development activities such as housing programs, and economic development facilities such as streets, sewers, and water systems.

Compaction- (soil) Any process such as by weight of the upper part of a sedimentary deposit, compressing or consolidating material below, whereby a soil mass loses pore space and achieves a higher density. Compaction increases the bearing capacity and reduces the tendency to settle or deform under the weight of the overlying material, and increases the general stability of the soil. (sed) Pore spaces within a body of fine-grained sediments in response to the increasing weight of overlying material that is continually being deposited, or to the pressures resulting from earth movements within the crust. It is expressed as a decrease in porosity (percentage of pore spaces or openings) brought about by a tighter packing of the sediment particles; The process whereby fine-grained sediment is converted to consolidated rock, such as clay lithified to a shale.

Composition- The general makeup of a rock based on the specie type and number of minerals present.

Concealed Fault- An inferred fault usually covered by deposits younger than the last displacement event on the fault.

Conditionally Active Fault- A fault showing evidence of movement in the Quaternary but greater than 750,000 years ago (considered only for certain critical facilities).

Cone Penetration Test (CPT)- Soil penetration test in which a standard steel cone is pushed into the soil by hand (mechanically) or hydraulically (movement using water) and the required to advance the cone at a slow constant rate or a specified distance, or in some designs the penetration at various loads is recorded.

Conflagration- A large fire, usually in excess of 1,000 acres that advances along a front.

Conglomerate- A coarse-grained sedimentary rock composed of rounded to subangular fragments larger than 2 mm in diameter set in a fine-grained (less than 2 mm diameter) matrix of sand or silt, and commonly cemented by calcium carbonate, iron oxide, silica or hardened clay.

Conjugate Fault- Faults that are of the same age and deformational episode as a primary fault.

Consistence- The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are: Terms such as loose, friable, firm, plastic, sticky, hard, soft, and/or cemented are often associated with consistence.

Consistency- Development of a parcel must be within the range of allowable uses and density (numbers of houses per acre) that is enumerated in the text of the General Plan and the Land Use Plan Map.

Consolidation - Any process whereby loose particles, soft earth materials become firm and cohesive (having relatively high shear strength) rock. Also the gradual reduction in volume and increase in of a soil mass in response to increased amount of overlying material or effective compressive stress, such as the squeezing of fluids from pore spaces (open spaces in rock or soil).

Contour- An imaginary line, or a line on a map or chart, that connects points of equal value, e.g. elevation of a land surface. Contours are commonly used to depict topographic or structural surfaces.

Coseismic Rupture- Ground rupture occurring during an earthquake but not necessarily on the causative fault.

CPT- Cone Penetration Test.

Creep- The slow, imperceptible downslope movement of mineral, rock, and soil particles under gravity; Continuously increasing, slow deformation (strain) of solid rock resulting from a small constant stress acting over a long period of time.

Critical Facilities- Facilities that are a part of a community's infrastructure that must remain operational after an earthquake, or that pose unacceptable risks to public safety if severely damaged. Critical facilities that are needed during an emergency include hospitals, fire and police stations, emergency operation centers (EOC's) and communication centers.

Critical Fire Weather Frequency Class- A numerical rating obtained by multiplying fuel loading , fire weather. HUD lists the Critical Fire Weather Frequency Class assigned to each of the USGS Quadrangle Maps for California to determine a severity scale.

Cross Section- A diagram showing the features transected by a vertical plane e.g. a vertical section through a mineral deposit, an anticline (convex fold upward containing stratigraphically older rock, or a fossil; An actual exposure or cut that shows transected geologic features.

Crown Fires- Tree-consuming infernos with spectacular flames as fire jumps from tree crown to tree crown very rapidly.

Crustal Plate- One of the six blocks into which the lithosphere (solid or crust portion of the earth) is divided, according to the scheme of global tectonics A crustal plate is about 100 km thick.

Crustal Plate Strain System- A group of crustal plates or blocks dividing the earth's crust that change in shape or volume with the onset of stress. For example, the Whittier-Elsinore fault parallels the San Jacinto and is part of the same right-lateral crustal plate strain system as the San Andreas and the San Jacinto.

CRWQCB- California Regional Water Quality Control Board.

CSD - Community Service District.

Culvert- Any covered structure not classified as a bridge, that constitutes a transverse drain, waterway, or other opening under a road, railroad, canal, or similar structure.

Curtain Wall- Cladding or metal coating bonded onto another metal.

Cut and Fill- In engineering, the excavation of earth material from one place and its deposition as compacted fill (man-made deposits of natural earth materials) in an adjacent place, as in road-building or infrastructure locations.

CWFDRS - California Wildland Fire Danger Rating System.

Dam- An artificial barrier or wall constructed across a watercourse or valley to obstruct or confine a flow of water to create a reservoir, divert water into a conduit or channel, to create a hydraulic head (the height of the free surface of a body of water above a given subsurface point) that can be used to generate power, control floods, or retention of debris.

Danger- An exposure to injury or loss: Hazard.

Debris- Any surficial accumulation of loose material detached from rock masses by chemical and mechanical means, as by decay and disintegration, and occurring in the place where it was formed, or transported by water or ice and redeposited. It consists of rock fragments, soil material, and sometimes organic matter.

Debris Basins- An area in which sediments accumulate; A sunken area caused by the accumulation of sediments on it.

Debris Falls- Occurs when a mixture of soil, regolith vegetation, and rocks on a steep slope become dislodged and drops down the slope.

Debris Flow- Rapidly moving saturated earth material with 50 percent rock fragments coarser than 2 mm in size which can occur on natural and graded slopes. Debris flows occur when sufficient force is applied to rocks and regolith that they begin to flow down slope. It is a mixture of rock, and/or regolith with some water or air. The debris-flow scenario depends on numerous factors: soil depth and composition, the kind of vegetation and the size of tree roots, subtle variations in slope shape, road cuts, drainage pipes, incongruities in underlying bedrock, even the presence of small animal burrows. Water can collapse a slope after traveling beneath the surface from miles away.

Debris Slides- Results when debris descends down a pre-existing surface, such as a bedding plane, foliation surface (planar arrangement of textural or structural features), or joint surface. Piles of talus (coarse angular rock fragments) are common at the base of a slide. Slides differ from slumps in that there is no rotation of the sliding rock mass along a curved surface.

Decomposition-Chemical weathering, or the breaking down of rocks, minerals, or organic matter by chemical processes. Usually complex compounds are broken down into simpler ones that are more stable under the prevailing conditions at or near the Earth's surface.

Deflected Canyon - A diversion in the trend of a stream or canyon caused by any number of processes, including folding and faulting.

Deformation- A general term for the process of folding, faulting, shearing, compression, or extension of the rocks as a result of various Earth forces.

Degree of Confidence- A comparison or succession of reliance in, and of limitations in data and conclusions.

Dekameters- Unit of dam storage capacity where 1 Dam^3 is equal to 0.8 acre-feet. An acre-foot is the volume of an acre of area that is one foot in thickness.

Demography- The study of the characteristics of people such as growth, size, and vital statistics.

Density- The quantity or amount of something per unit measure, area, volume, or length.

Density Transfer- A commonly used incentive for mitigating geologic hazards on an individual project. Where a site has known geologic hazards, general plan and/or zoning densities are transferred from the part of the site with the hazard to the portions of the site where the hazard is minimally present or nonexistent. Density transfer is more difficult on smaller sites due to height and setback limitations and more direct impacts on adjoining properties. However, provisions may be made in the zoning code for modification of height and setback provisions to enable density transfer, taking into account possible impacts on the neighborhood.

Dependent Care Facilities- Facilities that house populations with special evacuation considerations, such as preschools and schools, rehabilitation centers, prisons, group care homes, and nursing and convalescent homes.

Desert- An area of low moisture due to low rainfall, (less than 10 inches annually), high evapotranspiration or extreme cold and which supports only one specialized vegetation, not that typical of the and is generally unsuitable for human habitation under natural conditions. Deserts are not characterized by uniformity of elevation but wind often produces distinctive erosional features.

Design Earthquakes- The more critical the project, the longer the time period chosen and the larger the design earthquake. The largest earthquake likely to occur on a fault or fault segment is termed the maximum credible (MCE) or characteristic earthquake. Depending on the planned use, lifetime, or importance of a facility, a maximum probable earthquake (MPE) is the earthquake most likely to occur in a specified period of time, (such as 30 to 500 years).

Design Flood- The amount of a rising body of water that overtops its natural or artificial confines and that covers land not normally under water's magnitude for which a specific project was designed.

Detritus- A collective term for loose rock and mineral material that is worn off or removed directly by mechanical means, as by disintegration (the breaking down of vegetable matter by slow burning in which only volatile or vaporable substances are produced) or by abrasion; esp. fragmental material, such as sand, silt, and clay, derived from older rocks and moved from its place of origin.

Dewatering- To remove water from a waste produce or streambed, for example; The extraction of a portion of the water present in sludge or slurry producing a dewatered product which is easier to handle.

Differential Settlement- Nonuniform settlement; the uneven lowering of different parts of an engineering structure, often resulting in damage to the structure. Sometimes included with liquefaction as a ground failure phenomenon.

Dip- (seismic) The angle between a reflecting or refracting seismic wave and the horizontal; the angle between a seismic discontinuity surface and the horizontal. (struc geol) A measure of the angle between the flat horizon and the slope of a sediment layer, fault plane, metamorphic foliation, or other geologic structures; The angle that a structural surface e.g. a bedding or fault plane , makes with the horizontal, measured perpendicular to the strike of the structure (angle of dip).

Dip Slip- The component of the movement or slip that is parallel to the dip of the fault.

Displaced Households/Shelter Requirements- Earthquakes can cause loss of function or habitability of buildings which contain housing units, resulting in people driven from their households. These households may need alternative short-term havens, provided by family, friends, renting apartments or houses, or public shelters provided by relief organizations such as the Red Cross, Salvation Army, and others.

Displacement- The relative movement of the two sides of a fault, measured in any chosen direction; also, the specific amount of such movement. Displacement in an apparently lateral direction includes strike slip and strike separation; displacement in an apparently vertical direction includes dip slip and dip separation.

Dissolution- A space or cavity in or between rocks, formed by the dissolving of part of the rock material.

DMG- Division of Mines and Geology.

Drainage Patterns- The configuration or arrangement map view of the natural stream courses in an area. It is related to local geologic and gemorphologic features and history.

Drought-Tolerant Grass or Ground Cover- Grass, vegetation or foliation able to withstand or endure during long periods without rain.

Ductile- Said of a rock that is able to sustain under a given set of conditions, 5-10% deformation before fracturing or faulting (brittle).

Dune- A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand and sometimes volcanic ash), either bare or covered with vegetation, capable of movement from place to place but always retaining its own characteristic shape.

Duration- Interval of time. (stream) The interval of time from high water to low water, or from low water to high water (falling and rising of tide).

Dwelling Density- The number of homes that can be built per one acre; It is expressed on the Land Use Plan in six residential categories each allowing a range of living units per acre (Du/Ac).

Dynamic Analysis - A complex earthquake-resistant engineering design technique (UBC - used for critical facilities) capable of modeling the entire frequency spectra, or composition, of ground motion. The method is used to evaluate the stability of a site or structure by considering the motion from any source or mass, such as that dynamic motion produced by machinery or a seismic event.

Earth's Crust - The outermost layer or shell of the Earth.

Earth Materials/Earth Units- Rock, soil, sand, and gravels.

Earthquake Fault Zone (EFZ)- Regulatory zones around and along faults which are "sufficiently active" and "well-defined" (to be zoned by the State Geologist under the EFZ Act). The zones are defined by turning points connected by straight lines. Most of the turning points are identified by roads, drainages, and other features on the ground. These faults show evidence of Holocene surface displacement along one or more or their segments (sufficiently active) and are clearly detectable by

a trained geologist as a physical feature at or just below the ground surface (well defined). The boundary of an "Earthquake Fault Zone" is generally about 500 feet from major active faults, and 200 to 300 feet from well-defined minor faults. EFZs are plotted on topographic maps at a scale of 1 inch equals 2,000 feet. They vary in width, but average about one-quarter mile wide.

Earthquake Loss Estimates- The probability of earthquake damage the state will incur determined and averaged for each census tract.

EFZ- Earthquake Fault Zone.

Earth Flow- Imperceptibly slow moving surficial material in which 80 percent or more of the fragments are smaller than 2 mm, including a range of rock and mineral fragments.

Earthquake - Vibratory motion propagating within the earth or along its surface caused by the abrupt release of strain from elastically deformed rock by displacement along a fault.

Earthquake Related Fires- Fires induced by an earthquake that include: open flames, electrical malfunctions, natural gas leaks, severed gas lines, inadequate bracing of mobile homes, and chemical spills. Commonly affected are unanchored gas heaters or gas-fired hot water heaters or appliances that tend to tip over during strong ground shaking.

Ecology- The study of the relationships between organisms and their environments, including the study of communities, patterns of life, natural cycles, relationships of organisms to each other, and population changes.

Economic Facilities- Facilities that should remain operational to avoid severe economic impacts, such as banks, archiving and vital record keeping facilities, airports and ports, and large industrial and commercial centers.

Economic Loss- The methodology that provides estimates of the structural and nonstructural repair costs caused by building damage and the associated loss of building contents and business inventory. Building damage can also cause additional losses by restricting the building's ability to function properly. To account for this, business interruption and rental income losses are estimated.

EDC- EROS Data Center. http://edcwww.cr.usgs.gov/eros-home.html

EERI- Earthquake Engineering Research Institute

EIR- Environmental Impact Report.

Elevation- A general term for a topographic feature of any size that rises above the adjacent land or the surrounding ocean bottom; The vertical distance from a datum(usually mean sea level) to a point or object on the Earth's surface; esp. the height of a ground point above the level of the sea.; often times used synonomous with altitude except that altitude is used to indicate the heights of points in space above the Earth's surface.

Emergency Operation Center (EOC)- A room or building equipped and staffed to monitor and direct the response to an emergency situation.

EOC- Emergency Operation Centers.

Endemic- Said of an organism or group of organisms that is restricted to a particular region or environment; native.

En echelon- Said of geologic features that are in an overlapping or staggered arrangement; e.g. en echelon faults are relatively short but collectively they form a linear zone, in which the strike of the individual feature is oblique to that of the zone as a whole.

Engineered Slope- Designed to resist seismically induced failure. Uses soil engineering parameters based on static stability analyses established on a site-specific basis from detailed geotechnical investigations that include subsurface soil sampling and laboratory testing. The stability analyses should factor in the intensity of ground shaking expected.

Engineering Geologist- A geologist who is certified by the State as qualified to apply geologic data, principles, and interpretation to naturally occurring earth materials so that geologic factors affecting planning, design, construction, and maintenance of civil engineering works are properly recognized and used. An engineering geologist is particularly needed to conduct investigations, often with geotechnical engineers, of sites with potential ground failure hazards.

Engineering Geology- Geology as applied to engineering practice, esp. mining and civil engineering. As defined by the Association of Engineering Geologists it is the application of geologic data, techniques, and principles to the study of naturally occurring rock and soil materials or ground water for the purpose of assuring that geologic factors affecting the location, planning, design, construction, operation, and maintenance of engineering structures, and the development of ground-water resources, are properly recognized and adequately interpreted, utilized, and presented for use in engineering practices.

Engineering Properties- Properties such as rock type, age, degree of consolidation (soft soil materials becoming firm and cohesive), depositional environment, texture, and structure were used for the development of GIS Engineering Geology Map for Riverside.

Epicenter- The point at the Earth's surface directly above where an earthquake originated.

EROS Data Center (EDC)- In Sioux Falls, South Dakota, EDC produces weekly and biweekly maps for the 48 contiguous states and Alaska that display plant growth and vigor, vegetation cover, and biomass production, using multispectral data from satellites of the National Oceanic and Atmospheric Administration (NOAA). EDC also produces maps that relate current vegetation conditions for 2-week periods to average (normal) conditions for the same period during the past 7 years.

Erosion- Removal of material loosened, dissolved, or worn away of soil and rock by mass wasting, the action of streams, glaciers, waves, wind, and underground water by natural agencies that include solution, corrosion, and transportation. Weathering, although sometimes is included here, is a distant process which does not imply removal of any material. (geol) Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains.

Essential Facilities- Facilities that provide services to the community and should be functional in times of emergencies. Essential facilities include hospitals, police stations, fire stations, communication centers, and schools.

Evapotranspiration- Water withdrawn from a land area by evaporation from water surfaces and moist soil and by plant transpiration.

Expansive Soil- Soil with a significant amount of clay particles that have the ability to give up water (shrink) or take on water (swell). When these soils swell, the change in volume exerts significant pressures on loads (such as buildings) that are placed on them. Expansion testing and mitigation are required by the current grading and building codes.

Extension- (fault) A fault in which there has been tension-type displacement in the plane of bedding. (fracture) A fracture that develops perpendicular to the direction of greatest stress; and parallel to the direction of compression. (joint) A joint that forms parallel to the direction of compression. (see definitions of fracture and joint).

Fabric- The spatial and geometrical configuration of all those components that make up a deformed rock, including texture, structure, and preferred orientation; The orientation in space of the particles, crystals, and cement of which a sedimentary rock is composed; The physical nature of a soil according to the spatial arrangement of its particles and voids.

Falls- Occurs when material on steep slopes or cliffs become dislodged and drop down the slope.

Fault- A fracture or rupture, or zone of fractures along which there has been displacement of adjacent earth material; A fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time

Fault Creep- Slow, gradual, nonrecoverable deformation of the earth's crust sustained by fault rupture

Fault Hazard Zones- Delineated by the California Department of Mines and Geology (CDMG) as "zones of required investigation" whereby site-specific geotechnical hazard investigations are required by the Seismic Hazard Mapping Act (SHMA). The zone is an area where there is potential for infrastructures designed for human occupancy need to be setback away from any potential ground rupture hazards esp. in areas with faults with high rates of displacement (>5 mm/yr).

Fault Plane- A fault surface that is more or less planar. Generally referred to as "the fault'.

Fault Plane Solution- A model of the sense and orientation of the generating fault displacement.

Fault Rupture- The process of fault movement that generates an earthquake as frictional energy is released by the movement.

Fault Segment - A continuous portion of a fault zone that is likely to rupture(displacement as a result of movement on a fault) along its entire length during an earthquake.

Fault Slip Rate - The average long-term rate of movement of a fault (measured in cm/year or mm/year) as determined from geologic evidence.

Fault Strand- A small or minor fault either connected to or subparallel to a primary fault.

Fault Trace- Line on the earth's surface defining the fault.

Fault Zone- A system of fault strands that when taken together define a zone of primary and secondary faults, generally aligned roughly along trend of the primary fault. Can also refer to the width of the crushed zone by the primary fault.

FEMA- Federal Emergency Management Agency. www,fema.gov

Field Act- Act set up for structural standards for public school that passed after the Long Beach earthquake of 1933.

Fill- Man-made deposits of natural earth materials (rocks and soil particles) and waste materials such as tailings or spoil from dredging, or sediment deposited by any agent (i.e. stream, glacier, slope movement, etc.) used for leveling or filling low places or valleys, extending a shoreline into a lake, building embankments, roads or for infrastructure grades.

Fine-grained- (geol) Said of a sediment or sedimentary rock, and of its texture, in which the individual constituents are too small to distinguish with the naked eye. (soil) Said of a soil in which silt and/or clay predominates.

Fire- The chemical reaction of burning, which releases heat and light; To ignite or cause to become ignited.

Fire and Land Managers- One who assesses the condition of all vegetation throughout the growing season to provide a foundation for planning fire suppression, schedule prescribed burns, or study long-term vegetation changes resulting from human or natural factors.

Fire Codes- Requirements and standards of fire hazard reduction to protect the health, safety, and welfare of the existing and future residents.

Fire Ecologist- One who is trained and works in the field of fire ecology by studying the relationships between fire and organisms and their environments including the study of communities, patterns of life, natural cycles, relationships of organisms to each other, biogeography and population changes., and population changes as they relate to fire.

Fire Emergency Division- The Emergency Services Division that maintains two underground Emergency Operating Center's (EOC's) with communications, for government use during major events.

Fire Flow- Duration and pressure requirements as a function of building size, type, material, purpose, location, proximity to other structures, and the type of fire suppression systems installed. The various water districts are required to test fire protection capability for the various land uses per the flow requirements of the Uniform Fire Code.

Fires Following Earthquakes- Cause severe losses that can sometimes outweigh the total losses from the direct damage caused by the earthquake, such as collapse of buildings and disruption of lifelines. Many factors affect the severity of the fires following an earthquake, including but not limited to: ignition sources, types and density of fuel, weather conditions, functionality of water systems, and the ability of fire fighters to suppress the fires.

Fire-Following Earthquake Model- Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area with input with respect to the level of readiness of local fire departments and the types and availability (functionality) of water systems. To reduce the input requirements and to account for simplifications in the lifeline module, the fire following earthquake model presented are simplified.

Fire Hazard Mapping and Real Estate Distribution Law- Civil Code Section 1103(c)(6) requires real estate sellers to inform prospective buyers whether or not a property is located within a Wildland Fire Area that could contain substantial fire risks and hazards.

Fire Hazard Severity Scale- Each class of fuel loading, fire weather, and slope is assigned a severity factor. The values are multiplied to produce a Fire Hazard Severity Scale. The scale is determined by multiplying the three factors together to determine a numerical rating. HUD lists the Critical Fire Weather Frequency Class assigned for each of the USGS Quadrangle Maps for California. The Fuel Loading is captured directly from the Quadrangle Maps. The slope can be either mechanically calculated or automatically calculated with a software program containing the USGS Quadrangle data (e.g. TopoScout8).

Fire Hazards- Suburban or rural areas of which contain uncultivated lands, timber, range, watershed, brush or grasslands; weather, topography and fuel type can effect the intensity of the fires.

Fire Potential Index (FPI)- FPI is a valuable fire management tool that has been developed by USGS scientists in collaboration with scientists at the United States Fire Service (USFS). The FPI characterizes relative fire potential for forests, rangeland, and grasslands, both regionally and locally, so that land managers can develop plans for minimizing the threat from fires. The FPI combines multispectral satellite data from National Oceanic and Atmospheric Administration (NOAA) with geographic information system (GIS) technology to generate 1-km resolution fire potential maps. Input data include the total amount of burnable plant material or fuel type derived from vegetation maps, plus the water content of the dead vegetation, and the fraction of the total fuel load that is live vegetation.

Fire Prevention- Scenario analysis for major earthquake induced for both wildland and earthquake induced fires, for mitigation, planning and preparedness, and state mandates that includes mapping of Very High Fire Hazard Severity Zones (VHFHSZs).

Fire Protection Flow and Emergency Water Storage- Uniform Fire Code fire flow requirements as a function of building size, type, material, purpose, location, proximity to other structures, and the type of fire suppression systems installed, and a seven day emergency storage supply.

Fire Response Resources- Include Riverside County Fire Department (RCOFD), Community Service District (CSD), California Department of Forestry, and Emergency Services Division.

Fire-Retardant Ground Cover- Low-growing plants or other material such as burlap mat, straw mulch, or chemical nutrients, that forms a dense, extensive layer used to impede fires.

Fire Safety (Homeowner)- A checklist to reduce fire risk that should consider the following: Local area fire history; Site location and overall terrain; Prevailing winds and seasonal weather; Property contours and boundaries; Native vegetation; Plant characteristics and placement; Irrigation requirements; Designing and installing fire-wise landscapes; and Maintenance.

Fire Safety and Land Use Planning- Clearance laws, zoning, and related fire safety requirements prevention, and reduction techniques.

Fire Severity Forecasting Predictions- For good fire management planning fire weather predictions on several time scales ranging from hours to months is required. Research aims to provide forecast tools for the medium-range (daily forecasts out to 10-15 days), extended-range (30 days), and for seasons (90 days). The accuracy of weather forecasts can vary with season, location, and parameter

Fire Weather Class- There are three fire weather classes. Each class is related to the frequency of critical fire weather days occurring in each of the state's Fire Danger Rating Areas over a 10-year period. The Low class (Class I) includes all those Fire Danger Rating Areas which have experienced fire weather in the "very high" or "extreme" ranges with an annual average of less than one day. The High class (Class II) has an annual average of 1 to 9.5 days. While the Extreme class (Class III) has an annual average of more than 9.5 days. Each USGS topographic map in the state is keyed to one of the Fire Danger Rating Areas and assigned that Area's critical fire weather frequency classification.

Firebreak- A firebreak is made by removing and clearing away all flammable vegetation or other combustible growth for a distance of not less than 30 feet on each side thereof or to the property line, whichever is nearer.

Firestorm- A large fire that stays in one place and has cyclonic attributes such as strong in-rushing winds and a grossly rotational motion.

Fissure- (joint) A surface of fracture or crack in rock along which there is a distinct separation. Generally caused by extensional forces in the rock (or sediment).

Flash Flood- A local and sudden flood or torrent of relatively great volume and short duration that overflows a stream channel in a usually dry valley such as in a semiarid area. Flash floods tend to carry an immense load of mud and rock fragments, and generally result from a rare and brief but heavy rainfall over a relatively small area. It may also be caused by ice jams and by dam failure.

Flood-A rising body of water that overtops its natural or artificial confines and that covers land not normally under water. Flooding is the number-one natural disaster in the United States in terms of number of lives lost and property damage.

Flood Hazards- Normally associated with large amounts of precipitation or snow melt that cause floods, landslides, and debris flows. Most lives are lost when people are swept away by flood currents, whereas most property damage results from inundation (flooding) by sediment-laden water. Flood currents also possess tremendous destructive power, such as lateral forces that can demolish buildings and erosion can undermine bridge foundations and footings leading to the collapse of structures.

Flood Inundation- A rising of water and its spreading over land not normally submerged.

Flood Inundation Maps- State of California Government Code Section 65302 (g) requires local governments to assess the potential impact that flooding, and failure of dams or other water retention structures, might have on their jurisdiction, and assess the impact of flooding from storm activity such as a 100-year flood event.

Flood Plain- The portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.

Flood Plain, 100 Year- Flat tracts of land bordering a river or channel which can expect to be flooded in a storm that has a one-percent chance of occurring each year or will happen on the average of once every one hundred years. Federal legislation requires that the City have a flood management program for areas that are within the 100 Year Flood Plain.

Flow Failure- A mass movement of unconsolidated material that exhibits a continuity of motion and a plastic or semifluid behavior resembling that of a viscous (sticky and gluey) fluid. i.e. creep, earthflow, mudflow. Water is usually required for most types of flow movement.

Foliation- A general term for a planar arrangement of textural or structural features in any type of rock, e.g. cleavage in slate or schistocity in a metamorphic rock. This term is most commonly applied to metamorphic rock.

Footwall- The underlying side of a fault, an orebody, or of a mine floor.

Foothill- A lower, subsidiary hill at the base of a mountain or higher hills; A region of relatively low, rounded hills at the base of or fringing a mountain range.

Force- That which tends to put a stationary body in motion or to change the direction or speed of motion of a moving body.

Foreshock- A small tremor that commonly precedes a larger earthquake or main shock by seconds to weeks and that originates at or near the focus of the larger earthquake.

Forest- A large tract of land covered with trees; Something resembling a forest, as in quantity or density.

Foundation- The lower, man-made, supporting part of an engineering structure, in contact with the underlying soil or rock and transmitting the weight of the structure and its included loads to the underlying earth material; A term that is sometimes applied to the upper part of the soil or rock mass in contact with, and supporting the loads of, an engineering structure.

FPI- Fire Potential Index.

Fracture- A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fracture includes cracks, joints, and faults; Deformation due to a momentary loss of cohesion or loss of resistance to differential stress and a release of stored elastic energy.

Frequency Composition- The range of frequencies (the number of times a specified phenomenon occurs within a specified interval) as measured at a site, including high frequency earthquake ground motion (greater than 1 Hz) and lower frequency energy (less than 1 Hz).

Friction- Mechanical resistance to the relative motion of contiguous bodies or of a body and a medium.

Fuel- A combustible matter consumed to generate energy, especially a material such as wood, coal, or oil burned to generate heat.

Fuel Hazard Ratings- Primary, secondary and tertiary vegetation community types with assigned ratings for potential fire hazard based on fuel loading, slope angle, and where they occur in relation to urbanization. The California Gap Analysis vegetation data in accordance with the HUD Study System (1973) and the Bates Bill Process (AB337, 1992) are used to determine the fuel loads. Fuel hazard ratings for grasslands, shrublands, and woodlands consist of light, medium, and heavy, respectively. These ratings are then normalized based on the primary, secondary and tertiary type of vegetation communities.

Fuel Loading- Management of onsite volumes of vegetation or other combustible material. Fuel loading includes three classes. Light fuels (occupy the uncolored areas on the USGS maps) represent flammable grass and annual herbs. Medium fuels (shown as "scrub" on the USGS maps) include brush and other perennial shrubs less than six feet in height and having a crown density of 20 percent or more. Heavy fuels (shown as "woods-brushwood" on the USGS maps) include the heavier brush species, woodland types, and timber types over six feet in height and having a crown density of 20 percent or more.

Fuel Types- Include grass, weeds, shrubs, brush, large shrubs, small trees, timber, woodland, large brush, or heavy planting of ornamentals.

Generalized Liquefaction Susceptibility Map- Research into the process and consequences of liquefaction in past earthquakes have linked liquefaction to certain hydrologic and geologic settings, characterized by water-saturated cohesionless (not holding together), granular materials situated at depths of less than 50 feet. In simplified terms, the procedure used to delineate areas having significant potential for liquefaction areas where the geology and hydrology are favorable for liquefaction.

Geodetic Leveling- Spirit leveling of a high order of accuracy, usually extended over large areas (and with proper applications of orthometric corrections), to furnish accurate vertical control for surveying and mapping operations.

Geologic Constraints- Restrictions or hazard to life or property such as earthquakes, landslides, wind erosion, blown sand, flooding, and wildland fires.

Geologic Hazard- A naturally occurring or man-made geologic condition or phenomenon that presents a risk or is a potential danger to life and property. Examples include: landsliding, flooding, earthquakes, ground subsidence, coastal and beach erosion, faulting, dam leakage and failure, mining disasters, pollution and waste disposal, and seawater intrusion.

Geologic Hazard Abatement- Adopted in 1979, this law spells out the procedures by which property owners wishing to abate a geologic hazard found on their properties may form a special assessment district to pay for correction of that hazard. While there are a few successful applications of this law in the state, it has been difficult to implement due to stringent provisions and the emotion often encountered after property damage has occurred. The California Seismic Safety Commission is studying how to make it more attractive to apply in advance of damage.

Geologic Record- The "documents" or "archives" of the history of the Earth, represented by bedrock, regolith ,and the earth's morphology (changes occurring on rocks and the accessible solid part of the Earth). Also, the geologic history based on inferences from a study of the geologic record.

Geologic Setting- The physical geography of an area or place.

Geologist- One who is trained and works in any of the geological sciences.

Geology- The study of the planet earth and the materials of which it is made; The processes that act on these materials, the products formed, and the history of the planet and its life forms since its origin.

Geomorphology- The science that treats the general configuration of the Earth's surface. The study of the classification, description, nature, origin and development of landforms, and the history of geologic changes as recorded by these surface features.

Geoscience- A short form denoting the collective disciplines of the geological sciences. The term, as such, is synonymous with geology.

Geotechnical- Pertaining to soil and soil mechanics that involves the properties of soil such as compaction, strengths, stabilization, and chemical reactivity.

Geotechnical Engineer- A licensed civil engineer who is also certified by the State as qualified for the investigation and engineering evaluation of earth materials and their interaction with earth retention systems, structural foundations, and other civil engineering works.

Geotechnical Investigations- The application of scientific methods and engineering principles to the acquisition, interpretation, and use of knowledge of materials of the Earth's crust to the solution of civil-engineering problems; the applied science of making the Earth more habitable. It embraces the fields of soil mechanics and rock mechanics, and many of the engineering aspects of geology, geophysics, hydrology, and related sciences.

Geothermal- Pertaining to the heat of the interior of the Earth.

GIS- Geographical Information System.

Government Code Section 65302- Requires a safety element for the purpose of protecting the community from unreasonable risks associated with the effects of seismic hazards, flooding and fire. The safety element must include maps of known seismic and other geologic hazards, such as seismically-induced surface rupture, ground shaking, ground failure, dam failure, slope instability and subsidence, as well as related phenomena such as tsunami, seiche, flooding, and wildland and urban fire hazards. It must address evacuation routes, peak load water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards. It also may address any other subjects that the local governing body considers pertinent to the physical development of the community.

Graben- An elongate, relatively depressed crustal unit or block that is bounded by faults on its long sides. It is a structural form that may or may not be geomorphically expressed as a rift valley (elongated trough or tectonic depression bounded by faults).

Grading- Any excavation or filling or combination thereof. Generally refers to the modification of the natural landscape into pads suitable as foundations for structures.

Grain Size Distribution (Particle Size)- The percentage, usually by weight and sometimes by number or count, of particles of defined size fractions of a soil, sediment, or rock.

Grassland- A prairie; Land in which grasses are the main vegetation.

Gravel- Round or angular fragments of rock up to 3 inches (2 mm-7.6 cm) in diameter. An individual piece is a pebble.

Gravity- The force exerted by the earth and its rotation on unit mass, or the acceleration imparted to a freely falling body in the absence of friction; The resultant effect upon which any body of matter in the universe of the inverse square law attraction between it and all other matter lying within the frame of reference and of any centrifugal force (the component of apparent force on a body in a curvilinear motion as directed away from the center of curvature of axis of rotation) which may act on the body because of its motion in any orbit.

Gravity Gradient- The partial derivative of the acceleration of gravity with respect to distance in a particular direction, for which purpose the acceleration of gravity is considered as a scalar; for example, regional settlements can damage pipelines by changing the gravity gradient on water and sewer lines and canals.

Great Basin High- The formation of Santa Ana wind is a typical pressure configuration that consists of a stalled but intense high pressure called the Great Basin High near Idaho and Salt Lake, and a weak low pressure system just off shore of southern California (Chen, 2000).

Greenness Mapping- Mapping used to help reduce wildland fire hazards weekly and biweekly maps for the 48 contiguous states and Alaska display plant growth and vigor, vegetation cover, and biomass (amount of vegetation in weight) production, using multispectral data from to measure vegetation greenness over time. They are used by fire and land managers to assess the condition of all vegetation throughout the growing season to provide a foundation for planning for fire suppression, scheduling prescribed burns, or studying long-term vegetation changes resulting from human or natural factors.

Ground Acceleration- The acceleration of an earth particle, usually as measured by an accelerometer.

Ground Failure- Permanent ground displacement produced by fault rupture, differential settlement, liquefaction, or slope failure.

Ground Oscillation- Liquefaction-related effects via shifting patterns of the earth's surface or the sediments, bringing about changes in the character of the earth's surface.

Ground Rupture- Displacement of the earth's surface as a result of fault movement associated with an earthquake.

Ground Shaking- Ground motion. Seismic ground shaking at any given site is a function of several factors, but primarily the magnitude of the earthquake, the distance from the epicenter to the area of concern, the type of bedrock or soil materials between the epicenter and the site, and the topographic conditions of the site (whether it is located in a valley, or at the top of a hill or mountain). The amount of damage is also controlled to a certain extent by the size, shape, age, and engineering characteristics of the affected structures.

Ground Shaking Risks- Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. In general, however, long-period seismic waves, characteristic of earthquakes that occur about 10 miles (15 kilometers) and farther from the area of concern, interact with and damage preferentially long-period structures such as high-rise buildings and bridges. Short-period seismic waves, characteristic of earthquakes that occur less than 10 miles from the area of concern, have the potential for damaging preferentially short-period structures, such as one- and two-story buildings.

Ground Subsidence- Typically a gradual settling or sinking of the ground surface with little or no horizontal movement. In the areas of southern California where ground subsidence has been reported, this phenomenon is usually associated with the extraction of oil, gas or ground water from below the ground surface, or the organic decomposition of peat deposits, with a resultant loss in volume. Ground subsidence can also occur as a response to natural forces such as earthquake movements, and the folding and subsiding activity of sedimentary basins.

Ground-Surface Cover- Low-growing plants that form a dense, extensive growth and tend to prevent soil erosion.

Ground Water- 1. That part of the subsurface water that is the zone of saturation (at full capacity -not allowing anymore moisture), including underground streams. 2. Underground water that occupies the pore spaces in soil or fissures (joints) in rock. 3. Loosely, all subsurface water (excluding internal water) as distinct from surface water. 4. Water found in that portion of the soil which is always saturated or below the water table. Also called the "phreatic water."

Groundwater Table- The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

Habitat- Environment. All those external factors and conditions which may influence an organism or a community.

Hanging Wall- The overlying side of a fault, orebody, or other structure.

Hard Rock- A term used loosely for an igneous rock or a metamorphic rock, as distinguished from sedimentary rock.

Hazard- Expresses the menace or threat imposed by potential natural phenomena, such as hurricanes, floods and earthquakes, that can cause adverse consequences to human activities, negative social impact, and severe human and economic losses; A risk; Source of danger.

Hazard Abatement Notices- These notices request that property owners reduce the fuels around their property. Requirements for hazard reduction include a minimum of a 30 foot clearance around all structures, which can be extended to 100 feet in areas where a severe fire hazards exist. On unimproved parcels the property owner is required to disc or mow 100 feet along the perimeter of the property.

Hazardous Fire Area- Fire risk area based on drought and other conditions.

Hazardous Fire Area Designation- Areas that require closure based on potentially fire hazardous conditions. The fire chief is given the authority to officially determine and publicly announce the closure of any hazardous fire area or portion thereof. However, if closure is of a period of more than fifteen (15) days it must be approved by the Board of Supervisors within fifteen (15) days of the chiefs original order of closure. No person is permitted in any hazardous fire area, except on public roadways and inhabited areas during such time as the area is closed to entry. During periods of closure, the chief shall erect and maintain at all entrances to the closed areas sufficient signs giving adequate notice of closure.

Hazardous Materials- Dangerous waste material that can cause serious illness, injury, or death, and environmental damage; Any substance designated pursuant to the Federal Water Pollution Control Act; Any hazardous waste having the characteristics identified under or listed in the Clean Air Act; Any imminently hazardous chemical substance or mixture with respect to which the Administrator of the U.S. EPA has taken pursuant to Toxic Substances Control Act; A designated substance or material that has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

HAZUS/HAZUSTM- The standardized methodology based on a geographic information system (GIS) for earthquake loss estimation, is a project of the National Institute of Building Sciences, with funding from the Federal Emergency Management Agency (FEMA). Designed to produce loss estimates for use by state, regional and local governments in planning for earthquake loss mitigation, emergency preparedness and response and recovery. The methodology deals with nearly all aspects of the built environment, and with a wide range of different types of losses. These HAZUS loss estimations are based on current scientific and engineering knowledge, they are improved by mapping of soil type, liquefaction and landslide susceptibility as part of this study, and can be further improved by enhancing building and infrastructure inventory. (see soil type, liquefaction, landslide and landslide susceptibility).

HAZUS Earthquake Induced Fire Scenarios- Fires following earthquakes can cause severe losses. These losses can sometimes outweigh the total losses from the direct damage caused by the earthquake, such as collapse of buildings and disruption of lifelines (e.g. 1906 San Francisco). Many factors affect the severity of the fires following an earthquake, including but not limited to: ignition sources, types and density of fuel, weather conditions, functionality of water systems, and the ability of fire fighters to suppress the fires.

Heavy Urban Search and Rescue Teams- Victim extrication and survivability Implementation. The establishment of Heavy Urban Search and Rescue teams as recommended by (FEMA) Federal Emergency Management Agency (1985). Location and extrication of victims trapped under the rubble is generally a dangerous process that requires equipment to tunnel and lift heavy debris. Extrication of trapped victims within the first 24 hours after the earthquake becomes critical for victim survivability.

High Loss Facilities- Examples include nuclear power plants, dams and flood control structures, freeway interchanges, bridges, and industrial plants that use or store explosives, toxic materials or petroleum products. High-loss facilities, if severely damaged, may result in a disaster far beyond the facilities themselves.

High Occupancy Facilities- Facilities such as high-rise buildings, large assembly public and private facilities and large multifamily residential complexes that have the potential for catastrophic fatalities and crowd control problems.

Hill- A natural elevation of the land surface, rising rather prominently above the surrounding land, usually of limited extent and having a well-defined outline (rounded rather than peaked or rugged), and generally considered to be less than 300 m (1000 ft) from base to summit.

Historic Building Code Design Functions- Estimates of building damage are provided for both "High", "Moderate" and "Low" seismic design criteria. Buildings of newer construction (e.g., post-1973) are best represented by "High" design functions. Buildings built after 1940, but before 1973, are best represented by "Moderate" design functions. If built before about 1940 (i.e. before significant seismic codes existed), "Low" seismic design criteria are more appropriate. The vast majority of buildings in the County of Riverside are considered of "High" seismic design.

Hollows- Bowl-shaped geomorphic scars located at the top of swales and serve as source areas for certain types of debris flows.

Holocene- An epoch of the geologic Quaternary time period, from the end of the Pleistocene- about 10,000 years ago to the present time; Also, the corresponding series of rocks and deposits. When the Quaternary is designated as an era, the Holocene is considered a period.

Homeowner Checklist to Reduce Fire Risk- Designing and installing a fire wise landscape, consider the following: Local area fire history; Site location and overall terrain; Prevailing winds and seasonal weather; Property contours and boundaries; Native vegetation; Plant characteristics; Irrigation requirements; fire resistant landscape (well-irrigated, low growing, and well-spaced); Leave a minimum of 30' around the house to accommodate fire equipment; Take out "ladder fuels" -- vegetation that serves as a link between grass and tree tops. It can carry fire to a structure or from a structure to vegetation; Give yourself added protection with "fuel breaks" like driveways, gravel walkways, and lawns; Keep trees and shrubs pruned; Remove leaf clutter and dead and overhanging branches; Mow lawn regularly; Dispose of cuttings and debris promptly; Store firewood away from the house; irrigation system is well maintained; Use care when refueling garden equipment and maintain it regularly; Store and use flammable liquids properly; build on the most level portion of the land; Use construction materials that are fire-resistant or non-combustible whenever possible; consider using materials such as Class-A asphalt shingles, slate or clay tile, metal, cement and concrete products, or terra-cotta tiles; fire resistive materials such as stucco or masonry; prevent sparks from entering your home through vents, cover exterior attic and underfloor vents with wire mesh no larger than 1/8 of an inch; driveway that is wide enough 12 feet wide with a vertical clearance of 15 feet and a slope that is less than 12 percent - to provide easy access for fire engines; and at least two ground level doors for safety exits and at least two means of escape either a door or window.

HUD Study System- Combines Fuel loading based on U. S. Geological Survey (USGS) life forms, fire weather based on the California Wildland Fire Danger Rating System (CWFDRS), and three Slope Classes taken from CWFDRS.

Hydroconsolidation- Soil collapse that typically occurs in recently deposited, Holocene soils that were deposited in an arid or semi-arid environment. Soils prone to collapse are commonly associated with wind-laid sands and silts, and alluvial fan and mudflow sediments deposited during flash floods. The soils typically contain minute pores and voids. The soil particles may be partially supported by clay, silt, or carbonate bonds. When saturated, the soils (collapsible soils) undergo a rearrangement of their grains and a loss of cementation.

Hydrologic Budget B- An accounting of the inflow to, outflow from, and storage in a hydrologic unit such as drainage basin, aquifer, soil zone, lake, or reservoir; the relationship between evapotranspiration precipitation, runoff, and the change in water storage, expressed by the hydrologic equation.

Hydrologic System- A complex of related parts-physical, conceptual, or both-forming an orderly working body of hydrologic units and their man-related aspects such as the use, treatment and reuse, and disposal of water and the costs and benefits thereof, and the interaction of hydrologic factors with those of sociology, economics, and ecology .

Hydrocompaction- Settlement of loose, granular soils that occurs when the loose, dry structure of the sand grains held together by a clay binder or other cementing agent collapses upon the introduction of water. Hydroconsolidation.

Hydrology- The science that deals with continental water (both liquid and solid), its properties, circulation, and distribution, on and under the earth's surface and in the atmosphere , from the moment of its precipitation until it is returned to the atmosphere through evapotranspiration or is discharged into the ocean.

Igneous- Said of a rock or mineral that solidified from molten or partly molten material; Also applied to processes leading to, related to, or resulting form the formation of such rocks.

IBCO- International Conference of Building Office.

Ignition Management- Biomass harvesting, fire resistant landscaping, mechanical and chemical fuels treatments, building construction standards, infrastructure, and land use planning.

Imbricate- A stacked sequence of overlapping; subsurface faults.

Impact- To affect force; An initial usually strong force; The impetus or force produced by a collision.

Incendiary Fire- A fire deliberately set in grass, brush, or woodland areas using a highly flammable substance for ignition.

Inclination- A general term for the slope of any geological body or surface, measured in the upward or downward direction and from the horizontal or the vertical. It is often used synonymously with dip; A deviation from the true vertical or horizontal. Also, the amount of such deviation; the rate of slope or grade; an inclined surface- slope.

Indirect Economic Loss- Earthquakes may produce dislocations in economic sectors not sustaining direct damage. All businesses are forward-linked (rely on regional customers to purchase their output) or backward-linked (rely on regional suppliers to provide their inputs) and are thus potentially vulnerable to interruptions in their operation. Such interruptions are called indirect economic losses. Note that these losses are not confined to immediate customers or suppliers of damaged enterprises. All of the successive rounds of customers of customers and suppliers of suppliers are impacted.

Indurated- Said of a compact rock or soil hardened by the action of pressure, cementation, and especially heat; Said of an impure, hard, slaty variety of talc.

Inertia- The tendency of a body to remain at rest or to stay in motion unless acted upon by an external force; resistance to motion or change.

Infiltration- The movement of water or solutions, especially ore-bearing (profitably mined or extracted) solutions, into a rock through interstices or fractures in of crevasses upon the melting of glacier ice.

Intensity- A measure of the effects of an earthquake at a particular place. Intensity depends on the earthquake magnitude, distance from the epicenter, and on the local geology.

International Conference of Building Office (IBCO)- Maps of known Near-Source Zones in California and adjacent portions of Nevada published by the International Conference of Building Officials and prepared by the California Division of Mines and Geology for use with the 1997 UBC. The changes to the 1997 UBC represent the most significant increases in ground shaking criteria in the last 30 years. In addition, to the new code, soil effects now impact buildings of short predominant period of ground shaking (low-rises).

Inundation- A rising of water and its spreading over land not normally submerged.

Irrigation- The artificial distribution of water over the ground surface, as by canals, pipes, or flooding, in order to promote plant growth.

Isoseismal (isoseismal line)- A line connecting points on the earth's surface at which earthquake intensity is the same. It is usually a closed curve around the epicenter.

Joint- Regularly spaced fractures in rock that result from expansion during cooling or uplift of the rock mass.

Land Subsidence- The loss of surface elevation due to removal of subsurface support; land slip.

Landslide- A general term covering a wide variety of mass-movement landforms and processes involving the downslope transport, under gravitational influence, of soil and rock material en masse; The down-slope movement of material, whether it be bedrock, regolith , or a mixture of these.

Landslide Management Zones (LMS)- Represents regions susceptible to slope instability. Without the presence of extensive flood control devices, including large debris basins, the areas outlined by the LMZ's may be subject to debris flow inundation.

Landslide Susceptibility Zone Map- Map of yielded potential landslide areas or regions. Seismically induced landsliding and rock falls can be expected to occur in a major earthquake. Development policies, based on the Geographical Information System (GIS) mapping, include avoidance and mitigation of the hazard during construction to help in reducing the potential losses associated with this hazard.

Land-Use- The solid, exposed surface of the earth as distinguished from waters employed or utilized for a certain purpose.

Large Fire- A fire that is out of control at first arrival.

Large Occupancy Structure- Infrastructure that allows for a high volume of people used to live in or employ such as high-rises.

Lateral Force- The force of the horizontal side to side motion on the earth's surface as measured on a particular mass; either a building or structure.

Lateral Spreading- Lateral movements in a fractured mass of rock or soil that results from liquefaction or plastic flow or subjacent materials.

Latitude- Angular distance of a point on the Earth's surface north or south of equator, measured along the meridian through 90 degrees.

Load- (sed) The material that is actually carried by a natural transporting agent, such as by a stream, wind, waves, etc. The actual quantity or amount of such material at any given time. (struct geol) Vertical pressure caused by the weight of the overlying rocks, as a result of gravity alone.

Loess- A widespread, homogeneous, commonly nonstratified, porous, friable, unconsolidated but slightly coherent, usually highly calcareous, fine-grained , blanket deposit of loam consisting predominantly of silt with subordinate grain-sizes ranging from clay to fine sand. It is buff to light yellowish or yellowish brown in color thought to be windblown dust of Pleistocene age lying south of the limits of the ice sheets or from unconsolidated glacial deposits.

LUST- Leaking Underground Storage Tank.

LUSTIS- Leaking Underground Storage Tank Information Systems.

Left-Lateral Strike Slip Fault- A fault, the displacement of which is of left-lateral separation, with movement of a lateral fault along which, in map view, the side opposite the observer appears to have moved to the left.

Left-Lateral Separation- Movement of a lateral fault along which, in plan view, the side opposite the observer appears to have moved to the left

Levee- An artificial embankment of earth fill, built along the bank of a water coarse or an arm of the sea in design to protect land from inundation (flooding).

Lifelines- Such as the control tower in an airport, or the buildings housing the computers and telephone circuits central to the communication lifelines of a district, bridges, highways and freeways.

Lifeline Categories- A hazard analysis focuses on four lifeline categories: (1) water and sewer facilities, (2) transportation facilities, (3) electric power facilities, and (4) gas and liquid fuel lines.

Lifeline System- Linear conduits or corridors for the delivery of services or movement of people and information (e.g. pipelines, telephones, freeways, railroads).

Lifeline System Facilities- Facilities whose operations are necessary at all times of emergencies, such as emergency transmission systems, major utility lines, evacuation and disaster routes, and warehouses storing heavy rescue and debris cleanup equipment.

Liquefaction- Changing of soils (unconsolidated alluvium) from a solid state to weaker state unable to support structures; where the material behaves similar to a liquid as a consequence of earthquake shaking. The transformation of non-binding soils from a solid or liquid state as a result of increased pore pressure and reduced effective stress. Liquefaction occurs primarily in saturated loose, fine to medium-grained soils in areas where the ground water table is 50 feet or less below the ground surface. When these sediments are shaken, such as during an earthquake, a sudden increase in pore water pressure causes the soils to lose strength and behave as a liquid. Excess water pressure is vented upward through fissures and soil cracks causing a water-soil slurry to bubble onto the ground surface. The resulting features are called sand boils, sand blows or "sand volcanoes." Liquefaction-related effects include loss of bearing strength, ground oscillations, lateral spreading, and flow failures or slumping.

Liquefaction-Induced Ground Failure Map- These maps attempt to characterize permanent ground displacements associated with liquefaction. These maps may be either of the scenario earthquake type or the probabilistic (see definition of probability) type.

Liquefaction Opportunity Map- Research into the process and consequences of liquefaction in past earthquakes have linked liquefaction to certain hydrologic and geologic settings, characterized by water-saturated, cohesionless, granular materials situated at depths of less than 50 feet. In simplified terms, the procedure used to delineate areas having significant potential for liquefaction requires development of a liquefaction opportunity and summarizes information about the potential for strong earthquake shaking.

Liquefaction Potential- Using the Liquefaction Opportunity Map and the Liquefaction Susceptibility Map to determine the relative likelihood that an earthquake will cause liquefaction in an area.

Liquefaction Potential Map- Incorporates considerations of both the susceptibility of the soils and the earthquake potential in a region. One kind of liquefaction potential map expresses the likelihood of liquefaction in the various geologic deposits for one or more selected regional scenario earthquakes. A second kind of potential map expresses either the likelihood of liquefaction of the geological deposits during a certain time period (for example, 10% probability of liquefaction in 50 years) or a return period for liquefaction (for example, average 500-yr return period for liquefaction occurrence).

Liquefaction Resistance- In areas of Holocene and Pleistocene deposition, geotechnical and hydrologic data are compiled. Standard Penetration Test (SPT) and/or Cone Penetration Test (CPT) and grain size distribution data can be used for liquefaction resistance evaluations.

Liquefaction Severity Index (LSI)- Expresses estimated maximum amounts of ground displacement due to lateral spreading in gently sloping, highly liquefaction-susceptible deposits for selected probabilities of exceedance and time periods.

Lithology- The description of rocks, esp. sedimentary rock types and esp. in hand specimen and in outcrop (a portion of bedrock or other stratum protruding through the soil level), on the basis of such characteristics as color, structures, mineralogical composition and grain size; The physical character of a rock.

LSI- Liquefaction Severity Index map.

LMS- Land Management System.

LMZ- Landslide Management Zones.

Local Response Areas (LRAs)- The Bates Bill Process is utilized to determine Very High Fire Hazard Severity Zones (VHFHSZs) in LRAs.

Long Period Structure- High-rise buildings and bridges. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. In general, however, long-period seismic waves, characteristic of earthquakes that occur about 10 miles (15 kilometers) and farther from the area of concern, interact with and damage preferentially long-period structures.

Low Probability/High Consequence Events- For example -Major earthquakes seldom occur, but when they do, catastrophic consequences follow. Because the limited number of past events and the difficulty in accurately predicting future events, insurers need to utilize the risk assessments from experts. However, these estimates are highly uncertain and ambiguous. For example, scientists forecast that a catastrophic earthquake will occur in Riverside County, but they do not know if it will occur next year, or if it will occur in 100 years, or which specific communities will be most affected.

LRAs- Local Response Areas

Magnitude- A measure of the size of an earthquake, as determined by measurements from seismograph records.

Major earthquake- Capable of widespread, heavy damage up to 50+ miles from epicenter; generally near Magnitude range 6.5 to 7.0 or greater, but can be less, depending on rupture mechanism, depth of earthquake, location relative to urban centers, etc.

Mandatory- Required by, having the nature of, or relating to a mandate; Obligatory

Marine Deposits- Of pertaining to, existing in, or formed by the sea; Typically marsh-like silt, sand, and fine gravel

Marsh- An area of low, wet land; a swamp; A water-saturated, poorly drained area, intermittently or permanently water-covered, having aquatic and grass-like vegetation, essentially without peat-like accumulation.

Mass-Wasting- The down slope movement of rock and regolith near the earth's surface mainly due to the force of gravity. Mass-wasting is an important part of the erosional process, as it moves material from higher elevations down to lower elevations where transporting agents like streams can then pick up the material and move it to even lower elevations.

Master Fault- Such as the San Andreas Fault that controls the seismic hazard for Southern California.

Matrix- (sed) The smaller or finer-grained, continuous material enclosing, or filling the interstices between, the larger grains or particles of a sediment or sedimentary rock; the natural material in which a sedimentary particle is embedded. The term refers to the relative size and disposition of the particles, and no particular particle size is implied. (ign) The fine-grained interstitial material of an igneous rock; e.g. the material surrounding the phenocrysts (large grains found set in finer-grained groundmass) of a porphyritic (texture term describing igneous rocks with phenocrysts) rock.

Maximum Credible Earthquake (MCE)- The highest magnitude earthquake a fault is capable of producing based on physical limitations, such as the length of the fault or fault segment.

Maximum Moment Magnitude (MMM)- Calculated from rupture area regressions (type "all") from Wells and Coppersmith (1994); Largest magnitude events which have the highest rate of seismicity.

Maximum Probable Earthquake (MPE)- The design size of the earthquake expected to occur within a time frame of interest, for example within 30 years or 100 years, depending on the purpose, lifetime or importance of the facility. Magnitude/frequency relationships are based on historic seismicity, fault slip rates or mathematical models. The more critical the facility, the longer the time period considered.

MCE - Maximum Credible Earthquake.

Meander (stream) One of a series of somewhat regular, sharp, freely developing, and sinuous curves, bends, loops, turns, or winding in the course of a stream. It is produced by a mature stream swinging from side to side as it flows across its flood plain or shifts its course laterally toward the convex side of an original curve.

Mercalli Intensity Scale (MMI)- An arbitrary scale of earthquake intensity, ranging from I (detectable only instrumentally) to XII (causing almost total destruction). It is named after Giuseppi Mercalli (d. 1914), the Italian geologist who devised it in 1902. Its adaptation to North American conditions is known as the Modified Mercalli Scale.

Metamorphic Rock- Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Metamorphism- The processes by which changes are brought about in rocks within the earth's crust by the agencies of heat, pressure, and chemically active.

Meteorology- The study of the earth's atmosphere, including its movements and other phenomena, especially as they relate to weather forecasting.

Microzonation- The detailed mapping of various seismic hazards for use in urban and disaster planning.

Mills Act- Enacted by the state legislature in 1976 and amended in 1985. Owners of historical properties can enter into a contract with a local government in order to qualify for property tax relief. The Mills Act requires a mandatory ten-year contract, subject to annual notice of non-renewal provisions that then starts a phase-out of the contract over the remaining nine-year period. Mills Act contract procedures provide the County the choice of which properties to include in the program and what seismic upgrading or other conditions to require, while at the same time providing property owners an incentive for offsetting retrofitting costs with property taxes saved.

Mitigation- To make or become less severe or painful by planning to result in reduction of life and property using building codes and hazard studies; Any action taken before an earthquake that has the potential to reduce the consequences of an earthquake. Non-construction actions, such as reducing the number of people in a building or removing hazardous contents, and construction actions that are not strengthening per se, such as removing the upper floors of a building or adding base isolation, are considered mitigation, as are all types of seismic strengthening or upgrading. This definition is intended for general use and is not to be confused with Federal Emergency Management Agency (FEMA's) legal definition.

MMI- Mercalli Intensity Scale.

MMLW- Mean Low-Low Water.

MMM- Maximum Moment Magnitude.

Mobile Home- Prefabricated housing units that are trucked to the site and then placed on isolated piers, jackstands, or masonry block foundations (usually without any positive anchorage). Floors and roofs of mobile homes usually are constructed with plywood and outside surfaces are covered with sheet metal. Mobile homes typically do not perform well in earthquakes.

Model Fire Hazard Reduction Ordinance To assist local governments in adopting ordinances to reduce fire hazard in local jurisdictions, the State Fire Marshal, Fire Engineering Division has developed a model checklist. The development of this model was required by Assembly Bill 3819, on September 27, 1994. The model ordinance addresses the following standards: Road Standards for Fire Equipment Access, Structural Standards, and Fuel Modification Standards.

Moderate Earthquake- Capable of causing considerable to severe damage, generally in the range of Magnitude 5.0 to 6.0 (Modified Mercalli Intensity <VI), but highly dependent on rupture mechanism, depth of earthquake, and location relative to urban center, etc.

Moisture- Water diffused in the atmosphere or the ground, including soil water.

Mojave Desert- The Mojave Desert province consists of the eastern approximately one-half of the County, and includes the Blythe area. This province in Riverside County has a moderate to low rate of seismicity and very few mapped faults. However, north of the County, the Mojave Desert province was the location of the 1992 Landers MW 7.3, and the 1999 Hector Mine MW 7.1 earthquakes and numerous active right-lateral strike-slip faults .

Monte Carlo Simulation Model- A procedure in statistics by which random numbers are used to approximate the solution to intractable mathematical or physical problems. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area.

Moratorium- A deferment or delay of any action.

Mottling- (soil) Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage.

Mountain Range- A single, large mass consisting of a succession of mountains or narrowly spaced mountain ridges, with or without peaks, closely related in position, direction, formation, and age; a component part of a mountain system or of a mountain chain.

MPE- Maximum Probable Earthquake.

Mudflood- Refers to a flood in which the water carries heavy loads of sediment (as much as 50 percent by volume) including coarse debris. Mudfloods typically occur in drainage channels and on alluvial fans adjacent to mountainous regions, although they may occur on floodplains as well.

Mudflow- Wet earth flow containing 50% fragments smaller than 2 mm (Varnes, 1978).

Munsell Notation- A designation of color by degrees of the three simple variables hue, value, and chroma. I.e. 10YR 6/4 whereas 10YR hue, value of 6, and chroma of 4.

MWD- Metropolitan Water District. Emergency storage is required in the event of an interruption of the Metropolitan Water District (MWD) primary supply. MWD recommends a seven day emergency storage supply.

National Flood Insurance Program- Individuals and business owners can protect themselves from property losses by purchasing flood insurance through Federal Emergency Management Agency - FEMA's National Flood Insurance Program.

National Institute of Building Sciences- The development of HAZUSTM, the standardized methodology based on a geographic information system for earthquake loss estimation, is a project of the National Institute of Building Sciences.

National Oceanic and Atmospheric Administration (NOAA)- Since the early 1990's, the EROS Data Center (EDC) has been producing weekly and biweekly maps for the 48 contiguous states and Alaska that display plant growth and vigor, vegetation cover, and biomass production, using multispectral data from satellites of NOAA.

National Seismic Hazard Mapping Program- Consists of USGS and CDMG scientists that have produced maps indicating the probabilistic ground shaking parameters. Probabilistic Earthquake Hazard Assessment is utilized by the U.S. Geological Survey in producing national seismic hazard maps that are modified and adopted into the Uniform Building Code (UBC). Mapping produced for the 1997 UBC includes data from the California Division of Mines and Geology (CDMG, 1996). Development of these maps requires three steps: 1) delineating earthquake sources; 2) defining the potential distribution of seismicity for each of these sources; and 3) calculating the potential ground motions from attenuation relations for all the model earthquakes.

National Weather Service- Federal agency that plays a role in fire hazard mitigation, response and recovery. www.nws.noaa.gov

Natural Deposits- Material of any type or from any source that has accumulated or produced or existing by nature.

Natural Gas- Any of the gaseous hydrocarbons generated below the earth's surface. Methane is usually found as a product of decaying vegetable matter; ethane, propane, and butane in association with liquid hydrocarbons and distilled within the lithified crust.

Natural Hazard Disclosure Statement- If a property is located in a Seismic Hazard Zone the seller or the seller's agent must disclose this fact to potential buyers as provided in Section 1102.6c of the California Civil Code or to use the Local Option Real Estate Disclosure Statement as provided in Section 1102.6a of the California Civil Code.

Natural Hazards- A risk; chance; An accident; Source of danger produced or existing in nature; e.g. wildland fire, flooding, or earthquakes.

Natural Hazards Disclosure Act- Requires that sellers of real property and their agents provide prospective buyers with a "Natural Hazard Disclosure Statement" when the property being sold lies within one or more state-mapped hazard areas. If a property is located in a Seismic Hazard Zone as shown on a map issued by the State Geologist (Division of Mines and Geology), the seller or the seller's agent must disclose this fact to potential buyers. The law specifies two ways in which this disclosure can be made. One is to use the new Natural Hazards Disclosure Statement as provided in Section 1102.6c of the California Civil Code. The other way is to use the Local Option Real Estate Disclosure Statement as provided in Section 1102.6a of the California Civil Code. The Local Option Real Estate Disclosure Statement can be substituted for the Natural Hazards Disclosure Statement only if the Local Option Statement contains substantially the same information and substantially the same warning as does the Natural Hazards Disclosure Statement.

NEHRP - National Earthquake Hazard Reduction Program.

Near-field Earthquake- Used to describe a local earthquake within approximately a few fault zone widths of the causative fault which is characterized by high frequency waveforms that are destructive to above-ground utilities and short period structures (less than about two or three stories).

Near-Source- Identification, location, and directivity of fault rupture within a designated hazard zone.

Net Slip- On a fault, the distance between two formerly adjacent points on either side of the fault, measured on the fault surface or parallel to it. It defines both the direction and relative amount of displacement (total slip).

NOAA- National Oceanic and Atmospheric Administration. Since the early 1990's, the EROS Data Center (EDC) has been producing weekly and biweekly maps for the 48 contiguous states and Alaska that display plant growth and vigor, vegetation cover, and biomass production, using multispectral data from satellites of NOAA.

Nonductile- Refers to concrete construction using columns and beams with insufficient steel reinforcing, making a structure likely to break and prone to collapse during earthquakes.

Non-structural- Damage to buildings is commonly classified as either structural or non-structural. Non-structural damage does not affect the integrity of the structural support system. Examples of non-structural damage include broken windows, collapsed or rotated chimneys, and fallen ceilings.

Normal Fault- A fault in which the hanging wall appears to have moved downward relative to the footwall. The angle of the fault is usually 45-90°. There is dip separation but there may or may not be dip slip .

North American Plate- Earthquakes in Southern California occur as a result of movement between the Pacific and North American plates. The boundary between these plates bisects Riverside County. However, movement is broadly distributed across the area, and is accommodated by several faults that are located both onshore and offshore. Most of the movement (about 70%) between these plates is accommodated by the San Andreas fault. The rest of the motion is distributed between the Eastern Mojave Shear Zone (a series of faults east of the San Andreas, responsible for the 1992 Landers and the 1999 Hector Mine earthquakes), the northwest-trending San Jacinto, Whittier-Elsinore, Newport-Inglewood and Palos Verdes fault zones, and several east-trending thrust faults along the southern boundary of the Transverse Ranges .

Not Active- A fault that does not show evidence of, or is suspected of having experienced surface displacement within the last 11,000 years; A fault that on the basis of historical, seismological, or geological evidence does not have the finite probability of producing an earthquake.

Oblique Slip- In a fault, movement or slip that is intermediate in orientation between the dip slip and strike slip .

Oblique Slip Fault- A fault, the slip (movement) of which is oblique to, rather than parallel or perpendicular to, the dip of the constituent rocks or dominant structure.

Offset ridge- A ridge that is discontinuous on account of faulting.

Offset stream- A stream displaced laterally or vertically by faulting.

Operational Area Coordinator for the California Fire & Rescue Mutual Aid- Riverside County Fire Department (RCOFD) is the Operational Area Coordinator for the California Fire and Rescue Mutual Aid System for all fire service jurisdictions in the County of Riverside. It also has several automatic aid agreements with other city jurisdictions as well as the adjacent National Forests. The County of Riverside contracts with the State of California for fire protection. Public Resources Code (PRC) 4142 affords legal authority for the California Department of Forestry and Fire Protection to enter into agreements with local government entities to provide fire protection services with the approval of the Department of General Services. By virtue of this authority, California Department of Fire (CDF) administers the Riverside County Fire Department.

Ordinance- Laws adopted as specific implementation measures to General Plan goals, objectives or policies.

Organic Matter- Plant and animal residue in the soil in various stages of decomposition

Outcrop- A portion of bedrock or other stratum protruding through the soil level. That part of a geologic formation or structure that appears at the surface of the Earth; also, bedrock that is covered only by surficial deposits such as alluvium.

Overdraft- Withdrawl of ground water in excess of replenishment.

Overdrafted Valley- Where subsidence typically occurs, with differential displacement and fissures (joints) manifested at or near the valley margin.

Pacific Plate- Earthquakes in Southern California occur as a result of movement between the Pacific and North American plates. The boundary between these plates bisects Riverside County. However, movement is broadly distributed across the area, and is accommodated by several faults that are located both onshore and offshore. Most of the movement (about 70%) between these plates is accommodated by the San Andreas fault. The rest of the motion is distributed between the Eastern Mojave Shear Zone (a series of faults east of the San Andreas, responsible for the 1992 Landers and the 1999 Hector Mine earthquakes), the northwest-trending San Jacinto, Whittier-Elsinore, Newport-Inglewood and Palos Verdes fault zones, and several east-trending thrust faults along the southern boundary of the Transverse Ranges .

Paleoseismology- The study of ancient seismic (earthquake) events.

Parameters (stat) Any arbitrary numerical constant derived from a population or a probability distribution and characterizing by each of its particular values some particular member of a system; a quantity related to one or more variables in such a system; a quantity related to one or more variables in such a way that it remains constant for any specified set of values of the variable or variables; Any measurable characteristic of a sample or population; any of a set of physical properties whose values determine the characteristics or behavior of a system.

Parent Material- The unconsolidated organic and mineral material in which soil forms.

Parapet- The portion of any wall which extends above the roof line, or a wall that serves as a guard at the edge of a balcony or roof.

Particle Size- The general dimensions (such as average diameter or volume) of the particles in a sediment or rock, or of the grains of a particular mineral that make up a sediment or rock, based on the premise that the particles are spheres or that the measurements made can be expressed as diameters of equivalent spheres. It is commonly measured by sieving, by calculating settling velocities, or by determining areas of microscopic images.

Pathogen- Any agent that causes disease, especially a microorganism (animal or plant of microscopic size) such as a bacterium or fungus.

Peak Ground Acceleration (PGA)- The greatest amplitude of acceleration measured for a single frequency on an earthquake accelerogram (the record of the detection of acceleration of earth particles). The maximum horizontal ground motion generated by an earthquake. The measure of this motion is the acceleration of gravity (equal to 32 feet per second squared, or 980 centimeter per second squared), and generally expressed as a percentage of gravity.

Peak Flood- The highest discharge or stage value of a flood.

Peak Load Water Supply- Maximum quantity of water available for use.

Peak Water Flow Requirements- Sufficient water flow available to fight fires. Peak water flow requirements are based on building type, design, and use.

Peninsular Ranges- This province is characterized by major right-lateral strike-slip faulting associated with the San Jacinto and Elsinore faults and includes the Santa Ana and San Jacinto Mountain ranges in the County.

Perched ground water- Unconfined ground water separated from an underlying main body of ground water by an unsaturated zone.

Permeability- (geol) The property or capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; A measure of the relative ease of fluid flow under unequal pressure.

Petroleum- A naturally-occurring complex liquid hydrocarbon that may contain varying degrees of impurities (sulfur, nitrogen) which alter distillation yields a range of combustible fuels, petrochemicals, and lubricants.

Petrologic- Of pertaining to petrology.

Petrology- That branch of geology dealing with the origin, occurrence, structure, and history of rocks, esp. igneous and metamorphic rocks . Petrology is broader in scope than petrography, which is concerned with the description and classification of rocks.

PGA- Peak Ground Acceleration.

Physiographic Setting- Landforms and features considered with regard to its origin, cause, or history.

Piling- Used to pin a structure to stable bedrock below using long piles emplaced through an unstable zone of potential ground failure; commonly utilized for landslide and liquefaction mitigation. Commonly made of steel-reinforced concrete, steel or wood.

Pilot and Calibration Studies- Economic loss module to calculate a loss estimate for earthquakes and their effect upon buildings and facilities. Of course, uncertainties are inherent is any loss estimation methodology arising in part from incomplete scientific knowledge and in part from the approximations and simplifications necessary for comprehensive analyses. Pilot and calibration studies have as yet not provided an adequate test concerning the possible extent and effects of landsliding .

Planned Community- Are large, often multi-purpose development projects which implement the General Plan over a defined area of over 300 acres.

Plate- One of the large, nearly rigid, but still mobile segments or thin blocks involved in plate tectonics, with a thickness (50-250 km) that includes both crust and some part of the upper mantle (zone between the earth's crust and core).

Plastic- (struct) Said of a body in which strain produces continuous, permanent deformation without rupture.

Pleistocene- The earliest Epoch of the Quaternary Period beginning about 1.6 million years ago and ending 10,000 years ago. Commonly known as the "Ice Age" a time with episodes of widespread continental glaciation. When the Quaternary is designated as an era, the Pleistocene is considered to be a period.

Pliocene- An epoch of the Tertiary period, after the Miocene and before the Pleistocene; Also, the corresponding worldwide series of rocks. It is sometimes considered to be a period, when the Tertiary is designated an era.

Poorly Graded- Refers to a coarse- grained fragments or coarse-grained consisting mainly of particles of nearly the same size.

Pore Pressure- The stress transmitted by the fluid that fills the voids between particles of a soil or rock mass.

Pore Water Pressure- Neutral stress; The stress transmitted through the fluid that fills the voids between particles of a soil or rock mass; e.g. that part of the total normal stress in a saturated soil due to the presence of interstitial water.

Postfire Effects- Wildfires leave problems behind them, even when the last ember is extinguished. During an intense wildfire, all vegetation may be destroyed; also the organic material in the soil may be burned away or may decompose into water-repellent substances that prevent water from percolating into the soil. As a result, even normal rainfall may result in unusual erosion or flooding from a burned area; heavy rain can produce destructive debris flows. The watersheds of Riverside County may also be negatively affected by fire. The loss of ground-surface cover, and the chemical transformation of burned soils make watersheds more susceptible to erosion from rainstorms, and impairs water quality.

Postfire Management- To lessen the costly impacts of future wildfires and offer alternatives to continually increase suppression forces.

Potential Flood Limit- Capable but not yet in existence of the boundary of rising water and its spreading over land not normally submerged in the remote possibility a dam is catastrophically breached. Under State jurisdiction dams over 50 feet in height or 50 acre-feet in storage capacity are required to have inundation (flood) maps.

Potentially Active Fault- Under the APE a fault showing evidence of movement within the last 1.6 million years (750,000 years according to the U.S. Geological Survey) but before about 11,000 years ago, and that is capable of generating damaging earthquakes.

Power Intertie- Terminal facilities in a lifeline network system, such as water and sewage pumping stations, electrical power substations, and power generating facilities.

Pre-cast Components- Steel frame or concrete frame buildings with unreinforced masonry walls, reinforced concrete wall buildings with no special detailing or reinforcement,

Precipitation-(meteor) The discharge of water (as rain, snow, hail, or sleet) from the atmosphere upon the Earth's surface. It is measured as a liquid regardless of the form in which it originally occurred; in this sense, it may be called rainfall.

Pre-fabricated Elements- A constituent part or parts that are trucked to the site. Mobile homes are prefabricated housing units and then placed on isolated piers, jackstands, or masonry block foundations (usually without any positive anchorage). Pre-cast frames are often weakened due to a combination of the accumulated stresses that may result from shrinkage and creep, and due to stresses incurred during transportation. Vertical support may fail if the building was designed with an inadequate bearing area and/or with insufficient connections between floor elements and columns. Corrosion of the metal connectors between prefabricated elements may also occur weakening the structure.

Prefire Management- Includes a systematic application of risk assessment, fire safety, fire prevention and fire hazard reduction techniques. The County's extreme diversity and complex pattern of land use and ownership require equally diverse and complex techniques to effectively manage the fire environment. Some options are the responsibilities of state, federal and local governments; others fall to private citizens or businesses; most are joint responsibilities. They should lessen the costly impacts of future wildfires and offer alternatives to continually increasing suppression forces.

Prescribed Fire (burns)- Term used for occasions when a fire is deliberately set, under carefully controlled and monitored conditions. The purpose is to remove brush and other undergrowth which can provide fuel for naturally occurring fires. Fire is an essential ecological process in many ecosystems. Prescribed fire is used to alter, maintain or restore vegetative communities, achieve desired resource conditions, and to protect life, property, and values that would be degraded by wildland fire. Prescribed fire is only accomplished through managed ignition and should be supported by planning documents and appropriate environmental analysis.

Pressure- The force exerted across a real or imaginary surface divided by the area of that surface; the force per unit area exerted on a surface by the medium in contact with it.

Private Streets- Streets or roads not dedicated for public usage and, therefore, not maintained by the City; usually within planned developments or condominiums.

Probability- A statistical measure (where zero is impossibility and one is certainty) of the likelihood of occurrence of an event.

Probabilistic Seismic Hazard Assessment- Takes into account the recurrence rates of potential earthquakes on each fault in the area and the potential ground motion that may result from each of these earthquakes.

Project- A development application involving zone changes, variances, conditional use permits, tentative parcel maps, tentative tract maps, and plan amendments.

Proposition 218- This measure was adopted in November 1996 and dramatically revised local government finance. Proposition 218 transfers from local elected officials the power to establish new revenue sources, other than use fees, and requires voter or property owner approval to do so. It can be understood as replacing representative democracy in local government finance with direct democracy; Affects most local government revenues, including garbage collection fees, fire assessments, and utility user taxes. The only local revenues not affected directly by Proposition 218 are: fees for local services not related to property, gas and electric charges, fees collected as a condition of property development, and intergovernmental transfers (Colantuono, 1997).

Province- An extensive region all parts of which are characterized by similar geologic history or by particular structural, petrographic, or physiographic features.

Pseudostatic- A simplified engineering analyses of the stability of a site or structure that translates earthquake ground motion into a static force in performing stability calculations.

P wave- Primary body wave that arrives before the S wave; The type of seismic body wave which is propagated by alternating compression and expansion of material in the direction of propagation. It is the fastest of the seismic waves (traveling 6.0-6.7 km/sec in the crust and 8.0-8.5 km/sec in the upper mantle), and it is the type carrying sound.

Quaternary- The second period of the geololgic Cenzoic era, following the Tertiary; also, the corresponding system of rocks. It began two to three million years ago and extends to the present. It consists of two grossly unequal epochs the Pleistocene and the Holocene. The Quaternary may also be incorporated into the Neogene, when the Neogene (incorporating the Miocene and Pliocene) is designated as a period of the Tertiary Era.

Range/Rangeland- A tract of land over which animals such as cattle and horses graze; an extended line or row especially of mountains.

RCOFD- Riverside County Fire Department..

Rebound- In relation to subsidence said to occur when land springs back during intervening periods of water level recovery.

Recharge- The processes involved in the absorption and addition of water to the zone of saturation. This does not include water reaching the belt of soil water or the intermediate belt. Also, the amount of water added.

Reconstruction- To construct or assemble again and has the meaning of demolishing an existing building, partially or totally, and to rebuild and refashion it, due to damage, deterioration, change of function and use or due to other causes.

Recovery Reconstruction Act (1986)- Authorizes local governments to prepare before a disaster for expeditious and orderly recovery and reconstruction afterward. It enables pre-disaster plan preparedness and ordinances which may include: an evaluation of the vulnerability of specific areas under its jurisdiction to damage from a potential disaster, together with streamlined procedures for the appropriate modification of existing general plans or zoning ordinances affecting those areas after a disaster; a contingency plan of action and organization for post-disaster short-term and long-term recovery and reconstruction; and, a pre-disaster ordinance to provide adequate local authorization for post-disaster activities.

Recurrence Earthquake Interval- (fault) The average temporal duration between actual occurrences of a fault event of a given or greater magnitude. (hydrol) In an annual flood series, the average interval in which a flood of a given size recurs as an annual maximum. In a partial duration series, the average interval between floods of a given size, regardless of their relationship to the year or any other period of time. This distinction holds even though for large floods recurrence intervals are nearly the same on both scales.

Recurrence Rate- Probabilistic seismic hazard assessment that takes into account the time between events of potential earthquakes on each fault in an area and the potential ground motion that may result from each of these earthquakes.

Recycle- To extract and reuse; To extract useful materials.

Regional Statistical Area- Primarily for census and population purposes, areas within the five County areas of Southern California Association of Governments are divided into Regional Statistical Areas (RSAs).

Regolith- A general term for the entire layer of fragmental and loose, incoherent, or unconsolidated rock material, of whatever origin (residual or transported) and of very varied character, that nearly everywhere forms the surface of the land and overlies or covers the more coherent bedrock. It includes rock debris (weathered in place) of all kinds, volcanic ash, glacial drift (rock and soil material carried by glacier), alluvium, loess, and eolian deposits, vegetal accumulations, and soils.

Rehabilitation- Pre-earthquake construction actions that improve the seismic resistance of a structure to its original capacity by repairing, architectural remodelling and restoration. The term "rehabilitation' is used in this sense by the federal government in FEMA's series of publications on existing buildings.

Reinforced Masonry- Masonry construction with steel reinforcement.

Reinforcement- The act or process of giving more force or effectiveness to strengthen or support.

Relative Density- The ratio of the difference between the void ratio of a cohesionless soil in the loosest state and any given void ratio to the difference between its void ratios in the loosest and the densest states.

Relative Humidity- The ratio, expressed as a percentage, of the actual amount of water vapor in a given volume of air to the amount that would be present if the air were saturated at the same temperature.

Remodeling- To alter the structure, to make anew or in different form; Reconstruction, renewal, or restoration of an existing building due to change of usage, function or occupancy.

Repair- Post-earthquake restoration of what is broken or torn apart. Providing to the structural and non-structural elements the same level of resistance and capacity they had before damage occurred; repair of damage that does not increase the seismic resistance of a structure beyond its pre-earthquake state; also repair of damage due to other causes that returns the building to its original seismic resistance.

Reservoir- A body of water collected and stored in natural or artificial lake. Types of reservoirs include flood control, water supply and power generation.

Resonance- Amplification of ground motion frequencies within bands matching the natural frequency of a structure and often causing partial or complete structural collapse; Effects may demonstrate minor damage to single-story residential structures while adjacent 3- or 4-story buildings may collapse because of corresponding frequencies, or vice versa.

Response spectra - The range of potentially damaging frequencies of a given earthquake applied to a specific site and for a particular building or structure.

Retrofit- Post-earthquake improvement of the seismic resistance of a structure, including repair of damage and upgrading of structural and/or nonstructural systems to provide a higher level of resistance than existed before the earthquake; Seismic upgrading or seismic improvement; To restore pre-1971 infrastructure for seismic upgrade in response building codes for hazard mitigation.

Reverse Fault- Thrust fault with a high angle (>30°) dipping fault where one side is pushed relatively up and over the other side.

Right-lateral Strike Slip Fault- A fault, the displacement of which is right-lateral separation, with movement of a lateral fault along which, in map view, the side opposite the observer appears to have moved to the right.

Riley Act- Act which established the first lateral force standards for structures after the Long Beach earthquake of 1933.

Risk- The possibility or chance of suffering loss or injury and to the degree of probability of such loss; danger; A factor, element, or course involving uncertain danger; hazard. The danger or possibility of loss with respect to a person or thing.

Riverbed- The channel containing or formerly containing the water of a river.

Riverside County Fire Department (RCOFD)- RCOFD is one of the largest regional fire service organizations in California. It operates out of fire department headquarters in the city of Perris and 85 fire stations in 16 battalions, providing fire suppression, emergency medical, rescue, and fire prevention services. The department's service area is organized into two operational areas and six divisions. RCOFD is the Operational Area Coordinator for the California Fire and Rescue Mutual Aid System for all fire service jurisdictions in the County of Riverside. It also has several automatic aid agreements with other city jurisdictions as well as the adjacent National Forests.

Riverside Fire Laboratory- Of the U.S. Forest Service the laboratory conducts research on: Air Pollution and Climate Impacts on Western Forest Ecosystems; Meteorology for Fire Severity Forecasting; Wildland Recreation and Urban; Prescribed Fire and Fire Effects; and Fire Management in the Wildland/Urban Interface.

Riverside Ranger Unit- of CDF (with headquarters in Perris) provides direct protection for 1,070,000 acres of "wildland." These vegetation-covered, watershed lands are designated by the State Board of Forestry as state responsibility areas. This is generally private land, outside of incorporated cities and federally owned land, where the organized protection force is at maximum strength during the declared "fire season."

Roadcut- Geology, soil, stratigraphic units and/or geologic structures observed from an incision made from construction of a road or passageway for vehicles..

Rockfall- The relatively free falling or precipitous movement of newly detached segment of bedrock (usually massive, homogeneous, or jointed) of any size from a cliff or other very steep slope. Occurs when a piece of rock on a steep slope becomes dislodged and drops down the slope. It may be a single rock or a mass of rocks, and the falling rocks can dislodge other rocks as they collide with the cliff. Because this process involves the free fall of material, falls commonly occur where there are steep cliffs.

Rockfall Hazards- Areas susceptible to rockfall. Usually, located below steep, resistant outcrops of relatively well-cemented materials. Such materials underlie much of Riverside County's mountain ranges. The rockfall hazard in the County is considered high for hillside development, as well as for development located adjacent to steeply ascending slopes.

Rock Avalanche- Rapidly moving and large volume of debris fall (wet or dry).

Rock Fragments- Rock or mineral fragments having a diameter of 2 mm or more. i.e. pebbles, cobbles, stones, and boulders.

Rockslides- Results when rocks slide down a pre-existing surface, such as a bedding plane, foliation surface, or joint surface Piles of talus (coarse angular rock fragments) are common at the base of a rock slide. Slides differ from slumps in that there is no rotation of the sliding rock mass along a curved surface.

RSAs- Regional Statistical Areas.

Rubble- A loose mass, layer, or accumulation of rough, irregular, or angular rock fragments broken from larger masses usually by physical (natural or artificial) forces, coarser than sand.

Runoff- (water) That part of precipitation appearing in surface streams. It is more restricted than streamflow as it does not include stream channels affected by artificial diversions, storage, or other works of man. With respect to promptness of appearance after precipitation, it is divided into direct runoff and base runoff; with respect to source, it is divided into surface runoff, storm seepage, and ground-water runoff. It is the same as total runoff used by other workers.

Saltation- (sed) A mode of sediment transport in which the particles are moved progressively forward in a series of short intermittent leaps, jumps, hops, or bounces from a bottom surface; e.g. sand particles skipping downwind by impact and rebound along a desert surface, or bounding downstream under the influence of eddy (circular motion with a different direction form that of the main current) currents that are not turbulent enough to retain the particles in suspension (supporting the weight of undissolved sediment particles and keeping them held in the body of the surrounding fluid) and thereby return them to the stream bed at some distance downstream. It is intermediate in character between suspension and the rolling or sliding of traction.

Salton Trough- The trough is a broad structural depression under which oceanic-type sea floor spreading is occurring, and is considered the northward extension of the Gulf of California. Although tectonically similar to the Gulf of California, the trough is filled with as much as three miles of sediment derived primarily from the Colorado River. During the last 10,000 years, the trough has been periodically inundated by bodies of water, the latest being the formation of the Salton Sea in 1905. At present the trough is cut off from the Gulf of California by the accumulation of sediment at the mouth of the Colorado River.

San Andreas Fault- The principal boundary between the Pacific and North American Plates. In southern California, the San Andreas fault system is comprised of three segments: 1) the San Bernardino Mountains segment, 2) the Coachella Valley segment, and 3) the Mojave Desert segment; Considered the "Master Fault", controlling the seismic hazard for Southern California.

Sand- (soil) A term used in the U.S. for a rock or mineral particle in the soil, having a diameter in the range of 0.05-2 mm. The diameter range recognized by the International Society of Soil Science is 0.02-2 mm. As a soil textural class, a soil that is 85 percent or more sand and not more than 10% clay.
(eng) A round fragment having a diameter in the range of 0.074mm (retained on U.S,. standard sieve no.200) to 4.76 mm (passing U.S. standard sieve no.4).
(sed) A rock fragment or detrital particle smaller than a granule and larger than a coarse silt grain, having a diameter in the range of 1/16 to 2 mm (62-2000 microns) or a size between that at the lower limit of visibility of an individual particle with the unaided eye and that of the head of a small wooden match, being somewhat rounded by abrasion in the course of transport. (b) A loose aggregate of unlithified mineral or rock particles of sand size; an unconsolidated or moderately consolidated sedimentary deposit consisting essentially of medium-grained fragment. The material is most commonly composed of quartz resulting from rock wearing away.

Sand boil- An accumulation of sand resembling a miniature volcano or low volcanic mound produced by the expulsion of liquefied sand to the sediment surface. Also called sand blows, and sand volcanoes.

Sandstone- A medium-grained clastic (broken fragments of preexisting rocks) sedimentary rock composed of abundant rounded or angular fragments of sand size set in a fine-grained matrix and more or less firmly united by a cementing material.

Santa Ana Watershed Project (SAWPA)- Groundwater mapping for Riverside used data from this agency to obtain highest recorded groundwater elevation.

Santa Ana Winds- Named by the early settlers at Santa Ana. The formation of Santa Ana wind is a typical pressure configuration that consists of a stalled but intense high pressure called the Great Basin High near Idaho and Salt Lake, and a weak low pressure system just off shore of southern California (Chen, 2000). These winds constitute a contributing factor that cause small fires to spread quickly and create the need for an increased level of fire protection.

Saturated- Said of the condition in which the spaces between the materials are filled with a liquid, usually water.

SAWPA- Santa Ana Watershed Project Authority.

Scarp (scars/escarpment)- A long, more or less continuous cliff or relatively steep slope facing in one general direction, breaking the general continuity of the land by separating two level or gently sloping surfaces, produced by erosion or by faulting. The term is often used synonymously with "escarpment" which is more often applied to a cliff formed by differential erosion; A high, steep, abrupt face of rock, often presented by the upward termination of strata in a line of cliffs, and generally marking the outcrop of a resistant layer occurring in a series of gently dipping softer strata

SCEPP- Southern California Earthquake Preparedness Project.

Sea Floor Spreading- A hypothesis that the oceanic crust is increasing by convective (movement and mixing of water masses in the ocean) upwelling of magma along the mid-oceanic ridges or world rift system (deep central cleft in the crest with a mountainous floor), and a moving away of the new material at a rate of from one to ten centimeters per year. This movement provides the source of power in the hypothesis of plate tectonics. This hypothesis supports the continental displacement hypothesis.

Secondary Earthquake Hazards- Accidents or source of danger brought upon by earthquakes such as liquefaction, seiches, slope instabilities, fires, flooding.

Sediment- Solid fragmental material, or a mass of such either organic or inorganic, that originates from weathering of rocks and is transported by, suspended in, or deposited by, air, water, or ice, or that is accumulated by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the earth's surface at ordinary temperatures in a loose, unconsolidated form; e.g. sand, gravel, silt, mud, till, loess, alluvium; Strictly, solid material that has settled down from a state of suspension in a liquid.

Sediment Flow- Debris flows down hill mixed with water or air.

Sedimentary- Pertaining to or containing sediment ; e.g. a "sedimentary deposit" or a "sedimentary complex"; Formed by the deposition of sediment (e.g. a "sedimentary clay"), or pertaining to the process of sedimentation.

Sedimentary Rock- Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel, sandstone, formed from sand, shale, formed from clay, and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sediment-laden Waters- Material held in suspension in water or recently deposited from suspension. During floods most property damage results from inundation by sediment-laden water.

Seiche- A free or standing-wave oscillation of the surface of water in an enclosed or semi-enclosed basin (such as a lake, bay, or harbor), that is initiated chiefly by local changes in atmospheric pressure, aided by winds, tidal currents, and earthquakes, and that continues, pendulum-fashion, for a time after cessation of the originating force.

Seismic Capacity- The measure of resistance of a structure to strong earthquake shaking, or seismic loading as commonly used when applying lateral forces to a structure.

Seismic Event- An earthquake or a somewhat similar transient earth motion.

Seismic Hazards- Related to the menace or threat imposed by the future seismic activity of a region or country (not the consequences caused by a future seismic event); i.e. seismic ground shaking, liquefaction, seismically induced landslides, and surface fault rupture. It is measured in terms of probability that certain parameters, such as intensity of ground motion or peak ground acceleration, may be exceeded in a given place and in a given time.

Seismic Hazards Mapping Act (SHMA)- The Seismic Hazards Mapping Act passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides.
The principal State agency charged with implementation of the provisions Pursuant to the SHMA the California Division of Mines and Geology (CDMG) is directed to provide local governments with seismic hazard zone maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures. The seismic hazard zones delineated by the CDMG are referred to as "zones of required investigation.

Seismic Intensity- A qualitative estimate of the damage caused by an earthquake at a given location.

Seismic Risk- Expresses the "possibility or chance of damage, economic loss, victims, and injuries due to occurrence of a destructive earthquake and the degree of probability of such loss; Measured in terms of probability that, in a given place and a given period of time, the estimated loss or number of victims may be exceeded; Given the location and magnitude of future earthquakes in a region, and a means for specifying the return period for each fault, the cumulative risk for a site to experience a certain level of ground shaking in a given period of time can be ascertained. Expressed as a probability for design and planning considerations, seismic risk factors depend on the type of development. ATC 3-06 (1978) recommends that a 10 percent chance of exceeding a design ground motion in 50 years (0.002 percent probability of exceedance), which is equivalent to a 500 year return interval, be used for the design of critical structures such as lifelines, dams, and bridges. A 50 or 100 year return period, which is equivalent to a 0.01 percent probability of exceedance, is recommended for regional planning purposes or noncritical structures.

Seismic Risk Mitigation- Denotes any preventative actions taken before the occurrence of a destructive earthquake intended to reduce its consequences. All measures undertaken to increase the seismic resistance and performance of buildings and lifelines, as well as to increase the safety of people and to reduce economic losses and social impact.

Seismic Source Types- Near source factors also include a classification of seismic sources based on slip rate and maximum magnitude potential. These parameters are used in the classification of three seismic source types A, B and C (Type A: Faults that are capable of producing large magnitude events and which have a high rate of seismicity. Maximum Moment Magnitude (M) > 7.0 and Slip Rate (SR mm/yr) > 5; Type B: All faults other than Types A and C; Type C: Faults which are not capable of producing large magnitude earthquakes and which have a relatively low rate of seismic activity M < 6.5 and SR < 2).

Seismic Strengthening- Construction actions that improve the seismic resistance of a building by increasing the strength or stiffness. Both rehabilitation and retrofit can include seismic strengthening.

Seismic Upgrading- All actions undertaken to improve the overall seismic performance of existing buildings and may include repair and strengthening of structural elements, the redesign of the lateral load resistant system, improvement of non-structural elements and fixing of electrical and mechanical systems and equipment.

Seismic Vulnerability- A term related to a building or structure prone or susceptible to suffer damage or collapse due to a potential earthquake. The results of seismic vulnerability studies can be expressed in terms of the probability that, in a given period or exposure time, the estimated damage and losses can be exceeded.

Seismic Wave- A general term for all elastic sea waves produced by earthquakes or generated artificially by explosions. It includes both body waves and surface waves; A seismic sea wave, or tsunami (earthquake wave).

Seismically-Induced Settlement- In some situations, strong ground shaking can cause the densification of soils, with a resultant local or regional settlement of the ground surface.

Seismically-Induced Slope Instability- Seismically induced landsliding and rock falls can be expected to occur throughout the County in a major earthquake. Factors controlling the stability of slopes include: 1) the slope height and inclination, 2) the engineering characteristics of the earth materials comprising the slope, and 3) the intensity of ground shaking.

Seismicity- The phenomenon of seismic earth movements; Earthquakes.

Seismogenic- Capable of producing earthquake activity.

Seismograph- An instrument that detects, magnifies, and records vibrations of the earth, especially earthquakes. The resulting record is a seismogram.

Seismology- The study of earthquakes; The study of the structure of the interior of the Earth via both natural and artificially generated seismic signals.

Semi-Arid- Said of a type of climate in which there is slightly more precipitation (10-20 inches or 12-16 inches) than in an arid climate, and in which grasses are the characteristic vegetation. In Thornthwaite's classification, the moisture index is between B20 and B40 (subarid).

SEMS- Standard Emergency Management Systems.

Setback- Dwelling units put away from ground rupture hazards to establish structural avoidance zones. To determine if a setback is necessary is typically accomplished by excavation of a trench across the site, determining the location of faulting and establishing building setbacks.

Settlement- The gradual downward movement of an engineering structure, due to compression of the soil below the foundation; The gradual lowering of the overlying strata in mine, due to extraction of the mined material; The subsidence of surficial material (such as coastal sediments) due to compaction.

Shear- A strain resulting from stresses that cause or tend to cause contiguous parts of a body to slide relatively to each other in a direction parallel to their plane of contact; Specifically, the ratio of the relative displacement of these parts to the distance between them. In geologic literature the term refers to strain rather than stress. It is also used to refer to surfaces and zones of failure by shear, and to surfaces along which differential movement has taken place (shear strain).

Shear Failure- It is the mode of failure of a body or mass whereby the portion of the mass on one side of a plane or surface slides past the portion on the opposite side.

Shear Strength- The internal resistance of a body to shear stress; cohesion.

Shear Stress- The component of stress which acts tangential to a plane through any given point on a body; any of the tangential components of the stress tenor.

Shear Velocity- The square root of the product of the acceleration due to gravity, the hydraulic mean depth of flow, and the slope of the energy grade line (ASCE, 1962).

Shear Wave- See S wave.

Shear Zone- A tabular zone of rock that has been crushed and brecciated (crushing rock into angular fragments) by many parallel fractures due to shear strain. Such an area is often mineralized by ore-forming solutions

SHMA- Seismic Hazard Mapping Act (1990).

Shrink-Swell- The shrinking (loss of water) of soil when dry and the swelling (taking up water) when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Shrubland- Bush and clump vegetation in an area.

Silt- (soil) As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very fine sand (0.05). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.
(eng) Nonplastic or slightly plastic material exhibiting little or no strength when air-dried, consisting mainly of particles having diameters less than 0.074 mm (passing U.S. standard sieve no. 200). An indurated silt having the texture and composition of shale but lacking its fine lamination is called a siltstone.

Site-Specific- The collection of facts, data, and the testing of, surface and subsurface features (including physical nature, thickness, geologic structure, and other engineering properties) for the purpose of determining information for that particular location.

Slip- On a fault, the actual relative displacement along the fault plane of two formerly adjacent points on either side of the fault. Slip is three-dimensional, whereas separation is two-dimensional.

Slip Rate- To specify the measured quantity in mm/yr of the relative displacement along a fault plane.

Slope- (geomorph) Gradient; A measurement of the steepness of a hillside or other landform normally expressed as a percentage sphere or a ratio; The inclined surface of any part of the Earth's surface, as a hillslope; Also, a broad part of a continent descending toward an ocean, as the Pacific slope.

Slope Failure- A sudden failure of the slope resulting in transport of debris down hill by sliding, rolling, falling, or slumping.

Slope Stability- The gradient or inclined surface's resistance to sudden change. It is dependent on many factors and their interrelationships. Rock type and pore water pressure are possibly the most important factors, followed by slope steepness due to natural or man-made undercutting.

Slope Ratio- Refers to the angle or gradient of a slope as the ratio of horizontal units to vertical units. For example, in a 2:1 slope, for every two horizontal units, there is a vertical rise of one unit (equal to a slope angle, from the horizontal, of 26.6 degrees).

Slump- A landslide characterized by a shearing and rotary movement of a generally independent mass of rock or earth along a curved slip surface. Types of slides with downward rotation of rock or regolith occurring along a concave-upward curved surface. The upper surface of each slump block remains relatively undisturbed, as do the individual blocks. Slumps leave arcuate (curved or bowed) scars or depressions on the hill slope. Slumps can be isolated or may occur in large complexes covering thousands of square meters. They often form as a result of human activities, and thus are common along roads where slopes have been over-steepened during construction. Heavy rains and earthquakes can also trigger slumps.

Soft Ground- (eng) Ground that is too moist or too yielding to support weight and thereby allows an object to sink in; Rock that does not stand well and requires heavy timbering, such as that about an underground opening.

Soft-Story- A structure that has at least one story, often the ground level, with significantly less rigidity or strength than other floors in the structure during seismic loading, e.g. apartment dwellings with garages on the lower floor, etc. Buildings with a story, generally the first floor, lacking adequate strength or toughness, due to few shear walls, i.e., buildings where the first floor is the garage. The State Legislature passed Senate Bill 547 encouraging identification and mitigation of seismic hazards associated with potentially hazardous buildings that includes soft-stories.

Soil- (eng geo) All unconsolidated earthy material over bedrock. It is approximately equivalent to regolith (soil) The natural medium for growth of land plants; A term used in soil classification for the collection of natural bodies on the earth's surface, in places modified or even made by man of earthy materials, containing living matter, and supporting or capable of supporting plants out-of-doors. The lower limit is normally the lower limit of biological activity, which generally coincides with the common rooting of native perennial plants.

Soil Engineer- A civil engineer who applies the knowledge and behavior of soil properties to engineering practice, esp. mining and geotechnical.. It is the application of soil data, techniques, and principles to the study of naturally occurring soil materials for the purpose of assuring that geologic factors affecting the location, planning, design, construction, operation, and maintenance of engineering structures.

Soil Erosion- Detachment and movement of topsoil, or soil material from the upper part of the profile, by the action of wind or running water, esp. as a result of changes brought about by human activity (such as unsuitable or mismanaged agricultural methods). It includes: rill erosion, gully erosion, sheet erosion, and wind erosion.

Soil Horizon- A layer of soil that is distinguishable from adjacent layers by characteristic physical properties such as structure, color or texture, or by chemical composition, including content of organic matter, or degree of acidity soil pH < 7.0) or alkalinity (soil pH > 7.0). Soil horizons are generally designated by a capital letter, with or without a numerical annotation, e.g. A horizon, A_2 horizon.

Soil Profile- A vertical section of a soil which displays all its horizons and its parent material

Soil Sampling- Channel sampling. Soil segments taken from a soil profile to represent the distribution of soil types, processes, and their characteristics.

Soil Structure- (soil) The combination of aggregation of primary soil particles into compound particles, or clusters of primary particles (peds), which are separated from adjoining peds by surface of weakness. Soil structure is classified on the basis of size, shape, and distinctness into classes, types, and grades respectively.

Soil Type- A phase or subdivision of a soil series based primarily on texture of the surface soil to a depth at least equal to plow depth (about 6 inches). In Europe, the term is roughly equivalent to the term great soil group.

Special Boulevard- Designated major roadways and avenues in the city which require special treatment in regards to building setbacks, landscaping and pedestrian paths (sidewalks).

Special Studies Zone (SSZ)- Initial site specific studies indicating if fissuring coincides with active (Holocene) faulting. State Division of Mines and Geology began a study in accordance with the Alquist-Priolo Special Studies Zone Act (APSSZ).). This resulted in establishment of a state Special Studies Zone (SSZ) to locate where fissures coincided with active (Holocene) faulting. These special studies zones are 0.2-0.3 km wide and 2.0-4.0 km long.

Specific Plans- Are legal implementation tools used to further define the General Plan. Generally, specific plans cover large areas; the Planned Communities are a form of specific plans.

Sphere of Influence- An unincorporated area directly adjacent to the city which the city experts in the future to annex and is recognized by the Local Agency Formation Commission.

Splays- A series of minor faults at the extremities of a major fault; the fault pattern formed by splaying out (breakup of a fault into a dispersal of minor faults). It is associated with rifts.

SPT- Standard Penetration Tests.

SRA- State Responsibility Areas.

SSC- Seismic Safety Commission. www.seismic.ca.gov

SSZ- Special Studies Zone.

Stafford Act- Established basic rules for federal disaster assistance and relief, and the Earthquake Hazards Reduction Act of 1977, (amended in 1990, which establishes the National Earthquake Hazards Reduction Program (NEHRP)); Briefly mentions "construction and land use" as possible mitigation measures to be used after a disaster to forestall repetition of damage and destruction in subsequent events. However, the final rules promulgated by the Federal Emergency Management Agency (FEMA) to implement the Stafford Act (44 CFR Part 206, Subparts M and N) require post-disaster state-local hazard mitigation plans to be prepared as a prerequisite for local governments to receive disaster assistance funds to repair and restore damaged or destroyed public facilities. Under the regulations implementing Section 409 of the Stafford Act, a county or city must adopt a hazard mitigation plan acceptable to FEMA if it is to receive facilities restoration assistance authorized under Section 409. In recent disasters, FEMA has recognized safety elements of California local governments as fulfilling Section 409 hazard mitigation plan requirements. The Stafford Act also requires that 15% of the total assistance dollars be spent on disaster mitigation--with the hope of reducing the costs associated with future disasters.

Standard Cone Penetrometer- An engineering borehole measurement, which among other applications, is able to translate penetration resistances (as gauged from a narrow cylindrical instrument of standard weight dropped from a standard height) of unconsolidated earth materials into a measure of liquefaction susceptibility.

Standardized SPT- Seed and others (1971, 1983, 1985), provide guidelines for performing "standardized" SPT, and also provide correlation for conversion of penetration resistance obtained using most of the common alternate combinations of equipment and procedures in order to develop equivalent "standardized" penetration - basis for evaluation of liquefaction resistance.

Standard Emergency Management Systems (SEMS)- The County is required under State law to prepare and maintain a Standardized Emergency Management System (SEMS) Multihazard Functional Plan. The California Governor's Office of Emergency Services (OES, 1999) has extensive guidelines outlining the requirements of the County SEMS. These guidelines establish policies and procedures and assigns responsibilities to ensure the effective management of emergency operations under the SEMS. Effective management consists of the emergency management structure and how the emergency management team is activated. However, the SEMS does not address long-range recovery planning issues.

Standard Project Flood- As used by the U.S. Corps of Engineers, a flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographic areas in which the drainage is located.

State Board of Forestry and the Department of Forestry and Fire Protection- Identifies those lands where the California Department of Forestry and Fire Protection (CDF) has the primary duty for wildland fire prevention and suppression. These lands are "state responsibility areas" (SRA). They are vegetated-covered, watershed lands that are generally private land, outside of incorporated cities and federally owned land, where the organized protection force is at maximum strength during the declared "fire season." The fire safety provisions denoted in the Safety Element is prepared and adopted in conjunction with the State Board of Forestry's fire safety regulations. Public Resources Code section 4290 that requires minimum statewide fire safety standards pertaining to: Road standards for fire equipment access; Standards for signs identifying streets, roads, and buildings; Minimum private water supply reserves for emergency fire use; And fuel breaks and greenbelts. The State Board of Forestry and the Department of Forestry and Fire Protection are excellent sources of information regarding fire hazard abatement planning and regulatory measures.

State Division of Mines and Geology- Began a study in accordance with the Alquist-Priolo Special Studies Zone Act (APSSZ).

State Fire Marshal- Assists local governments in adopting ordinances to reduce fire hazard in local jurisdictions. The State Fire Marshal, Fire Engineering Division has developed a model checklist. The development of this model was required by Assembly Bill 3819, on September 27, 1994. The model ordinance addresses the following standards: Road standards for fire equipment access; Structural standards; And fuel modification standards.

State Geologist- The Chief of the Division of Mines and Geology delineates "Earthquake Fault Zones" (based on The Alquist-Priolo Earthquake Fault Zoning Act) along faults which are "sufficiently active" and "well-defined."

State Legislature Senate Bill 547- Addressing the identification and seismic upgrade of Unreinforced Masonry (URM) buildings. In addition, the law encourages identification and mitigation of seismic hazards associated with other types of potentially hazardous buildings, including: pre-1971 concrete tilt-ups, soft-stories, mobile homes, pre-1940 homes, etc.

State Natural Hazards Disclosure Act- Requires that sellers of real property and their agents provide prospective buyers with a "Natural Hazard Disclosure Statement" when the property being sold lies within one or more state-mapped hazard areas. If a property is located in a Seismic Hazard Zone as shown on a map issued by the State Geologist, the seller or the seller's agent must disclose this fact to potential buyers.

State of California Department of Forestry and Fire Protection- Rates counties as potential wildland fire areas (based on undeveloped and rugged topography with potentially highly flammable indigenous vegetation). Special State Statutes govern development in these regions as well as maintenance requirements of property owners.

State Responsible Areas (SRAs)- They are vegetated-covered, watershed lands that are generally private land, outside of incorporated cities and federally owned land, where the organized protection force is at maximum strength during the declared "fire season."

Statistical Analysis- Devising and applying techniques to determine the uncertainty of numerical data and their interrelationships to make comprehensible summaries or parameters .

STATSGO- U.S. Department of Agriculture State Soil Geographic Map.

Stone- Crushed or naturally angular rock particles that will pass a 3-inch sieve (76 mm) and be retained on U.S. standard sieve no. 4 (4.74 mm).

Stony- A name for something that consists dominantly of stone particles or contains at least 25% stones.

Storage Capacity- Dam storage measured in acre-feet or decameters, including dead storage.

Storm- (meteorol) A general term for any meteorological disturbance of the atmosphere, e.g. precipitation (rainstorm), wind (windstorm).

Storm Drain- A device, pipe or channel for carrying off rainwater.

Strain- Change in shape or volume of a body as a result of stress, Defined as the ratio of the change to the original shape or volume; A change in relative configuration of the particles of a substance.

Stratigraphy- The geologic study of the form, arrangement, geographic distribution, chronologic succession, classification, and esp. correlation and mutual relationships of rock strata "in normal sequence with respect to any or all of the characters, properties, and attributes which rocks may possess." It thereby involves interpretation of these features of rock strata in terms of their origin, occurrence, environment, thickness, lithology, composition, fossil content, age, history, paleogeographic conditions, relation to organic evolution, and relation to other geologic concepts; The arrangement of strata esp. to geographic position and chronological order of sequence.

Stream- Any body of running water, great or small (from a large river to a small rill), moving under gravity flow to progressively lower levels in a relatively narrow but clearly defined channel on the surface of the ground, in subterranean cavern (cave formed beneath the earth's surface), or beneath or in a glacier; esp. a body flowing in a natural channel. It is a mixture of water and of dissolved, suspended, or entrained matter. A term used in quantitative geomorphology interchangeably with channel.

Stream Flood- A flood of water in an arid region, characterized by the "spasmodic and impetuous flow' of a sheetflood but confined to a definite, shallow channel that is normally dry (Davis, 1938).

Stress- In a solid, the force per unit area, acting on any surface within it, and variously expressed as pounds or tons per square inch, or dynes or kilograms per square centimeter; also, by extension, the external pressure which creates the internal force. The stress at any point is mathematically defined by nine values: three to specify the normal component and six to specify the shear component, relative to three mutually perpendicular reference axes.

Strike- (struc geol) The direction or trend that a structural surface, e.g. a bedding or fault plane, takes as it intersects the horizontal.

Strike-slip fault- A fault with a vertical to subvertical fault surface that displays evidence of horizontal and opposite displacement.

Strip Mining- Opencut mining; Surficial mining, in which the ore is exposed to the sky by removing the overburden. Both coal and metalliferous ores (of iron, copper) are worked in this way.

Structural Damage- The building's structural support has been impaired. Structural support includes any vertical and lateral force-resisting systems, such as the building frames, walls, and columns.

Structural Depression- A hollow in the land surface caused by structural deformation of the Earth's crust.

Structural Engineer- A licensed civil engineer certified by the State as qualified to design and supervise the construction of engineered structures.

Structural Redesign- Modifying the lateral load resistant system using other kinds of structural elements; concrete structural or shear walls and steel bracing systems, or adopt other mitigation measures such as base isolation system.

Structural Strengthening- Actions undertaken in order to increase the resistance of structural elements for beyond the original capacity. Strengthening may consist in increasing the dimensions of and adding steel bars to reinforced concrete elements, (jacking of columns and girders) or welding plates or rolled sections to steel structural elements. Strengthening does not imply all actions in order to increase the rigidity and seismic capacity of the structural system.

Subsidence- The sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion. Is one of the most diverse forms of ground failure, ranging from small or local collapses to broad regional lowering of the earth's surface. The causes (mostly due to human activities) of subsidence are as diverse as the forms of failure, and include dewatering of peat or organic soils, dissolution in limestone aquifers, first-time wetting of moisture-deficient low-density soils (hydrocompaction), natural compaction, liquefaction, crustal deformation, subterranean mining, and withdrawal of fluids (ground water, petroleum, geothermal).

Subsidence Hazard Map- Riverside County Subsidence Hazard Map was prepared at a scale of 1:250,000. The accuracy of the Subsidence Hazard Map is about 1:100,000. Certain areas of Riverside County are prone to regional downwarping and rapid subsidence. Withdrawal of underground fluids, and tectonic elevation changes produced during extremely large earthquakes are most important in terms of potential causes. The map presented focused on land subsidence (see above) initiated exclusively by the withdrawal of ground water from alluvial valleys.

Subsidence Report Zone-- An area or region based on natural hydrologic and political boundaries created in 1991 in the Murrieta area, as a result of ground cracking at the California Oaks project. This cracking was determined to be a result of a rising ground water table, rather than a falling ground water table. Shlemon and Hakakian (1992) attribute the cracking at California Oaks to be the result of saturation of collapsible alluvium that was left in-place beneath the affected homes. Shortly after creation of this zone, the area was adopted into the city of Murrieta and continues to be enforced by the city.

Subsurface Geology- Geology and correlation of rock formations, stratigraphy and structures, and other features beneath the land or seafloor surface as revealed or inferred by exploratory drilling, underground workings, and geophysical evidence.

Subterranean- Formed or occurring beneath the Earth's surface, or situated in the Earth.

Superstructure (tect) The upper structural layer in an orogenic belt (linear region that has been subjected to folding and other deformation during the interval of time of their formative stages with most later becoming mountain belts), subjected to relatively shallow or near-surface deformational processes, in contrast to an underlying and more complexly deformed and metamorphosed infrastructure. Also spelled suprastructure.

Surface Rupture- Same as ground rupture; Displacement of the earth's surface as a result of fault movement associated with an earthquake; Movement on a fault deep within the earth breaks through to the surface that almost always follows preexisting faults which are zones of weakness.

Surficial Deposits/Materials- Unconsolidated and residua (developed in place) alluvial, or glacial deposits lying on bedrock or occurring on or near the earth's surface; It is generally unstratified and represents the most recent of geologic deposits.

Susceptible Types- Pursuant to the Seismic Hazard Mapping Act (SHMA) the Division of Mines and Geology (CDMG) is directed to provide local governments with seismic hazard zone maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures include:

- Susceptible liquefaction during historic earthquakes: Areas of uncompacted fills containing liquefaction susceptible material that are saturated, nearly saturated, or may be expected to become saturated; Areas where sufficient existing geotechnical data and analyses indicate that the soils are potentially liquefiable; Areas containing young (less than 15,000 years) soils where there is limited or no geotechnical data that include generally granual sediments Ground water depth is based on the historic high measurement at < 30 feet in depth.

- Structures susceptible to damage during an earthquake, including pre-cast tilt-up concrete buildings, soft-story structures, unreinforced concrete buildings, as well as pre-1952 single-family structures. Other potentially hazardous buildings include irregular-shaped structures and mobile homes.

- Areas most susceptible to rockfall are located below steep, resistant outcrops of relatively well-cemented materials. Such materials can underlie mountain ranges.

- Fine-grained sedimentary rocks are susceptible to mud-flows or debris flows, especially during exceptionally high rainfall periods. The areas most susceptible to debris flows include: Canyon bottoms, stream channels, areas near the outlets of canyons or channels, roadcuts and other altered or excavated areas of slopes, and areas where surface runoff is channeled, such as along roadways and below culverts

- The regions in Riverside County that may be susceptible to subsidence include all the alluvial valley regions, esp. the Elsinore trough, including the communities of Temecula and Murrieta., the San Jacinto Valley from the community of Hemet to Moreno Valley, and the southern Coachella Valley. These valleys contain generally unconsolidated sand and silty sand with interbeds of silt and clayey silt. Fine grained alluvium and organic matter is often encountered underlying the fissure areas (Kupferman, 1995).

- The loss of ground-surface cover, and the chemical transformation of burned soils make watersheds more susceptible to erosion from rainstorms, and impairs water quality.

Suspension- A mode of sediment transport in which the upward currents in eddies (circular motion with a different direction form that of the main current) of turbulent flow are capable of supporting the weight of undissolved sediment particles and keeping them indefinitely held in the body of the surrounding fluid (such as silt in water or dust in air); The state of a substance in such a mode of transport; also the substance itself.

Swale- A slight depression, sometimes swampy, in the midst of generally level land; A shallow depression in an undulating ground moraine due to uneven glacial deposition; A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline.

S wave- That type of seismic body wave which is propagated by a shearing motion of material, so that there is oscillation perpendicular to the direction of propagation. It does not travel through liquids, or through the outer core of the Earth. Its speed is 3.0-4.0 km/sec in the crust and 4.4-4.6 km/sec in the upper mantle. The S stands for secondary; it is so named because it arrives later than the P wave.

System- (geol) A group of related features, objects, or forces; e.g. a fault system, drainage system, or a mountain system.

Talus- Coarse angular detrital material accumulation of loose rock fragments composing a steep, concave slope esp. at the base of a cliff or steep slope with a constant angle of repose close to 35°.

TDR- Transfer of Development Right.

Tectonic- Said of or pertaining to the forces involved in, or the resulting structures or features of tectonics. The process of active faults, earthquakes, and how they shape the geomorphology and structure of the earth

Tensile Stress- A normal stress that tends to cause separation across the plane on which it acts.

Terrain (terrane) An obsolescent term applied to a rock or group of rocks and to the area in which it outcrops .The term is used in a general sense and does not necessarily imply a specific rock unit or group or rock units.

Tertiary Period- The earliest Period of the Cenzoic Era. Encompasses the time interval of 1.6 million years ago through today.

Threat- Anything holding a possible source of danger.

Threshold- Beginning; the point at which a process or effect commences.

Threshold Velocity- The minimum velocity at which wind or water, in a given place and under specified conditions, will begin to move particles of soil, sand, or other material.

Thrust Fault- A fault with a dip of 45° or less in which the hanging wall appears to have moved upward relative to the footwall. Horizontal compression rather than vertical displacement is its characteristic feature.

Tilt-up- A poured concrete-and-steel reinforced wall raised or lifted into place and tied to other walls, and the roof and floor

Tip Resistance- (qc) May be used as a basis for evaluation of liquefaction resistance by direct empirical comparison between qc-values to "equivalent" SPT resistance and use of correlation between (N1) 60 data and case histories of seismic performance (Robertson, et al., 1985; Seed and De Alba, 1986).

TLMA- Transportation and Land Management Agency.

Topographic Map- A map on a sufficiently large scale showing, in detail, selected man-made and natural features of a part of a land surface, including its relief (generally by means of contour lines) and certain physical and cultural features (vegetation, roads, drainage, etc.). Its distinguishing characteristic is the portrayal of the position (horizontal and vertical), relation, size, shape, and elevation of the features of the area. Topographic maps are frequently used as base maps.

Topography- The general configuration of a land surface or any part of the earth's surface, including its relief (shape, configuration considered with reference to variations of height and slope to irregularities of the land surface) and the position of its natural and man-made features; The natural or physical surface features of a region, considered collectively as to form; the features revealed by the contour lines of a map.

Torsion- The state of stress produced by two force couples of opposite moment acting in different but parallel planes about a common axis.

Total Freeboard- The vertical distance in feet and meters from the dam crest to the lowest point of the spillway control section (excluding flashboards and gates).

Toxic Chemical Releases- Harmful, deadly, or poisonous hazardous material agents circulating.

Transfer of Development Right (TDR)- A similar concept that extends the transfer incentive beyond property boundaries. This procedure consists of the allowance by the County of the transfer of unused densities from a "donor" site to a designated "receiver" site. The unused increment of building bulk from the donor site is added to allowable maximum bulk on the receiver site through County review of the transfer. The financial incentives include proceeds from purchase of the unused increment gained by the owner of the donor site, and the increased value of the project on the receiver site gained by the developer. The purchase transaction can be entirely private, regulated or public.

Transform Fault- A strike slip fault characteristic of mid-oceanic ridges and along which the ridges are offset. Analysis of transform faults is based on the concept of sea-floor spreading .

Transport- (sed) Sediment transport or mass transport B the movement and carrying away of sediment by natural agents; esp. the conveyance of a stream load by suspension, saltation, solution, or traction.

Transportation and Land Management Agency (TLMA)- Is responsible for the County's Land Management System (LMS) and the Geographic Information System (GIS). The Transportation and Land Management Agency consists of three departments: Building & Safety, Planning and Transportation.

Transportation System Management Program (TSMP)- A program designed to facilitate the flow of traffic on an existing street system by improving roadways, signalization and the traffic management procedures.

Transverse Ranges- Geomorphic block is characterized by east-west trending mountain ranges and includes the easternmost San Bernardino Mountains located in the north-central portion of the County. The name "Transverse" is derived from the east-west fabric, rather than the more common northwesterly trend in California that is associated with the boundary of the North American and Pacific plates.

Trench (fault investigation) Any long, narrow cut or excavation to look at soil stratigraphy .

Trenching Investigation- A paleoseismic approach to determine deposition, erosion, displacement deformation, and geometry of strata within a trench(es) to interpret fault history for an area.

Trench Plate Boundary- Subduction of one crustal plate under or descending beneath another at line of convergence.

Trend- Direction or bearing of a geologic feature.

TriNet Maps- Maps generated by actual instrumental recordings following a major earthquake. This near-real-time potential of loss estimating can provide County officials and emergency managers with accurate damage patterns and projections for distribution of resources in a timely manner.

Trough- (geomorph) Any long and narrow depression in the earth's surface, such as one between hills or with no surface outlet for drainage; esp. a broad, elongated, U-shaped valley, such as a glacial trough or a trench; The channel in which a stream flows. (marine geol) An elongate depression of the sea floor that is wider and shallower than a trench, with less steeply dipping sides. Troughs and trenches are gradational forms; a trough may develop from a trench by becoming filled with sediment. (fault) Graben.

TSMP- Transportation System Management Program.

Tsunami- A gravitational sea wave produced by any large-scale, short-duration disturbance of the ocean floor, principally by a shallow submarine earthquake, but also by submarine earth movement, subsidence, or volcanic eruption, characterized by great speed of propagation (up to 950 km/hr), long wavelength (up to 200 km), long period (varying from 5 min to a few hours), and low observable amplitude on the open sea although it may pile up to great heights (30 m or more) and cause considerable damage on sands of kilometers from the source.

Tsunami Runup- The height of the tsunami wave as it crosses mean low-low water (MMLW) at shoreline.

Type A- Type A faults are active and capable of producing large magnitude events. The Type A slip rate (>5 mm/yr) and magnitude (Mw 7.0 or greater) is common only to faults near boundaries of tectonic plates (Pacific and North American), and is approximate to the rate at which a human fingernail grows. Most segments of the San Andreas, associated faults and most of the San Jacinto faults are classified as Type A, including those in the County of Riverside.

Type B- Type B sources include most of the active faults in California and include all faults that are neither Type A nor C.

Type C- Type C Seismic sources are considered to be sufficiently inactive and not capable of producing large magnitude events such that potential ground shaking effects can be ignored. Type B sources include most of the active faults in California and include all faults that are neither Type A nor C.

UBC- Uniform Building Code.

UFC- Uniform Fire Code.

UBC Source Zone Classification- Classification of seismic sources based on slip rate and maximum magnitude potential. These parameters are used in the classification of three seismic source types A, B and C (Type A: Faults that are capable of producing large magnitude events and which have a high rate of seismicity. Maximum Moment Magnitude (M) > 7.0 and Slip Rate (SR mm/yr) > 5; Type B: All faults other than Types A and C; Type C: Faults which are not capable of producing large magnitude earthquakes and which have a relatively low rate of seismic activity M < 6.5 and SR < 2).

Unconsolidated Sediments- A deposit that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth.

Undergrowth- Low-growing plants, saplings, and shrubs beneath trees in a forest.

Uniform Building Code (UBC)- Building code enforcement. Building and Safety adopted the 1997 UBC in July 1999. The first change was a revision to soil types and amplification factors, and the second change was the incorporation of the proximity of earthquake sources in UBC seismic zone 4.

Uniform Fire Code (UFC)- Fire and building code enforcement. Relevant fire safety code standards and programs requires that buildings or structures more than three stories or 30 feet in height, or more than 15,000 square feet shall be provided with an approved fully automatic sprinkler system and new construction requirements for Class B roofing materials

Unreinforced Masonry Building (URM)- Unless the URM buildings have been appropriately reinforced and strengthened, an earthquake may cause irreparable damage, and even collapse of some URMs, with the resultant threat to human life and property. Deterioration of the mortar (often of lime and sand with little or no cement, having very little shear strength , and of the wood framing as a result of weather exposure may also contribute to the weakening and poor performance of these structures during an earthquake.

USFS- U.S. Forest Service.

USGS -United States Geological Survey.

URM- Unreinforced Masonry Building.

Uplift- A structurally high area in the crust, produced by positive movements that raise or upthrust the rocks, as in a dome or arch.

URRNSF- Urban Regional Research for the Natural Science Foundation.

USGS Quadrangle Maps- A map of a quadrangle, the size being given in minutes or degrees; e.g. a 7.5 minute quadrangle map (scale: 1/24,000) having dimensions of 7.5 minutes in both latitude and longitude, the bounding parallels of latitude and meridians of longitude being integral multiples of 7.5 minutes. The U.S. Geological Survey has also published 15-minute (scale: 1/62,500) and 30-minute (scale: 1/125,000) quadrangle maps.

U.S. Department of Agriculture State Soil Geographic (STATSGO)- data base captured as 1:250,000 scale USGS topographic quadrangle units. STATSGO included a soils map of the state of California that was refined for Riverside County. These data included a classification of the soil within each polygon for wind erodibility. This wind erodibility number was used to assign each polygon a WER (Wind Erodibility Rating).

Valley- (geomorph) Any low-lying land bordered by higher ground; esp. an elongate, relatively large, gently sloping depression of the earth's surface, commonly situated between two mountains or between ranges of hills or mountains, and often containing a stream with an outlet. It is usually developed by stream erosion, but may be formed by faulting; A broad area of generally flat land extending inland for a considerable distance, drained or watered by a large river and its tributaries; A river basin.

Vegetation- Plant or plant life which grow from the soil.

Vegetation Management- Weed abatement using mechanical treatments and prescribed fires to keep risk from major disastrous wildfires low.

Velocity- A vector quantity, the magnitude of which is a body's speed and the direction of which is the body's direction of motion; Distance traveled in a specified amount of time. (seismic velocity) The rate of propagation of an elastic wave, usually measured in km/sec. The wave velocity depends upon the type of wave, as well as the elastic properties and density of the Earth material, which it travels.

Veneer- A covering layer of material for walls, which is attached to the wall, but not bounded adequately so as to act with it during earthquake shaking.

Very High Fire Hazard Severity Zones (VHFHSZ)- Utilizes consistent statewide criteria and on the severity of fire hazard that is expected to prevail in areas. VHFHSZ are based on fuel loading, slope, fire weather, dwelling density and other relevant factors; and as the foundation for the system, and added additional mitigation factors both plus and minus to adjust the score upward or downward. The basic system had a four-point minimum score with a thirteen-point maximum. Potentially, the range of scores (including the mitigating factors) could range from a low of 1 to a high of 16, but to qualify as a Very High Fire Hazard Severity Zone (VHFHSZ), an area had to score 10 or more points. (see definitions for fuel loading, slope, fire weather, dwelling density, and mitigation)

VHFHSZ - Very High Fire Hazard Severity Zones.

Volume- The size or extent of any three dimensional object or region of space.

Wash- (stream) A term applied in the western U.S. (esp. in the arid and semiarid regions of the SW) to the broad, shallow, gravelly or stony, normally dry bed of an intermittent stream, often situated at the bottom of a canyon; it is occasionally filled by a torrent of water. (sed) Loose or eroded surface material (such as gravel, sand, silt) collected, transported, and deposited by running water, as on the lower slopes of a mountain range esp. coarse alluvium. A fan-shaped deposit, as an alluvial fan or an alluvial cone, or a mound of detritus below a cliff opening.

Watershed- A topographically defined region draining into a particular water course. The usage of the term, esp. in the U.S. and by several international agencies, has been changed to signify the region drained by, or contributing water to, a stream, lake, or other body of water.

Watershed Management- Administration and regulation of the aggregate resources of a drainage basin for the production of water and the control of erosion, streamflow, and floods. Also includes the operational functions.

Water table- The upper surface of ground water saturation of pores and fractures in rock or surficial earth materials .

Weathering- All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well (water) An artificial excavation (pit, hole, tunnel), generally cylindrical in form and often walled in, sunk (drilled, dug, driven, bored, or jetted) into the ground to such a depth as to penetrate water-yielding rock or soil and to allow the water to flow or to be pumped to the surface; A term originally applied to a natural spring or to a pool formed by or fed from a spring; esp. a mineral spring. (oil) A borehole or shaft sunk into the ground for the purpose of introducing water or gas under pressure into an underground formation.

Wetland- A lowland area, such as a marsh or swamp, that is saturated with moisture, especially when thought of as the natural habitat of wildlife.

WER -Wind Erodibility Ratio.

WGCEP- Working Group on California Earthquake Probabilities.

Wildland- Uncultivated land, or land that is unfit for cultivation; e.g. a wasteland or a desert.

Wildland Fire Area- Suburban or rural areas that contain uncultivated lands, timber, range, watershed, brush or grasslands. This includes areas where there is a mingling of developed and undeveloped lands. (see definitions for uncultivated lands, range, wathershed, and grassland).

Wildland Fire Aspects- Based on geographical makeup and climatic conditions. Riverside County is statistically one of the most active wildland fire (see below) counties in the state.

Wildland Fires- Also called chaparral or bush, are a result of the indigenous (native) vegetation in the mountain and foothill areas of southern California. This vegetation typically has a very high oil content that makes them a high fire danger.

Wildland/Urban Interface- An area or zone where structures meet or intermingle with wildland fuels with a set of conditions where structures and/or other improvements are reasonably within the reach of an escaped prescribed fire. This determination must include the factors of fuel type, fire behavior prescription, topography and containment opportunities.

Williamson Act- Geared to agricultural land preservation requiring a mandatory ten-year contract, subject to annual notice of non-renewal provisions that then starts a phase-out of the contract over the remaining nine-year period.

Wind Erosion- Weathering-away (loosened, dissolved, worn away) of soil and rock by wind. A serious environmental problem attracting the attention of many across the globe. It is a common phenomenon occurring mostly in 1)flat, bare areas, 2)dry, sandy soils, or 3)anywhere the soil is loose, dry, and finely granulated. Wind erosion damages land and natural vegetation by removing soil from one place and depositing it in another. It causes soil loss, dryness and deterioration of soil structure, nutrient and productivity losses, air pollution, and sediment transport and deposition.

Wind Erodibility Ratio (WER)- Wind Erodibility Rating classification assigned wind erodibility numbers to polygons and used as follows:1 = Very Highly erodible 2 = High erodibility 3 = Moderate erodibility 4 = Low erodibility 5 = Water.

Wind-blown Sand- Sediment or loess deposited by wind that is vulnerable to collapse and hydroconsolidation.

Zoning- Used to implement the General Plan; Zoning normally is associated with what specific uses are allowable in an area and site specific criteria such as setbacks, building height, lot width, lot depth, etc. By law, the city must have a zoning ordinance that is consistent with the General Plan.

APPENDIX C
FAULT DATA

Fault Descriptions

This section provides a summary of current technical data and professional views pertaining to surface fault rupture hazards in Riverside County. Most of the faults in Riverside County that are considered a seismic hazard are part of the San Andreas Fault System, which is composed of a number of major fault zones. These include the Elsinore, San Jacinto, San Gorgonio Pass, and San Andreas fault zones. Where applicable, the numerous faults that are collectively grouped within a major "fault zone" are described within the section for their respective zones. In addition, there are numerous faults and smaller scale fault zones within Riverside County that are located outside of the major fault zones, which have been described separately.

The fault information below emphasizes the faults associated with the San Andreas Fault System, and starts with the faults in the west and moves eastward.

CONVERSIONS: 1 mile ~ 1.7 km; 1 inch = 2.54 millimeters.

ELSINORE FAULT ZONE

Classification (age): Historic/Active

Type of fault zone: Right-lateral strike-slip

Total Length: 250 km

Width: 1.5 to 15 km

Dip: Typically vertical- 90 degrees, except for the Whittier segment, which is a north-dipping thrust/reverse fault.

Slip Rate: ~5 mm/yr (Millman and Rockwell, 1986; Rockwell et al., 2000; Rockwell, 1990; Vaughan and Rockwell, 1986).

Recurrence Time: 240 to 760 years; average 400 years (WGCEP, 1995).

Total Displacement:
10 to 15 km (Hull, 1990; Morton and Miller, 1975; Webber, 1977; Woyski, 1998; Woyski et al., 1991)

Alquist-Priolo quadrangles:

Prado Dam, Corona South, Lake Mathews, Alberhill, Elsinore, Wildomar, Murrieta, Temecula, Pechanga, Pala.

Fault Strands:

Chino (Holocene)
Central Avenue Fault (Pre-Quaternary (?))
Fresno Fault (Holocene (?) to Late Pleistocene)
Tin Mine Fault (Holocene (?) to Late Pleistocene)
Eagle Mountain Fault (Holocene (?) to Late Pleistocene)
Joseph Canyon Fault (Pre-Quaternary)
Glen Ivy North (Holocene)
Glen Ivy South (Holocene)
Walker Fault (Late Quaternary ?)
Wildomar (Holocene)
Willard (Late Quaternary; Holocene ?)
Murrieta Hot Springs (Holocene)
Murrieta Creek (Holocene)
Wolf Valley (Holocene)
Aguanga (Late Pleistocene)
Agua Caliente (Late Pleistocene)
Lancaster/Hot Springs (age unknown; Quaternary?)
Buck Mesa (Quaternary)
Pechanga Jeep Trail (Quaternary or older)
Agua Tibia Mtn. (age unknown)

The Elsinore Fault Zone is a major northwest-trending right lateral strike-slip fault, which accommodates approximately 10 to 25 % of the plate-boundary slip in southern California (Working Group, 1995). The fault zone strikes northwestward and extends approximately 250 km from the Los Angeles basin area southeastward into northern Baja California in Mexico. Faults within the Elsinore Fault Zone, including those within Riverside County, are capable of producing events of magnitude 7 or greater. The Elsinore Fault Zone exists in the western-most portion of Riverside County for approximately 75 km along the eastern escarpment of the Santa Ana Mountains.

The Elsinore Fault Zone is divided into five segments (from north to south): Whittier, Glen Ivy, Temecula, Julian, and Coyote Mountain (WGCEP, 1995). The segments that reside in Riverside County include the southeastern end of the Whittier, the Glen Ivy, the Temecula, and the northwest end of the Julian. All of these segments are active and with the possible exceptions of the M~6 1910 Temescal Valley event on the Glen Ivy segment, the Elsinore Fault in Riverside

County has not produced a major earthquake with surface rupture during the past 200 years (WGCEP, 1995).

One historical surface rupture earthquake has occurred on the Elsinore Fault Zone within Riverside County, which was the M ~ 6.0 Temescal Valley Earthquake in 1910, which occurred in the area of the Glen Ivy faults. For more information regarding these earthquakes, visit the Southern California Earthquake Center (SCEC) on the web: http://www.scecdc.scec.org/clickmap.html

SAN JACINTO FAULT ZONE

Classification (age): Historic/Active

Type of fault: Right-lateral strike-slip

Total Length: ~230 km

Width: 0.5 to 15 km

Dip: Typically vertical (90 degrees)

Slip Rate: 10 to 12 mm/yr (Rockwell et al., 1990; Sharp, 1981).

Recurrence Time: 140 to 250 years (WGCEP, 1995).

Total Displacement: 16 to 27 km (Powell, 1993; Sharp, 1967).

Alquist Priolo quadrangles:

Sunnymead, San Bernardino South, El Casco, San Jacinto, NE 1/4 Hemet, NW 1/4 Idyllwild, SW 1/4 and SE 1/4 Idyllwild, Bucksnort Mtn., Collins Valley, Clark Lake NE, Clark Lake, Fonts Point, SW 1/4 Palm Desert, Borrego, Palm Canyon, Borrego Sink, Borrego Mountain, Shell Reef, Borrego Mountain SE, Harpers Well.

Fault Strands:

Claremont (Holocene)
Casa Loma & Park Hill (Holocene)
Clark (Holocene)
Hot Springs (Late Quaternary; Holocene)
Thomas Mountain (Holocene)
Buck Ridge (Late Quaternary)

Coyote Creek (Holocene)
Potrero (Quaternary)
Mt. Eden (Quaternary)
Toro Peak (Late Quaternary)
Lost Valley (Pre-Quaternary); located west of SJFZ.
Terwilliger Valley (Quaternary ?); located west of SJFZ.

The northwest trending San Jacinto Fault Zone accommodates between 15 to 25% of the strike-slip motion between the Pacific and North American Plates in southern California (WGCEP, 1995). The fault zone is approximately 230 km long, strikes northwestward, and extends from the southern San Gabriel Mountains in the northwest, to northern Baja California toward the southeast. It is capable of producing earthquakes of greater than 7.0, and is exposed for approximately 100 km in Riverside County. Within Riverside County, the San Jacinto Fault Zone is located on the west side of San Timoteo Canyon, and the San Jacinto and the Santa Rosa Mountains.

The slip rate on the San Jacinto Fault Zone is estimated in the range of 10 to 12 mm/yr. This value is second only to the San Andreas Fault in southern California, which exhibits slip rates in the range of 25-37 mm/yr. To assist in putting these numbers in perspective, a slip rate of 10 mm/yr produces 10 km of offset in 1 million years. The San Jacinto Fault Zone has the highest rate of microseismicity (small earthquakes) and historic (past 200 years) earthquakes of any other fault zone in southern California.

Based on fault geometry, historical seismicity, and slip rate the Working Group on California Earthquake Probabilities (WGCEP, 1995) divided the fault zone into 5 segments. The segments, include, from north to south, the San Bernardino Valley, San Jacinto Valley, Anza, Coyote Creek, Superstition Hills, and Superstition Mountain (WGCEP, 1995). All of these segments are active, and many have produced surface rupture during the past 200 years.

Notable historical earthquakes occurring in the San Jacinto Fault Zone in Riverside County include events in1899 (M ~ 6.5) and 1918 (M ~ 6.8) that occurred near San Jacinto-Hemet, an event in 1923 (M ~ 6.3) located near southern San Bernardino Valley, an event in1937 (M ~ 6.0) near Clark Valley, and an earthquake in1980 (M = 5.5) located near Anza. For more information regarding these earthquakes, visit the Southern California Earthquake Center (SCEC) on the web: http://www.scecdc.scec.org/clickmap.html

SAN ANDREAS FAULT ZONE

Classification: Historic/Active

Type of fault: Right-lateral strike-slip

Total Length: ~1000 km

Width: 0.5 to 15 km

Dip: Typically vertical- 90 degrees, possibly 75 degrees toward the northeast in the San Gorgonio Pass region where the fault may not reach the surface.

Slip Rate:

~12 - 28 mm/yr (Harden and Matti, 1989; Keller et al., 1982; Rasmussen, 1982; Seitz, 1999; Sieh, 1986). Best estimates are likely in the range of ~25 mm/yr.

Total Displacement:

~300 km during the past 10 to 15 million years in central California. The San Andreas Fault Zone in southern California has accrued approximately 150 km of right-lateral offset during the past 4.5 to 5 million years (Powell, 1993).

Alquist-Priolo quadrangles:

SE 1/4 Morongo Valley, Desert Hot Springs, Seven Palms Valley, NE 1/4 Thousand Palms, Cathedral City, Myoma, SW 1/4 Lost Horse Mtn., Indio, Thermal Canyon, Mecca, Mortmar, Orocopia Canyon, Salton, Durmid, Frink NW.

Fault strands:

Garnet Hill (late Quaternary, possibly Holocene)
South Branch or Banning Fault (Holocene)
North Branch or Mission Creek Fault (Holocene)
Indio/Coachella Valley segment (Holocene)
Indio Hills (Holocene)
Hidden Springs (Late Quaternary)
Skeleton Canyon (Late Quaternary)
Eagle Canyon (Late Quaternary)
Platform (Late Quaternary)
Painted Canyon (Late Quaternary)
Salt Creek (Late Quaternary)
South Grotto (Late Quaternary)

North Grotto (Late Quaternary)
Dry Lake (Late Quaternary)
Sheephole (Late Quaternary)
Hot Springs (Holocene)

The northwest trending San Andreas Fault Zone (SAFZ) is over 1000 km long and extends from near Cape Mendocino in northern California, to the Salton Sea region in southern California. Like the Elsinore and San Jacinto Fault Zones, the SAFZ is a right-lateral strike-slip fault that typically dips greater than 80 degrees. The SAFZ accommodates approximately 55 - 70% of the relative motion between the North American and Pacific Plates. This fault has been mapped continuously on the surface along its entire length except for the structurally complex region near and just north of the San Gorgonio Pass Fault Zone (SGPFZ; Allen, 1957) in Riverside County. The SGPFZ trends nearly east-west and represents a series of northward dipping compressional (reverse) faults located between San Gorgonio Mountain in the San Bernardino Mountains, and the northern San Jacinto Mountains. In this region, the San Andreas Fault may connect between the southern San Bernardino and northern Coachella segments at depth beneath the north-dipping reverse faults in the SGPFZ (Allen, 1957; Seeber and Armbruster, 1995).

The SAFZ in southern California is composed of numerous segments: the Mojave segment resides north of Riverside County; however, most of the Coachella Valley segment, and the southern most portion of the San Bernardino segment exists within the county. The Coachella Valley segment comprises the southern 100 km of the SAFZ and extends from San Gorgonio Pass to the southeastern edge of the Salton Sea (WGCEP, 1995). The San Bernardino segment is located along the western escarpment of the San Bernardino Mountains and in the northwest region of the San Gorgornio Pass Fault Zone where appears to "die out" on the surface.

The WGCEP (1995) indicated that the Coachella Valley segment has experienced the longest elapsed time since its last surface rupturing earthquake of any on the fault zone, and last experienced a large event around 1680. The 1988 Working Group estimated a recurrence interval for this segment using paleoseismic records of 220 ±13 yr. Thus this section of the fault zone is considered "overdue" for another earthquake.

Notable historical earthquakes on the southern San Andreas fault include the 1948 Desert Hot Springs (M=6.0), and the 1986 North Palm Springs (M=5.6). For more information regarding these earthquakes visit the Southern California Earthquake Center (SCEC) on the web: http://www.scecdc.scec.org/clickmap.html

SAN GORGONIO PASS FAULT ZONE

Classification: Active

Type of fault: Imbricate oblique-reverse and thrust faults possibly associated with high-angle strike-slip tear faults.

Length: ~ 30 km

Width: 3 to 7 km

Dip: The reverse and thrust faults dip northward

Slip Rate: unknown

Total Displacement:

Unknown, however, displacement has been mostly vertical during the late Quaternary, and has accommodated only ~1-2 km of right lateral motion during this time (Allen, 1957).

Alquist Priolo quadrangles:

Beaumont, Cabazon, Whitewater, Desert Hot Springs

Fault strands:

San Gorgonio Pass
Banning

The San Gorgonio Pass Fault Zone (SGPFZ) is approximately 30 km long, 3-5 km wide, east-west trending, and consists of a complex series of active north-dipping thrust and reverse faults which have been active during the Pleistocene (past 11,000 years). The SGPFZ represents a series of faults that accommodate compression across the San Andreas Fault Zone due to a restraining bend in the San Gorgonio Pass region. The restraining bend is referred to as the San Gorgonio Pass Knot, and has developed during the Pleistocene. This fault zone has created new faults to accommodate the Quaternary compression associated with the San Gorgonio Pass Knot, which we refer to as the San Gorgonio Fault(s), and has reactivated the Banning Fault, which accrued at least 16-25 km of late Cenozoic right slip in the San Gorgonio Pass region (see Allen, 1957, and Matti et al. 1992). As speculated by Allen (1957), and later supported by Seeber and Armbruster (1995), the San Andreas Fault may continue at depth below the north-dipping reverse (high angle dip) and thrust (low angle dip) faults of the SGPFZ. Allen (1957) indicated that recent displacements (Late Quaternary) on the

SGPFZ have probably been largely vertical with less than 1 mile of strike-slip movement.

BEAUMONT FAULT ZONE

Matti et al. (1992) applied the name Beaumont Plain Fault Zone to a series of northwest-trending en-echelon fault scarps that traverse late Quaternary alluvial deposits in the vicinity of Beaumont. They indicate that most of the scarps face northwest that they appear to have formed by normal dip-slip displacements. The fault zone is approximately 11 km long, 3 km wide, and consists of approximately 3 to 4 sub-faults.

FAULTS IN THE SOUTHWESTERN MOJAVE DESERT

Late Cenozoic faults east of the San Andreas Fault in eastern Riverside County principally fall into two types: North to north-northwest trending high angle right lateral strike-slip, and east-west trending high angle left lateral.

The north to north-northwest trending high angle strike-slip faults consist of the Long Canyon, Burnt Mountain and Eureka Peak Faults, which are active (Holocene), and the Coxcomb Mountain, Sheep Hole, Palen Mountain, Iron Mountain, Little Maria Mountain Faults which are possibly Pliocene to Pleistocene in age. These faults are discussed below.

The east-west trending left lateral faults in this region very in activity, with the youngest unit's offset representing older alluvial units of Pleistocene age. Thus, these faults pose little seismic hazard to the sparse population in the region, however few specific studies for each of these faults have been conducted. The most active of these faults is the Blue Cut Fault.

These faults are discussed below:

LONG CANYON, BURNT MOUNTAIN, EUREKA PEAK FAULTS

The northern sections of the Burnt Mountain and Eureka Peak Faults were associated with the 1992 Landers earthquake (Historic; Jennings, 1994; Treiman, 1992). These faults pose a seismic threat to the communities of Yucca Valley and as far south as Desert Hot Springs.

Long Canyon: The long Canyon Fault is a north trending, high angle, right lateral strike-slip fault which is approximately 11 km long and located just north of the

North Branch of the San Andreas Fault east of Desert Hot Springs. Jennings (1994) indicates that this fault has been active in the Holocene (Active; referenced work done by Mark Rymer, 1993).

Burnt Mountain: This fault is a north trending, high angle, right lateral strike-slip fault. As delineated by ground rupture during the 1992 Landers Earthquake in Yucca Valley, the Burnt Mountain Fault is approximately 7 km long and extends south from State Highway 62. The fault probably continues southward to the southern escarpment of the Little San Bernardino Mountains just north of the San Andreas Fault. Thus, the fault may be as long as 20 km.

Eureka Peak: The Eureka Peak Fault is a north trending, high angle, right lateral strike-slip fault, and extends to the southeast from near State Highway 62 following the Lower Covington Flat Wash area along much of its trace. The Landers earthquake ruptured the ground along this fault with maximum horizontal displacements of approximately eight inches (Treiman, 1993).

SHEEP HOLE, COXCOMB MOUNTAIN, PALEN MOUNTAIN, LITTLE MARIA MOUNTAIN, GRANITE MOUNTAIN, RICE VALLEY, DRY WASH, AND BLYTHE FAULTS

Powell (1981) indicated that a series of northwest-trending right-lateral faults likely exist in the southwestern Mojave Desert in eastern Riverside County that may exhibit between 60 to 140 km of cumulative displacement, however, this number is not well resolved. These types of faults probably continue toward the northwest, north of Riverside County and terminate near the Garlock Fault in the southern Sierra Nevada Mountains.

The age and total amount of displacement across these faults is not well understood at this time, however, none appear to have had Holocene displacement. Some of these faults are discussed below.

Sheep Hole and Coxcomb Mountain: Sheep Hole and Coxcomb Mountain Faults northwest have been proposed to reside along the western flank of the Coxcomb Mountains (Hope, 1966; Powell, 1981). These faults are mostly concealed beneath valley fill and are suggested primarily based on right-laterally offset basement rock units exposed in the local ranges; however, Hope (1966) indicated that at one locality, the Sheep Hole Fault offsets an olivine basalt capped by alluvium which may be Pleistocene in age. Hope (1966) indicated that the Sheep Hole Fault [and Coxcomb Mountain Fault] probably represents a major fault break which has right-laterally offset a pendant of metasediments approximately 0.8 miles.

Palen Mountain: Powell (1981) suggested that this fault exhibits about 3 kilometers of right-lateral separation based on offset crystalline basement rocks exposed in the Palen and McCoy Mountains.

BLUE CUT, PORCUPINE WASH-SUSBSTATION, SMOKE TREE WASH-VICTORY PASS, CHIRIACO, CORN SPRINGS, SHIP CREEK, AND SALT CREEK-AZTEC MINE WASH FAULTS

Other faults that pose a seismic hazard in eastern Riverside County include a series of parallel, east-west trending, left lateral strike-slip faults, which include from north to south, the Blue Cut, Porcupine Wash-Substation, Smoke Tree Wash-Victory Pass, Chiriaco, Corn Springs, Ship Creek, and Salton Creek-Aztec Mine Wash Faults (Powell, 1981; Treiman, J.A., 1992; Treiman, J.A., 1993; Jennings, 1994). These faults are described below:

Blue Cut Fault: The Blue Cut Fault has an approximately 80 km trace stretching from the western foot of the Little San Bernardino Mountains to the eastern edge of Pinto Basin, and terminates at both ends against northwest-trending faults (Hope, 1966; Powell, 1981). Where not buried by recent alluvium, the fault zone has a marked surface expression and is typically 90-300 meters wide (Hope, 1966). At the western Little San Bernardino Mountains and Hexie Mountains, the Blue Cut Fault exhibits left-lateral separation of nearly 6 km, and a small dip-slip component (Hope, 1966; also see Powell, 1981). At the eastern end in the Pinto and Eagle Mountain region, the Blue Cut Fault exhibits ~8 km of left lateral separation (Hope, 1966). The fault terminates eastward prior to the Coxcomb Mountains because no trace of the fault occurs within the crystalline rocks of that range (Powell, 1981). Fault deformation features presented by Hope (1966), indicate that the Blue Cut Fault was active during the Pleistocene, and possibly in the Holocene depending on the upper age of deformed alluvial fans which is uncertain.

Porcupine and Substation Faults: The east-west trending Porcupine Fault exhibits approximately 3 km of left lateral separation, and some small scarps in older alluvium which indicates slight Quaternary activity (Hope, 1966; also see Powell, 1981). The Porcupine Fault may extend eastward beneath sediments and connect with the Substation Fault. This is supported by the nearly identical left-slip separation of basement rock units of 3 km (Hope, 1966; Powell, 1981), and that the two faults line up in map view. However, Powell (1981), indicates that the lithologies and contacts between the two faults are not broken, suggesting that the two faults may not align.

Smoke Tree Wash and Victory Pass Faults: The Smoke Tree Wash fault offsets crystalline rock contacts about 1 km in a left lateral sense, and has produced scarps in all but the youngest alluvium (Powell, 1981). This fault may be as long as 25 km (Powell, 1981). The Victory Pass Fault resides east of the Smoke Tree Wash Fault in the southeastern Eagle Mountains, about 4 km south of the Substation Fault (Powell, 1981). The fault left laterally offsets a quartz latite dike swarm and a trace of the early Red Cloud thrust 1.5 km (Powell, 1981). At its eastern end, the fault passes beneath the alluvium of Chuckwalla Valley; at its western end, it dies out along the north margin of Big Wash (Powell, 1981). As with the Porcupine Wash and Substation Faults, the Victory Pass and Smoke Tree Wash Faults are not continuous at the surface (Powell, 1981).

Chiriaco Fault: The east-west trending Chiriaco Fault exhibits approximately 11 km of left lateral separation and 0.5 km of vertical separation determined by offset contacts and structures in the exposed basement rocks of the surrounding hills (Powell, 1975). No surface expression of the Chiriaco Fault has been found (Powell, 1981), however, the offset of basement rock features, the linearity of the valley and its bounding escarpments, and an east-west negative Bouguer gravity anomaly at the eastern end of the valley (Biehler et al., 1964; Rotstein et al., 1976), have been interpreted to reflect the presence of a fault in the subsurface. The fault is covered by undeformed Holocene sediments (Powell, 1975). The fault truncates Eocene Maniobra and lower Miocene Diligencia formations, and is covered by Pleistocene Ocotillo conglomerate west of Chiriaco Summit (Powell, 1975). Thus, the fault has not been active during the Holocene (10,000yrs), and possibly may not have been active during the Pleistocene (1.6 Ma to 10,000 years ago; Powell, 1975, 1981).

Corn Springs Wash Faults: The Corn Springs Wash Fault exhibits 2.5 to 3.0 km of left lateral offset of several contacts and lithologies associated with the Mesozoic batholithic rocks (Powell, 1981). The western end of the fault swings northwestward to disappear beneath alluvium, after which it may either merge with the Chiriaco Fault, or swing westward to connect with a fault along the north flank of the Orocopia Mountains (Powell, 1981). Fault activity postdates three geomorphic events: a colluvial unit a meter or two thick, deposition of caliche, and fluvial down cutting to the present stream level (Powell, 1981). These data indicate that the fault is older than Holocene.

Ship Creek Fault: The Ship Creek Fault is located in the Chuckalla Mountains and left laterally offsets Precambrian and Mesozoic lithologic units and contacts approximately 2 kilometers (Powell, 1981). Alluvial material is faulted against crystalline rock at least two localities, and at its west end, fault displacement dies out in a fold which left laterally bends steeply dipping lithologic units in older

basement rocks (Powell, 1981). The east end of the fault disappears beneath alluvial material east of the Chuckwalla Mountains (1981).

Salton Creek (wash) and Aztec Mine Wash Faults: The Salton Creek Fault trends east-west and is located in the wash region south of the Orocopia Mountains and north of the northernmost Chocolate Mountains. Jennings (1994) indicates that this fault offsets Quaternary age units (< 1.6 Ma). No surface break in the alluvium has been recognized east of the Salton Creek Fault, however, a lineament visible from orbital photographs does occur (Powell, 1981).

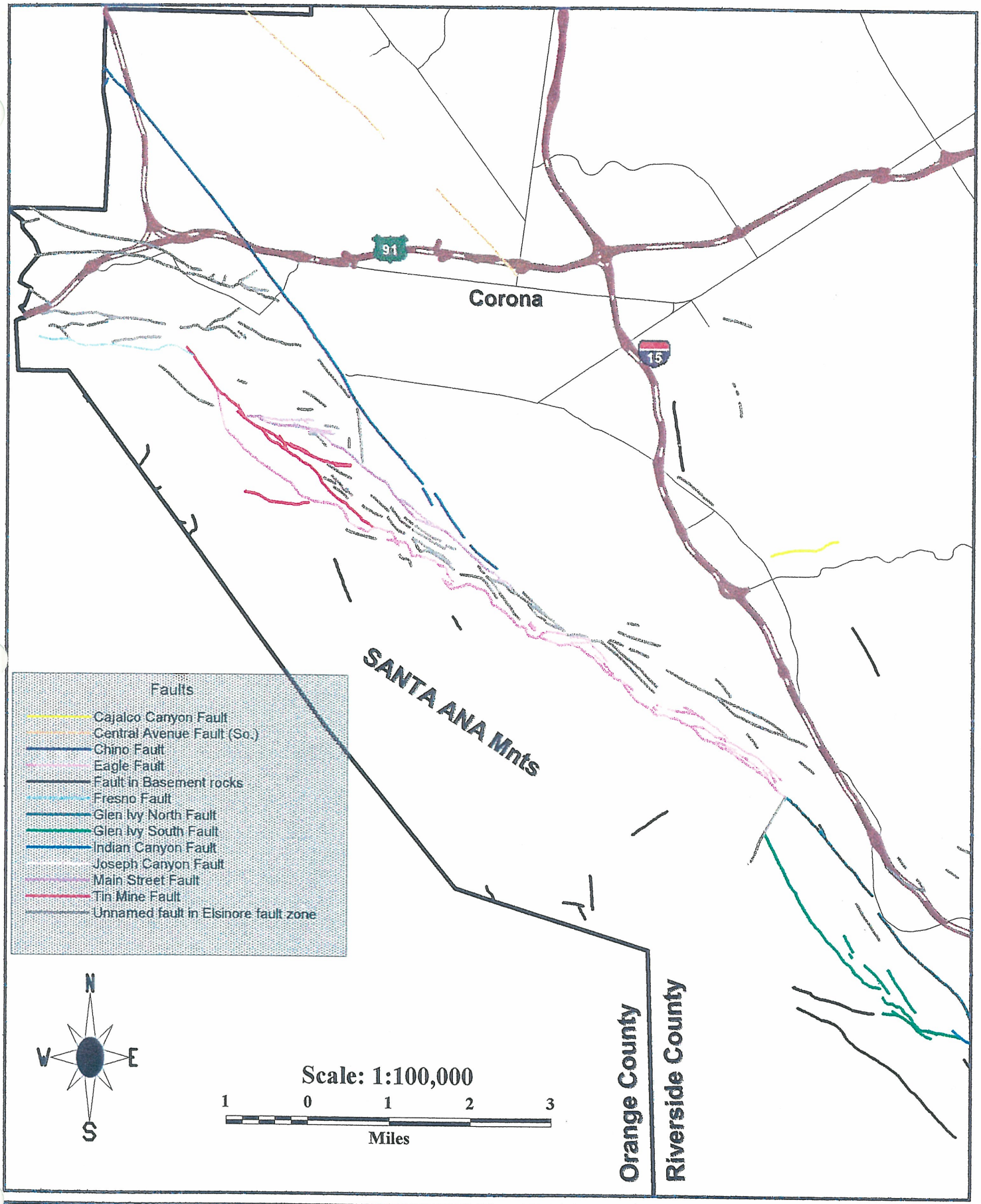
The Aztec Mine Wash Fault (Powell, 1981) is located east of the Salton Creek Fault in the southern Chuckawalla Mountains. This fault offsets an intrusive contact in crystalline basement rocks left laterally approximately 8 km (Powell, 1981). The fault also truncates lower Miocene rocks which overlie the crystalline basement (Powell, 1981). The fault does not appear to significantly offset the relatively old alluvial unit exposed at the drainage divide southeast of Gulliday Wash, and does not offset younger alluvium (Holocene ?)(Powell, 1981).

PRE-QUATERNARY "BASEMENT" FAULTS THROUGHOUT RIVERSIDE COUNTY

Quite a few Pre-Quaternary faults exist in Riverside County that are no longer active and were involved in deformation with either earlier phases of the San Andreas Fault System or tectonics that pre-date the San Andreas Fault System. These faults are not considered a fault hazard in terms of producing an earthquake, however, they may require some consideration during development of a site. For example, an onsite fault may influence issues regarding slope stability, groundwater, or clay soils within the zone of shear.

Selected faults that fall into this category include:

- Palm Canyon (South of Palm Springs).
- Deep Canyon Fault (South of Palm Springs)
- Indio Mountain (SE of Palm Desert).
- Martinez (Santa Rosa Mountains).
- Santa Rosa Shear Zone (Santa Rosa Mountains).
- Dillon (Parallel and east of San Andreas Fault).
- Clemens Well (East of Mecca Hills).
- Whipple Mountain Detachment (NE Riverside County).
- Slaughter Tree Wash (NE Riverside County)
- Orocopia Thrust/Detachment (Orocopia Mountains)
- Numerous Unnamed faults contained in older crystalline basement rocks.



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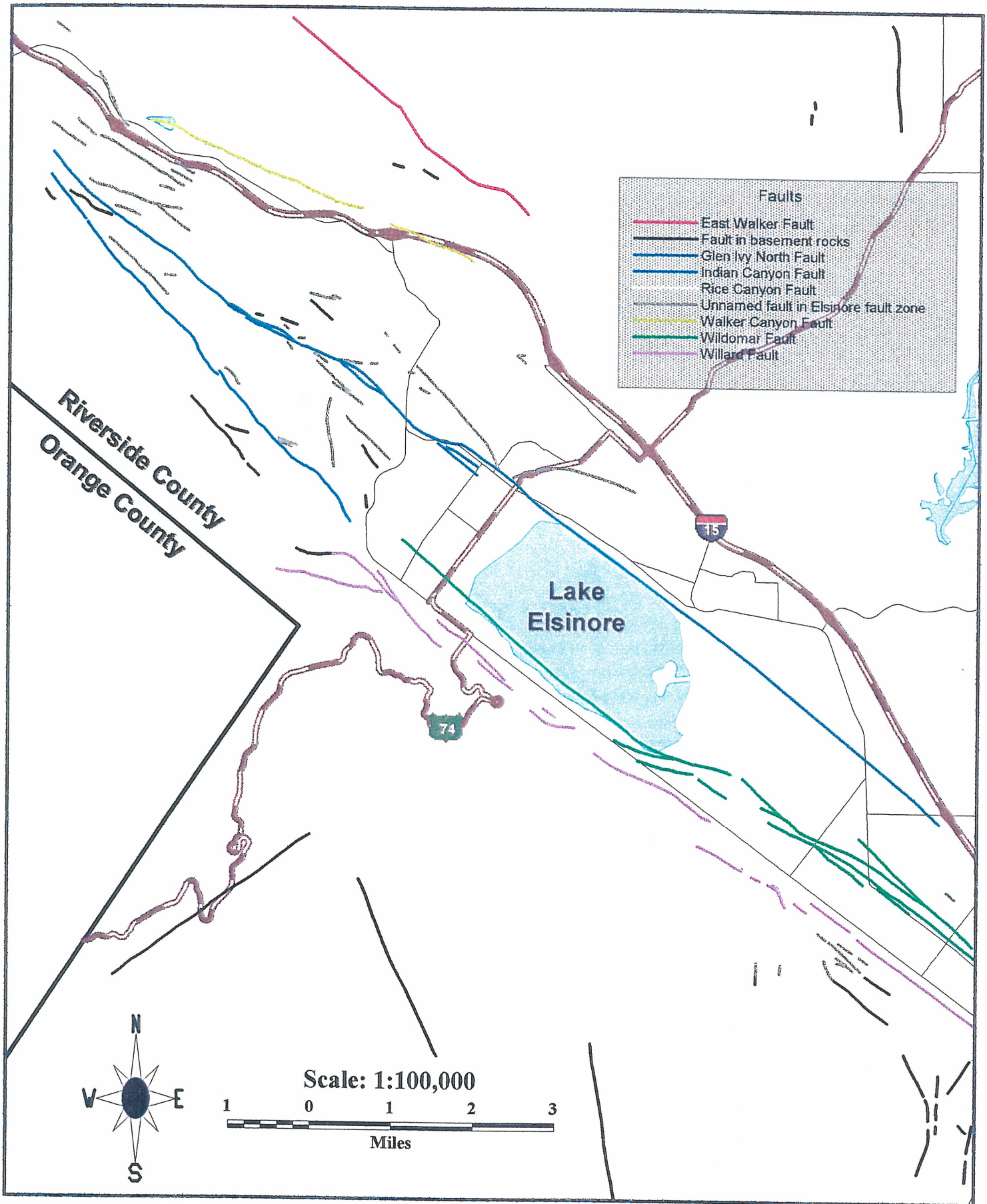
NORTHWEST ELSINORE FAULT ZONE

in Riverside County

Figure C-1

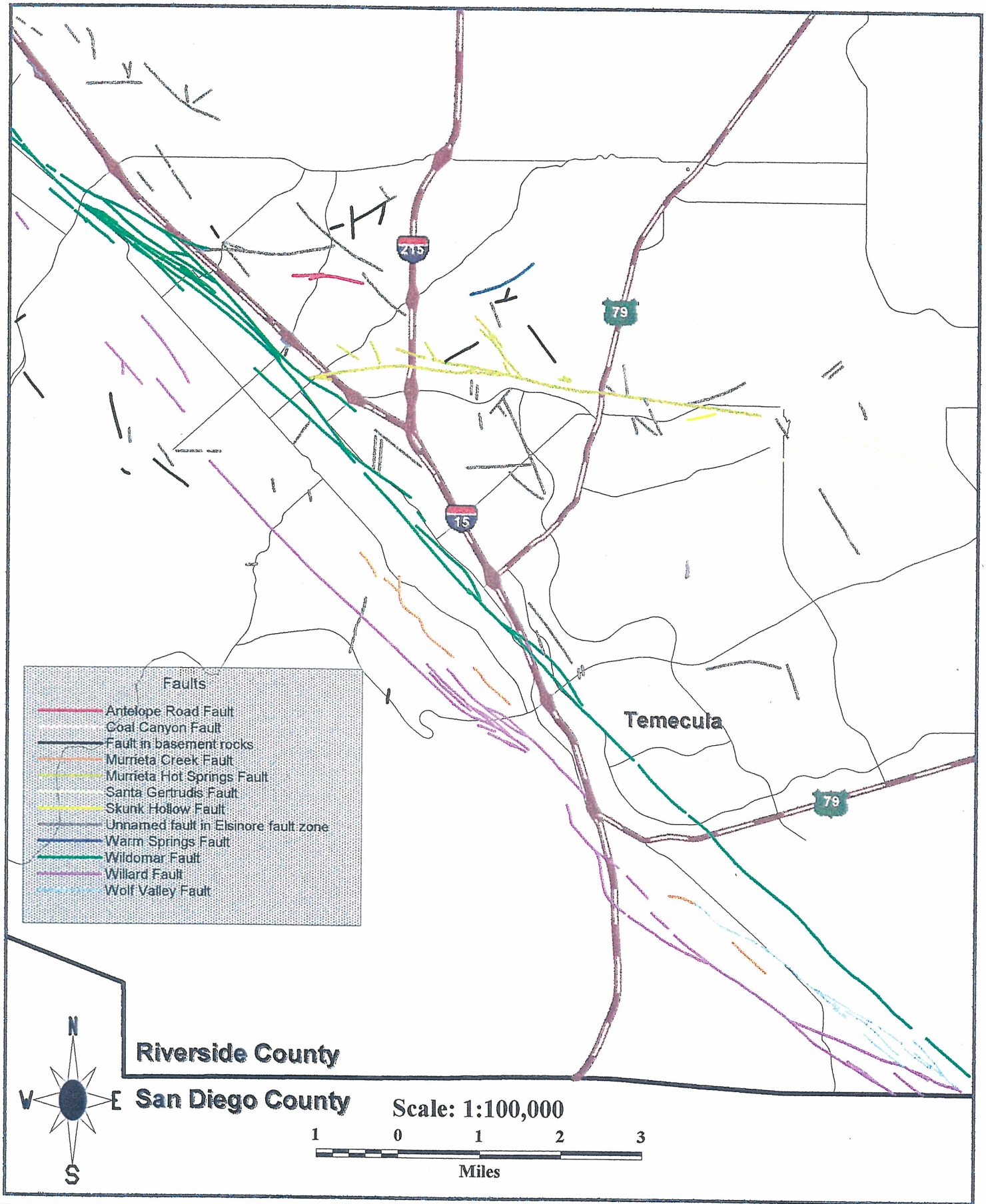


Earth Consultants International

CENTRAL ELSINORE FAULT ZONE

in Riverside County

Figure C-2



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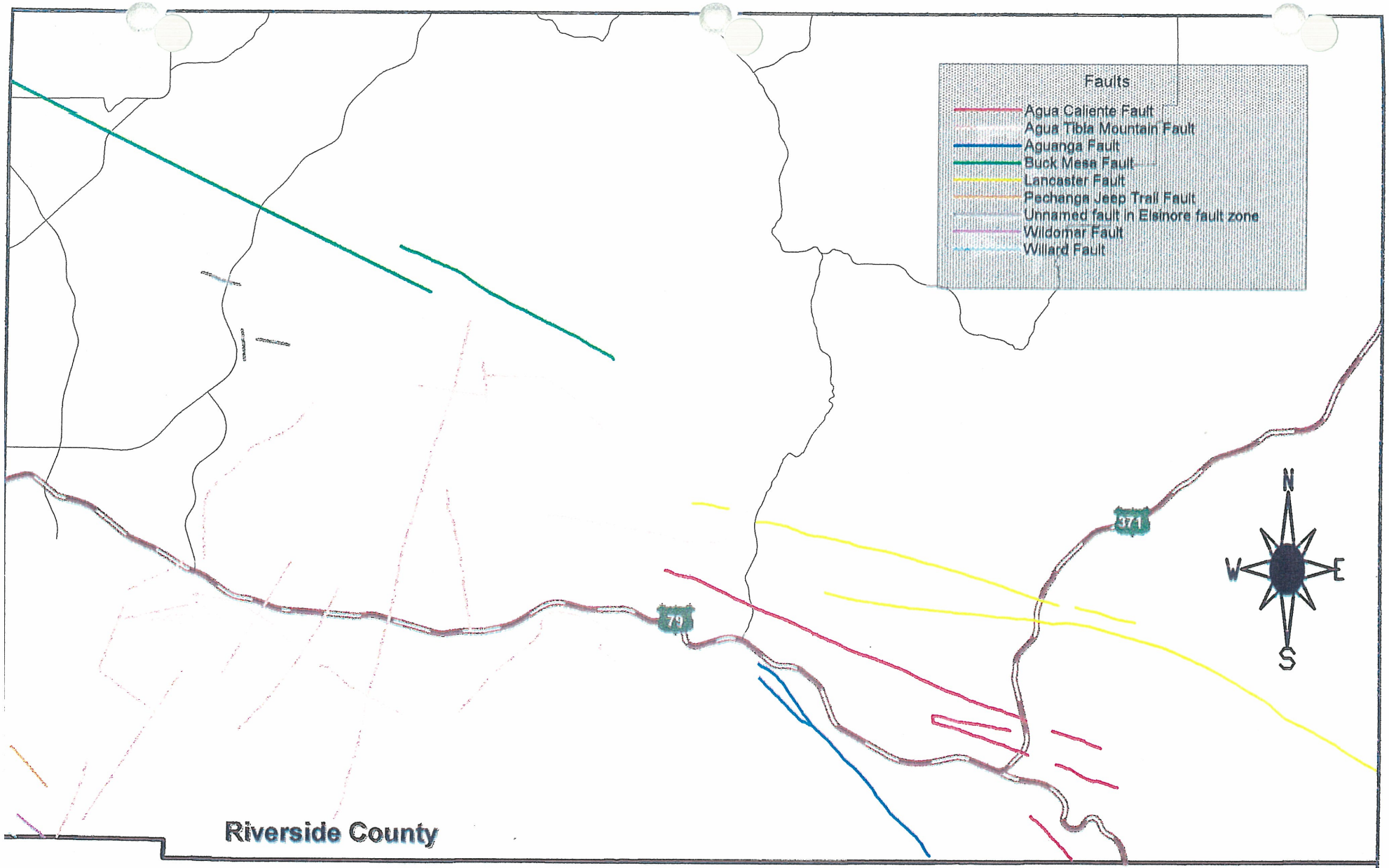
SOUTH ELSINORE FAULT ZONE
in Riverside County

Figure C-3



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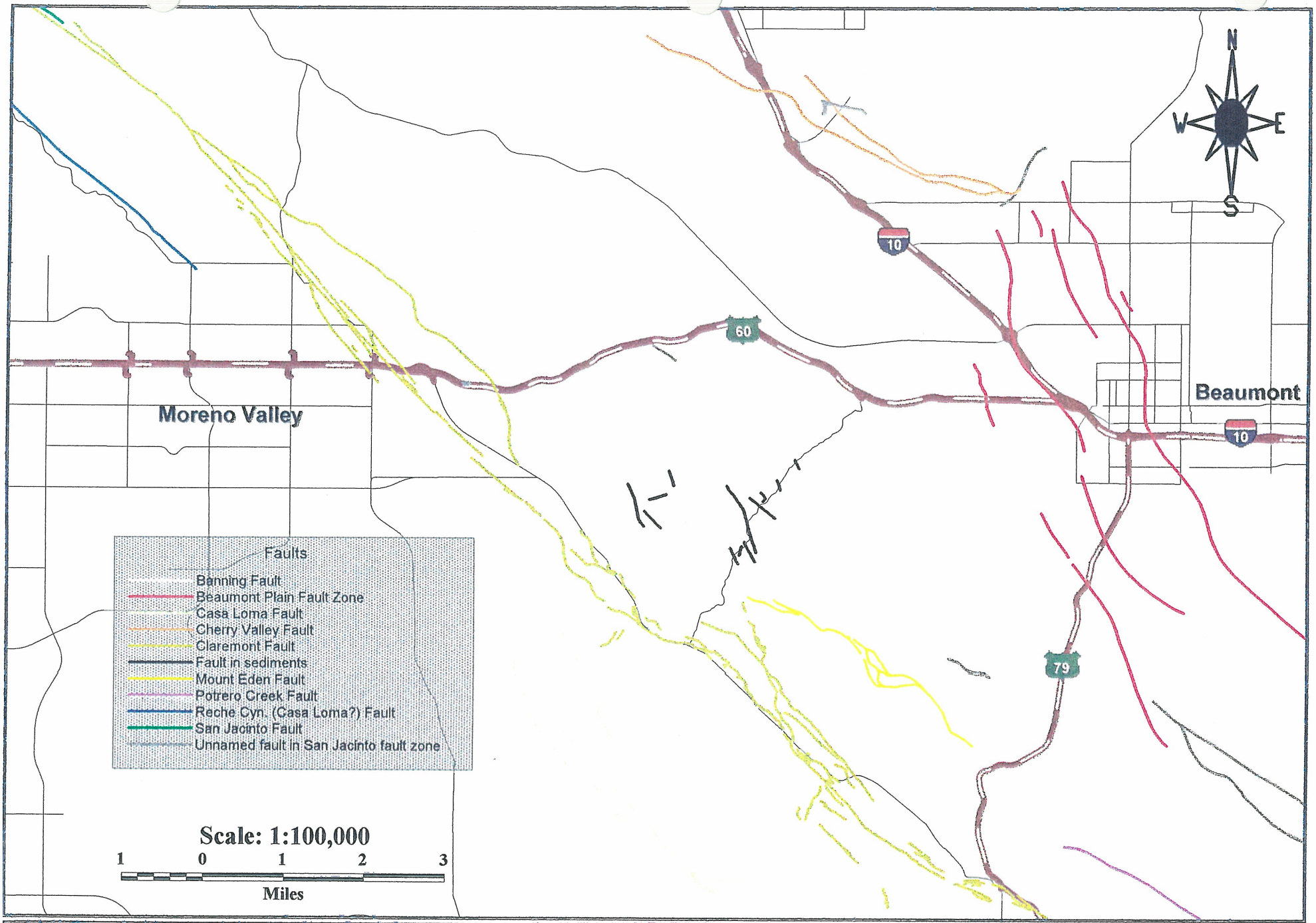
SOUTHEAST ELSINORE FAULT ZONE

in Riverside County

Figure C-4



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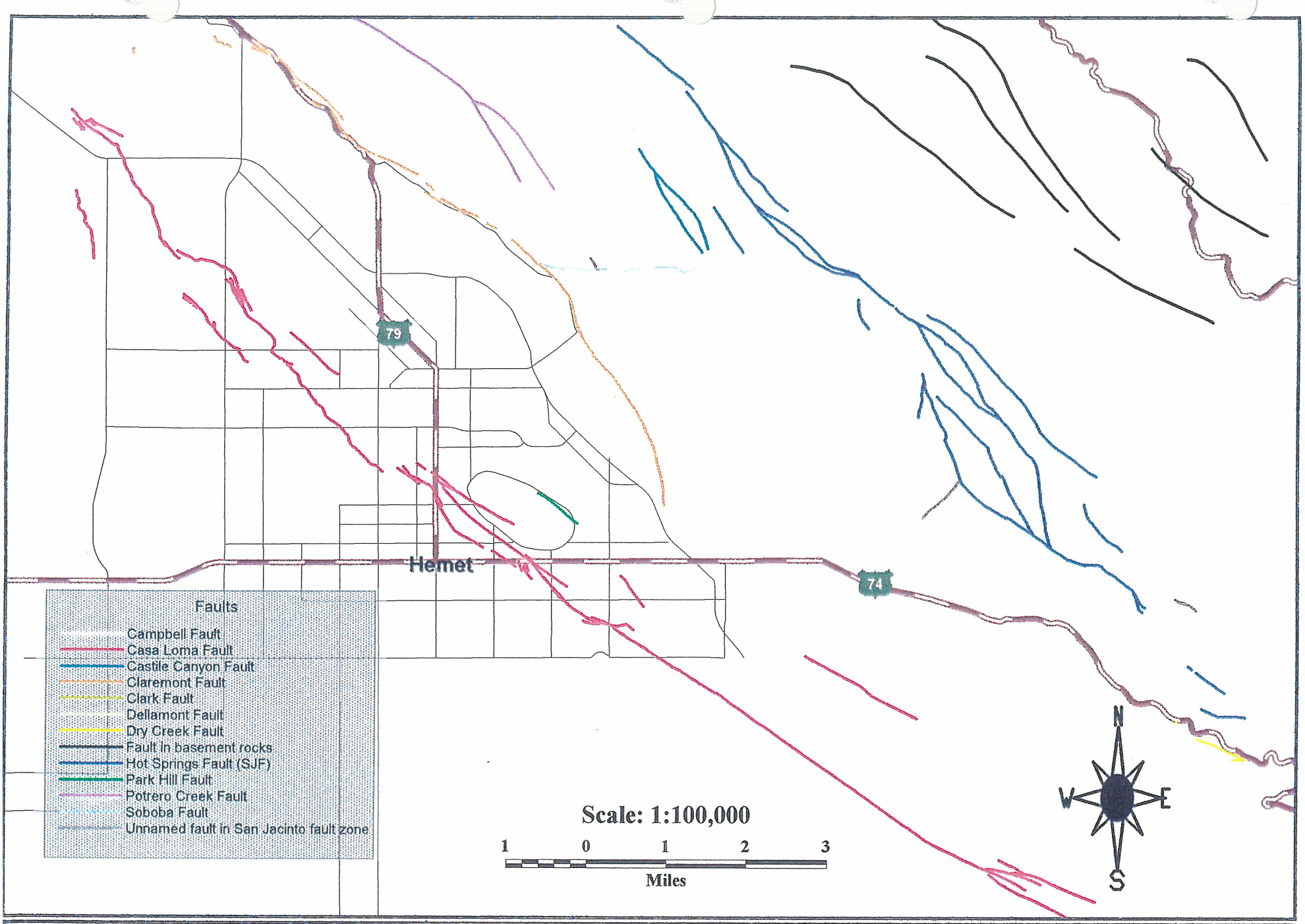
NORTHWEST SAN JACINTO FAULT ZONE

in Riverside County

Figure C-5



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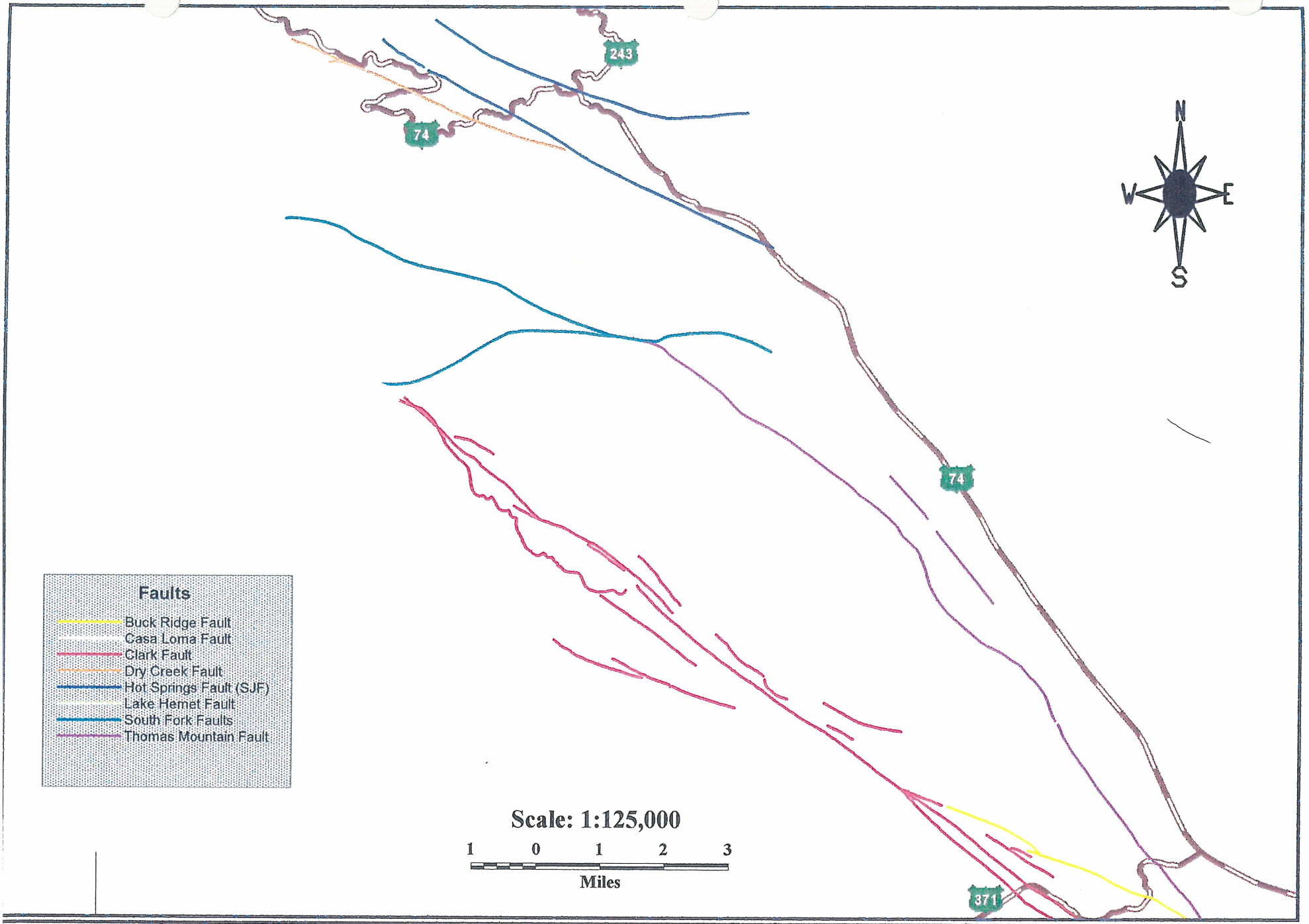
NORTH CENTRAL SAN JACINTO FAULT ZONE

in Riverside County

Figure C-6



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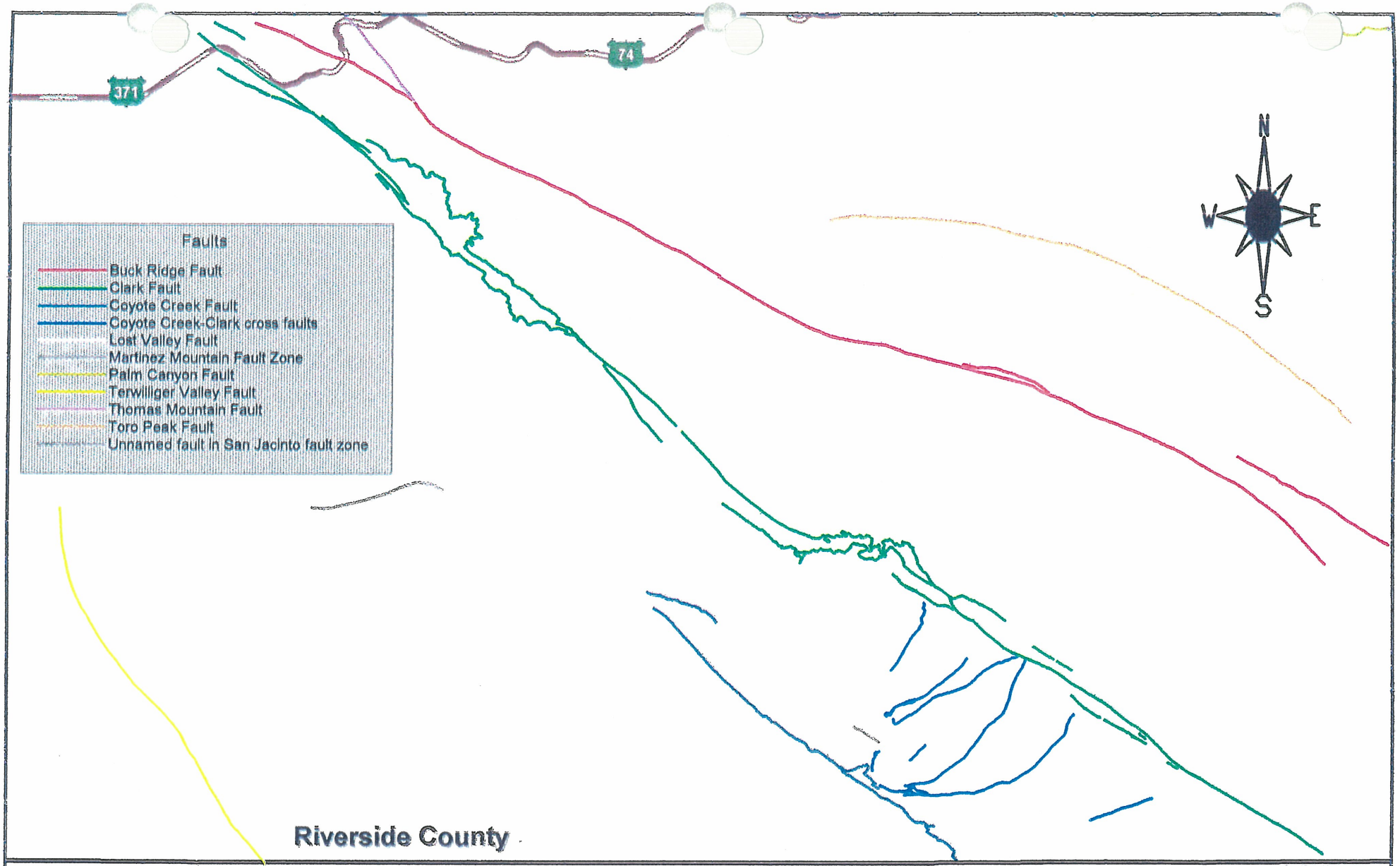
SOUTH CENTRAL SAN JACINTO FAULT ZONE
in Riverside County

Figure C-7



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1 0 1 2 3

Miles

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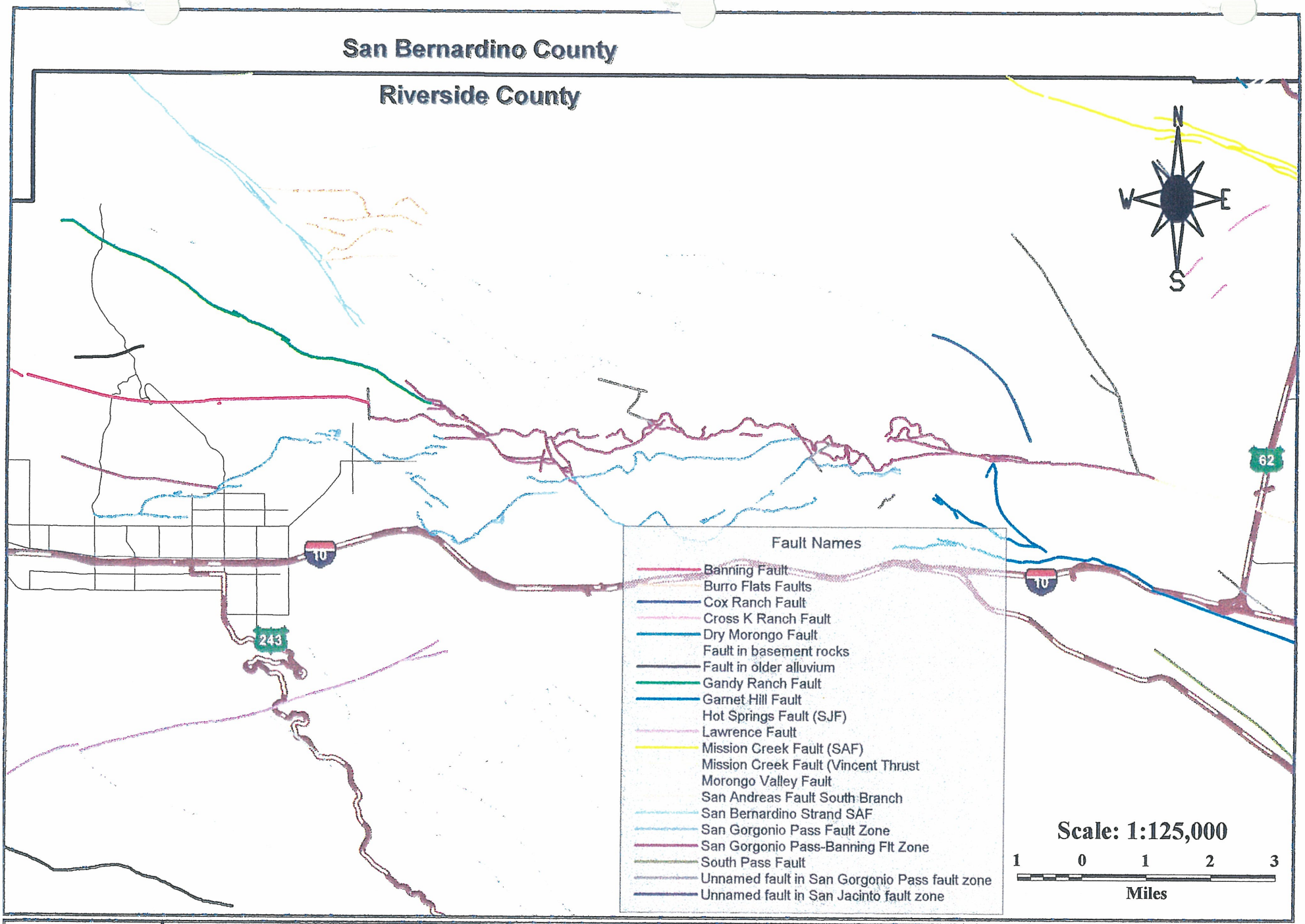
SOUTH SAN JACINTO FAULT ZONE

In Riverside County

Figure C-8



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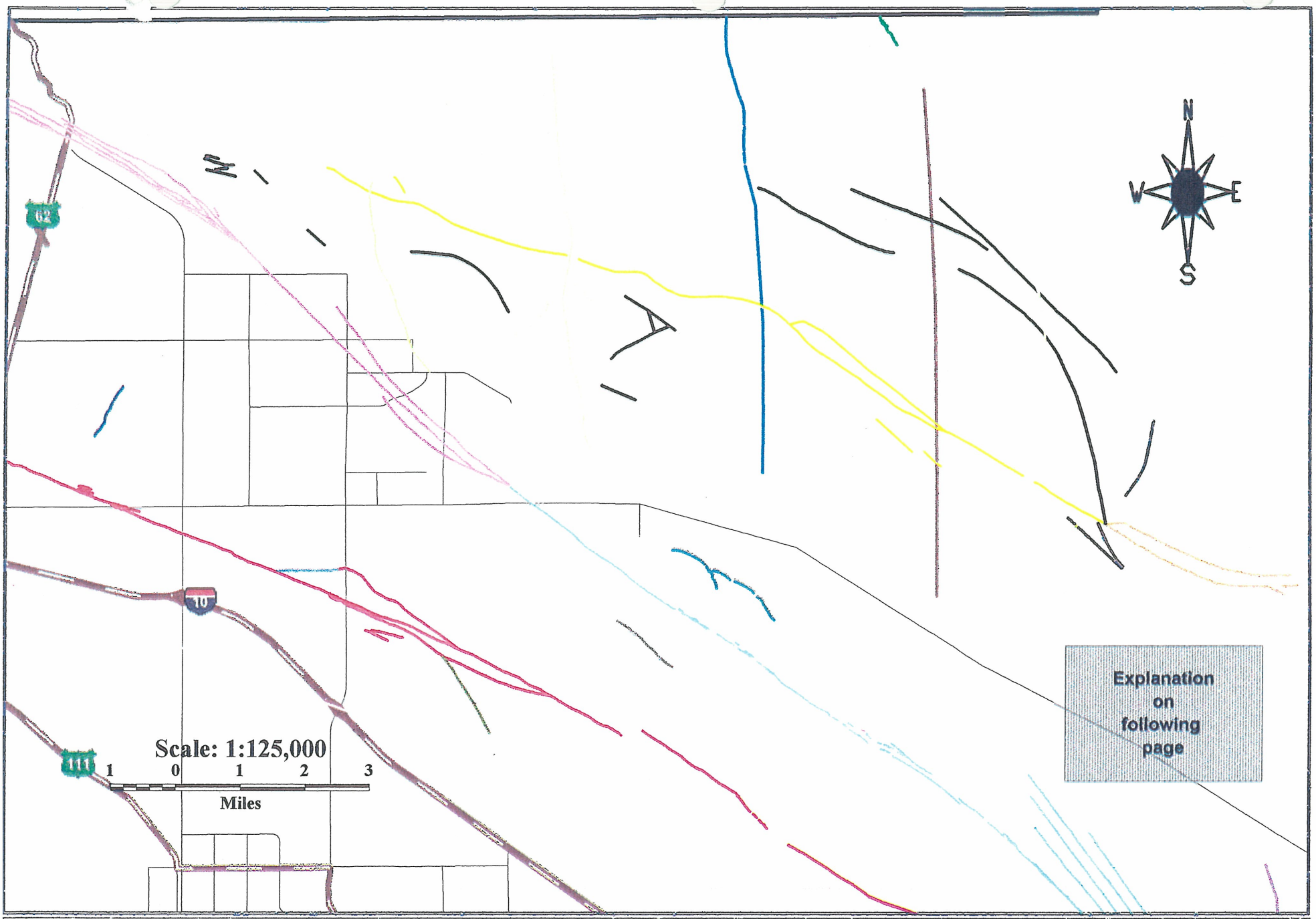
SAN GORGONIO PASS FAULT ZONE

in Riverside County

Figure C-9



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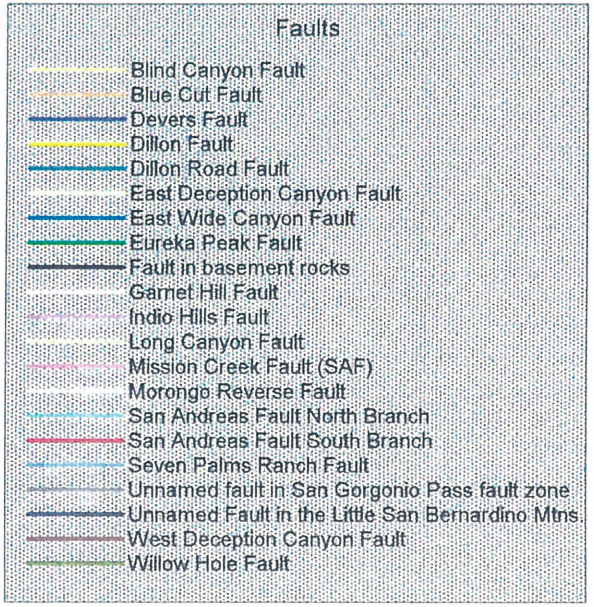
NORTHERN SAN ANDREAS FAULT ZONE
in Riverside County

Figure C-10



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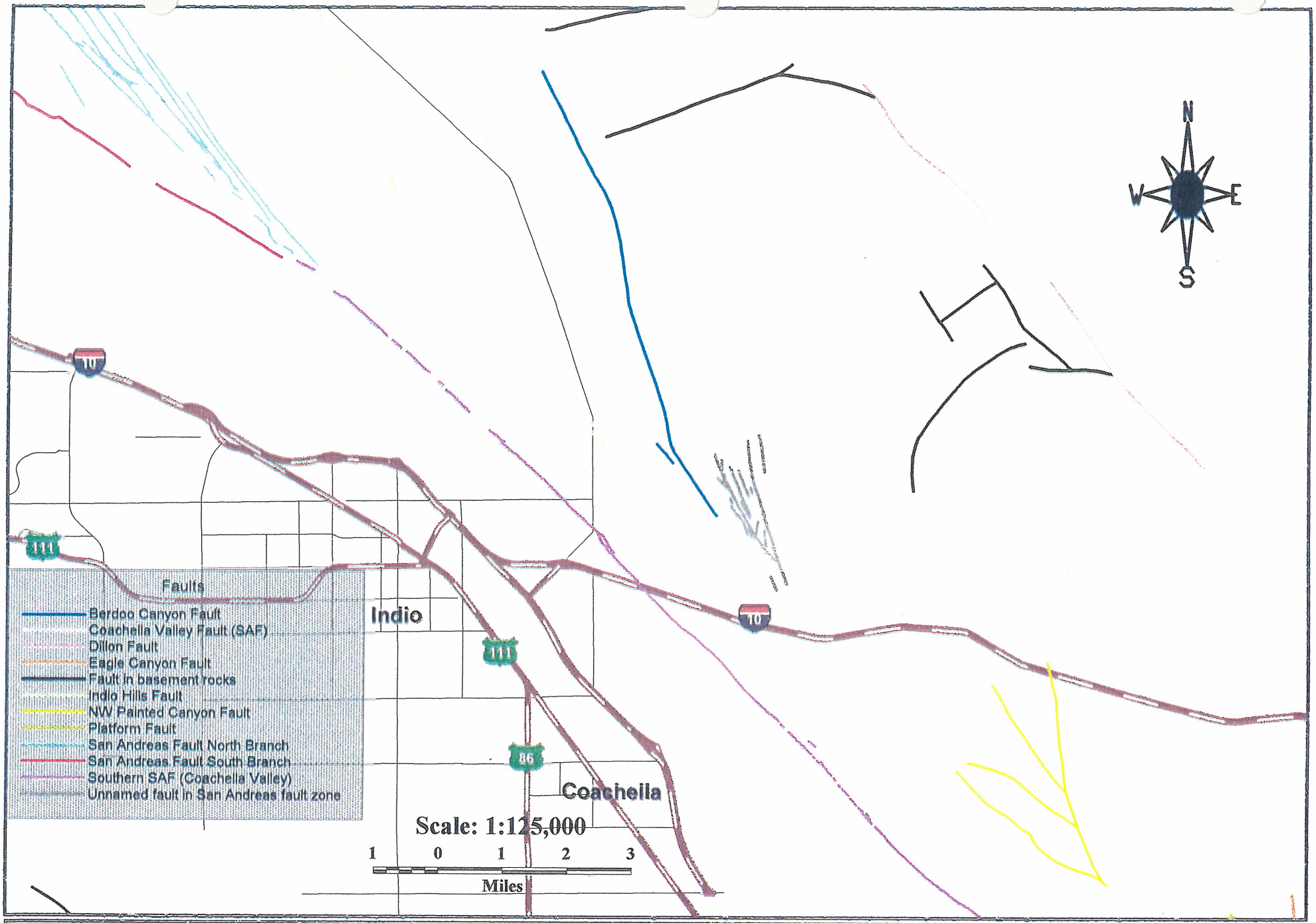
LEGEND FOR NORTHERN SAN ANDREAS FAULT ZONE

in Riverside County

Figure C-10a



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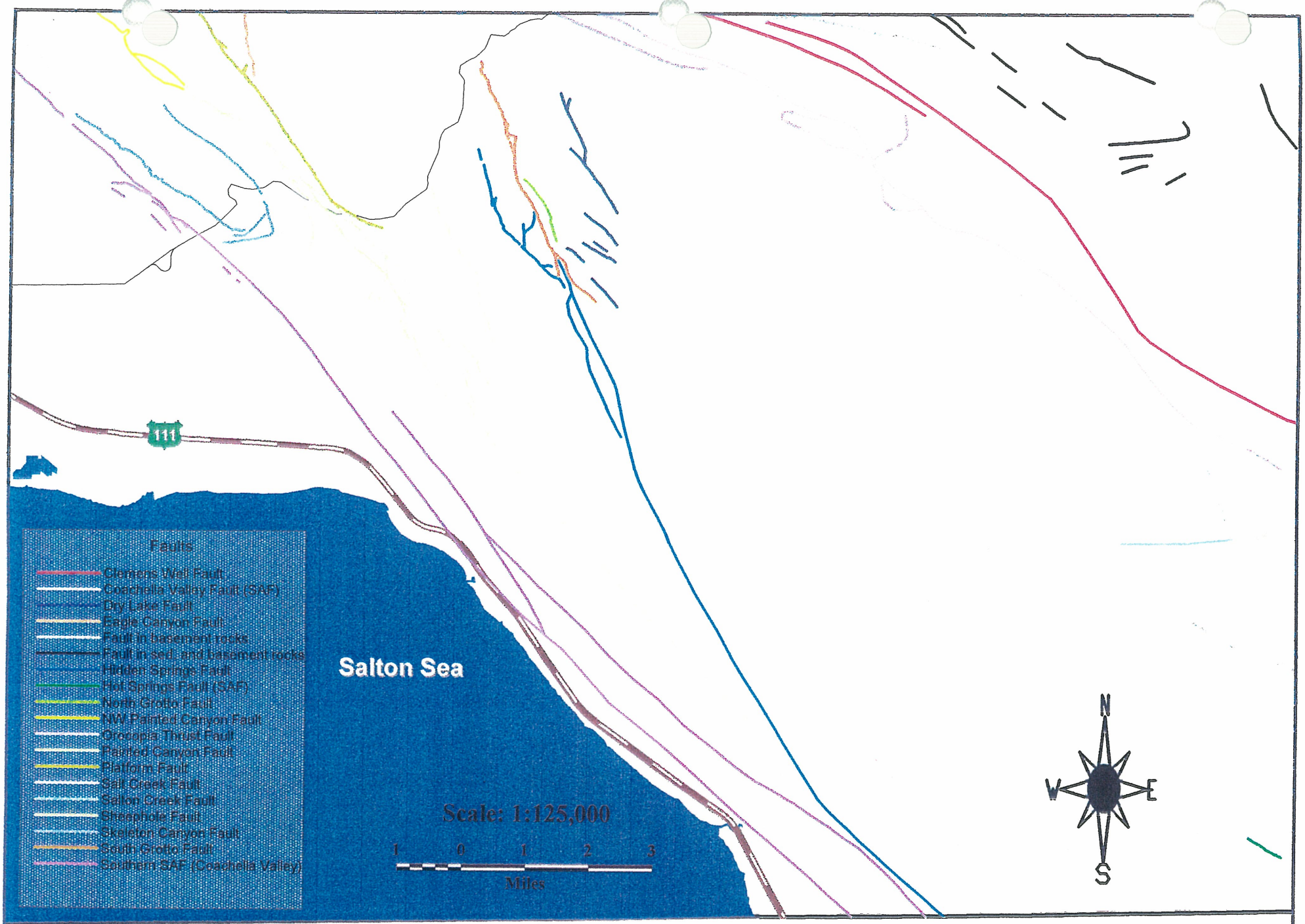
CENTRAL SAN ANDREAS FAULT ZONE

in Riverside County

Figure C-11



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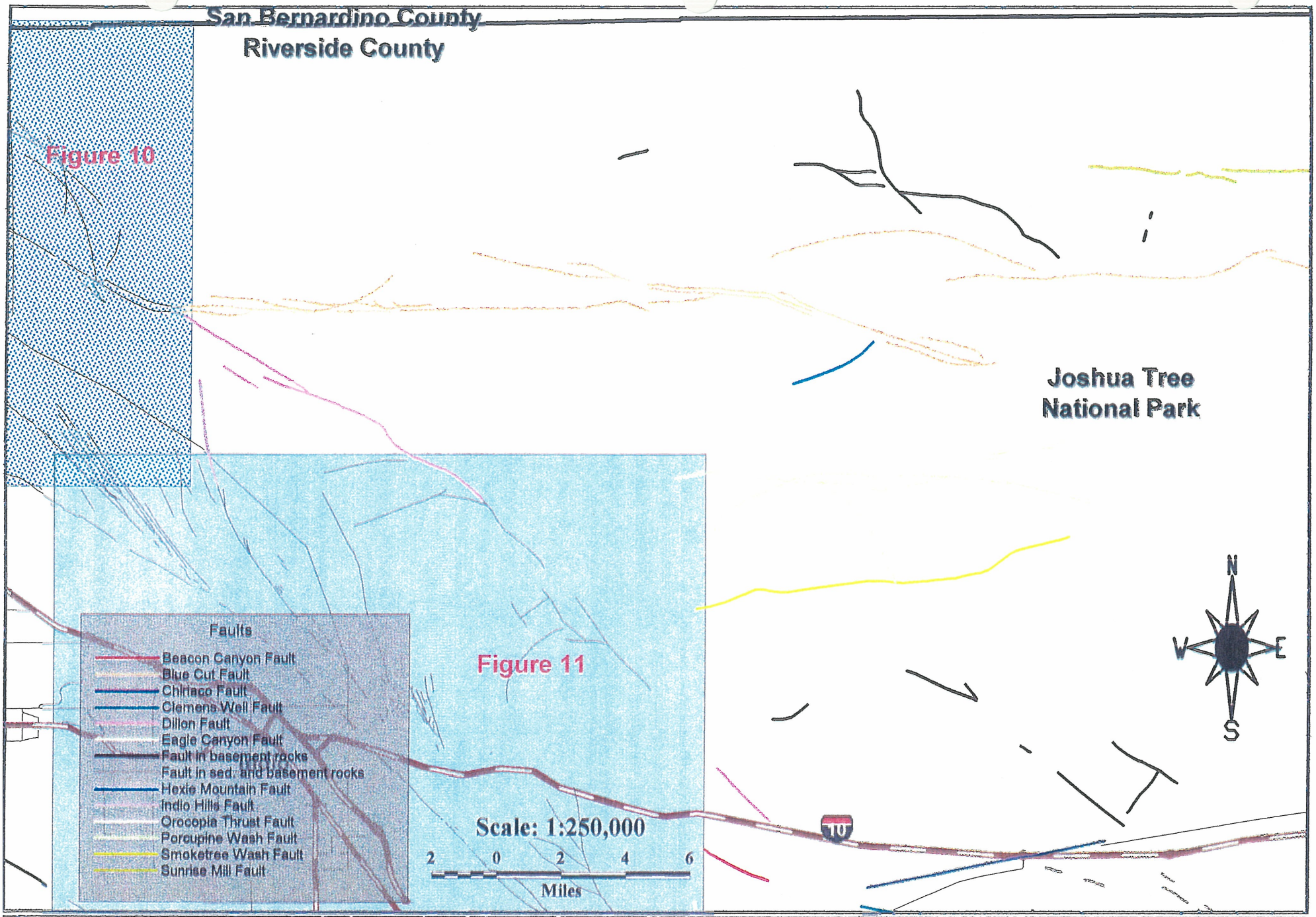
SOUTH SAN ANDREAS FAULT ZONE

in Riverside County

Figure C-12



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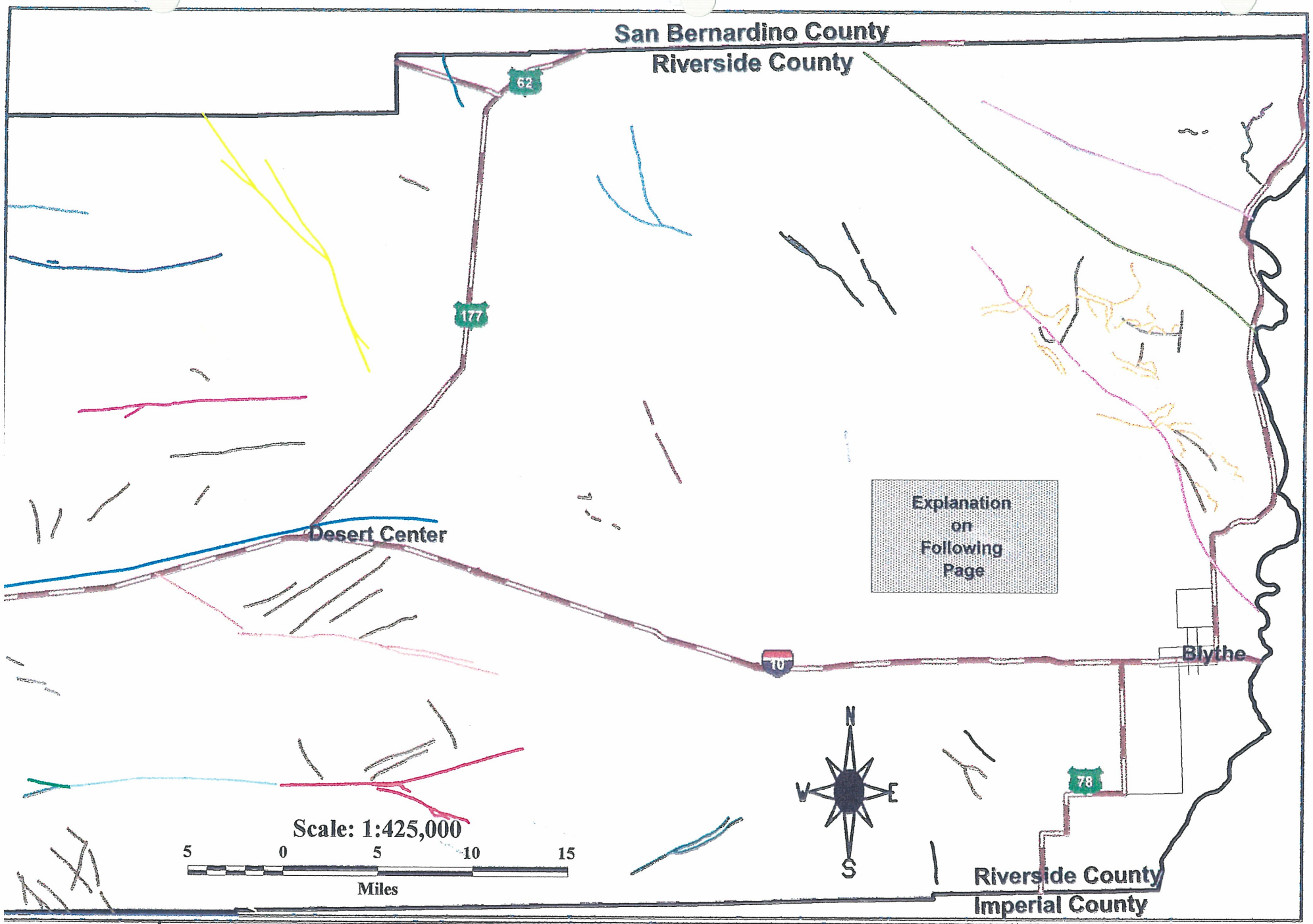
NORTHWEST MOJAVE DESERT FAULTS

in Riverside County

Figure C-13



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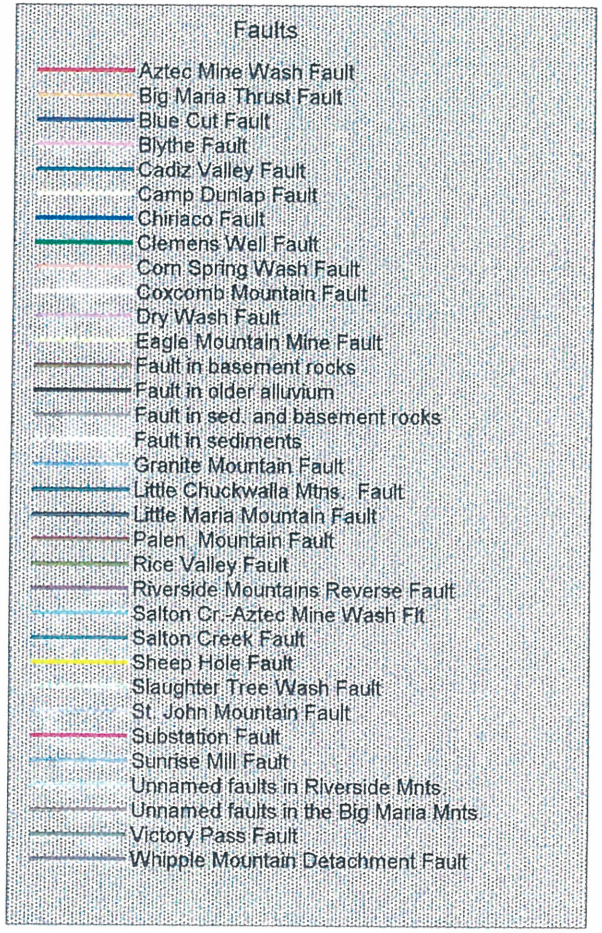
FAULTS IN THE MOJAVE DESERT

East Riverside County

Figure C-14



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LEGEND FOR FAULTS IN THE MOJAVE DESERT

East Riverside County

Figure C-14a

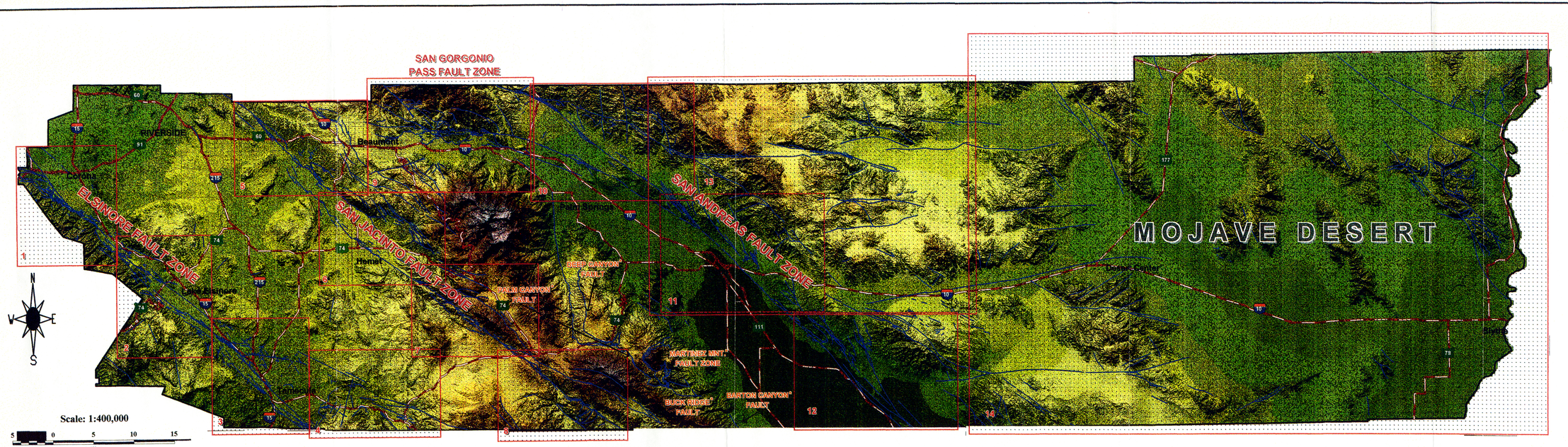

FIGURE C:

INDEX MAP

FOR

FIGURES

C-1 THROUGH C-14

- Faults
- Highways
- Major Roads
- Figure Boundaries

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* FAULTS NOT COVERED BY FIGURES

APPENDIX D
GIS METADATA

DAM FAILURE INUNDATION - DAMS

Coverage Description: Dam Inundation Pathways and Dam locations in Riverside County
Coverage distribution file name: daminund.e00 (dam inundation pathways); dams.e00 (dams and dam characteristics); damtt.e00 (dam inundation travel times)

VITAL STATISTICS: daminund.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	CERES, DMG
Source Media:	Paper maps
Source Projection:	vary
Source Units:	vary
Source Scale:	1:9,600 - 1:126,700
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polylines
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	Polylines
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: daminund.e00
RECORD LENGTH: 287

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Dam Name	35	C
2	Hazard Rating	10	C
3	Zone	-	I

VITAL STATISTICS: dams.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	CERES, DMG
Source Media:	Paper maps
Source Projection:	vary
Source Units:	vary
Source Scale:	1:9,600 - 1:126,700
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	points
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: dams.e00
RECORD LENGTH: 45

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Dam Name	30	C
2	DWR#	10	C
3	Dam Owner	45	C
4	Long	-	F
5	Lat	-	F

VITAL STATISTICS: damtt.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	CERES, DMG
Source Media:	Paper maps
Source Projection:	vary
Source Units:	vary
Source Scale:	1:9,600 - 1:126,700
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	point
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: damtt.e00
RECORD LENGTH: 214

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH		TYPE
1		Dam Name	35	C
2		Hazard Rating	10	C
3		Section #	8	C
4		Wave_tt	-	F
5		Rating#	-	I

Classification of Hazard Rating. Final rating is based on age, construction material, height, and storage capacity vs. drainage area and pathway hazard potential.

1. High (rating 4 - 5)(Red) - Dams that holds back a lake or significant amounts of water year around. These have a large reservoirs and large drainage basins. If construction materials were gravity or hydraulic fill they were automatically put into this category do to potential seismic failure.
2. Moderate (rating 2 - 3)(Orange) - Dams that hold back a lake or significant amounts of water year around. Construction was earth fill materials. These had significant heights and large drainage areas, but the pathway did not immediately flow towards populated areas.
3. Low (rating 1)(Blue) - Not a debris basin but holds water outside the rainy season and are made of rock or earth materials. Usually small impoundments with no direct path to populated areas.
4. Debris basins (Brown) - Only holds water during rainy periods.

The different types of dams in Riverside County and the number of that type are as follows:

- Earth (35)
- Gravity (1)
- Earth and Rock (2)
- Variable Radius Arch (2)
- Hydraulic Fill (1)

California WATER CODE SECTION 6000-6008

6000. Unless the context otherwise requires, the definitions in this chapter govern the construction of this part.

6002. "Dam" means any artificial barrier, together with appurtenant works, which does or may impound or divert water, and which either (a) is or will be 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier, as determined by the department, or from the lowest elevation of the outside limit of the barrier, as determined by the department, if it is not across a stream channel or watercourse, to the maximum possible water storage elevation or (b) has or will have an impounding capacity of 50 acre-feet or more.

6003. Any such barrier which is or will be not in excess of six feet in height, regardless of storage capacity, or which has or will have a storage capacity not in excess of 15 acre-feet, regardless of height, shall not be considered a dam.

6004. (a) No obstruction in a canal used to raise or lower water therein or divert water therefrom, no levee, including but not limited to a levee on the bed of a natural lake the primary purpose of which levee is to control flood waters, no railroad fill or structure, and no road or highway fill or structure, no circular tank constructed of steel or concrete, or both, no tank elevated above the ground, and no barrier which is not across a stream channel, watercourse, or natural drainage area and which has the principal purpose of impounding water for agricultural use shall be considered a dam.

(b) No obstruction in the channel of a stream or watercourse which is 15 feet or less in height from the lowest elevation of the obstruction and which has the single purpose of spreading water within the bed of the stream or watercourse upstream from the obstruction for percolation underground shall be considered a dam.

(c) The levee of an island adjacent to tidal waters in the Sacramento-San Joaquin Delta, as defined in Section 12220, even when used to impound water, shall not be considered a dam and the impoundment shall not be considered a reservoir if the maximum possible water storage elevation of the impounded water does not exceed four feet above mean sea level, as established by the United States Geological Survey 1929 datum.

(d) No noncircular tank, constructed of steel or concrete, or both, that is constructed in a county of the third class by a public agency, under the supervision of a civil engineer registered in the state, that does not exceed 75 acre feet in capacity or 30 feet in

height, and no barrier that is not across a stream channel, watercourse, or natural drainage area and that has the principal use as a sewage sludge drying facility shall be considered a dam.

6004.5. "Reservoir" means any reservoir, which contains or will contain the water impounded by a dam.

6005. "Owner" includes any of the following who own, control, operate, maintain, manage, or propose to construct a dam or reservoir:
(a) The state and its departments, institutions, agencies, and political subdivisions.
(b) Every municipal or quasi-municipal corporation.
(c) Every public utility.
(d) Every district.
(e) Every person.
(f) The duly authorized agents, lessees, or trustees of any of the foregoing.
(g) Receivers or trustees appointed by any court for any of the foregoing. "Owner" does not include the United States.

6006. "Alterations," "repairs," or either of them, mean only such alterations or repairs as may affect the safety of the dam or reservoir.

6007. "Enlargement" means any change in or addition to an existing dam or reservoir, which raises or may raise the water storage elevation of the water impounded by the dam or reservoir.

6008. Water storage elevation means that elevation of water surface, which could be obtained by the existing dam or reservoir, as previously operated, were there no outflow and were the reservoir full of water.

Dam Inundation maps were provided by California Office of Emergency Services (OES). The maps were digitized from the set of files, as published and maintained on the CA OES home page, contains images of the maps on file with this office marked "approved." Several dams within Riverside County have inundation maps that have not been officially approved. We have included these if they were released at the time of the project. These maps are intended to be used by state and local officials for the development and approval of dam failure emergency procedures as described in the above referenced Government Code section. The maps are also used to provide information needed to make natural hazard disclosure statements required under recent legislation (AB 1195 Chapter 65, June 9, 1998. Natural Hazard Disclosure Statement).

These maps are maintained on file at the CA OES in accordance with Section 8589.5 of the California Government code (a portion of the Emergency Services Act).

Dam	map number	Scale	Analysis By
Alessandro	1	1:9,600	Neste, Brudin & Stone, Inc.
Alessandro	2	1:9,600	Neste, Brudin & Stone, Inc.
Alessandro	3	1:9,600	Neste, Brudin & Stone, Inc.
Box Springs	1	1:9,600	Neste, Brudin & Stone, Inc.
Box Springs	2	1:9,600	Neste, Brudin & Stone, Inc.
Colorado River	6	1:126,720	Dept. of Interior, Bureau of Reclamation
Colorado River	7	1:126,720	Dept. of Interior, Bureau of Reclamation
Colorado River	8	1:126,720	Dept. of Interior, Bureau of Reclamation
Foster	1	1:6,000	Neste, Brudin & Stone, Inc.
Foster	2	1:6,000	Neste, Brudin & Stone, Inc.
Harrison Street	1	1:9,600	Neste, Brudin & Stone, Inc.
Harrison Street	2	1:9,600	Neste, Brudin & Stone, Inc.
Harrison Street	3	1:24,000	Neste, Brudin & Stone, Inc.
Henry J. Mills	1	1:12,000	Nelson N. Lee
Lake Hemet	1	1:63,360	Neste, Brudin & Stone, Inc.
Lake Hemet	2	1:24,000	Neste, Brudin & Stone, Inc.
Lake Hemet	3	1:24,000	Neste, Brudin & Stone, Inc.

Lake Hemet	4	1:24,000	Neste, Brudin & Stone, Inc.
Lake Hemet	5	1:24,000	Neste, Brudin & Stone, Inc.
Lake Mathews	1	1:24,000	Metropolitan Water District
Lake Mathews	2	1:24,000	Metropolitan Water District
Lee Lake	1	1:24,000	Krieger & Stewart
Mabey Canyon	1	1:24,000	Neste, Brudin & Stone, Inc.
Mary Street	1	1:9,600	Neste, Brudin & Stone, Inc.
Mary Street	2	1:9,600	Neste, Brudin & Stone, Inc.
Mary Street	3	1:9,600	Neste, Brudin & Stone, Inc.
Mockingbird Canyon	1	1:24,000	Robert L. Taylor
Perris	1	1:24,000	Dept. of Water Resourses
Perris	2	1:24,000	Dept. of Water Resourses
Perris	3	1:24,000	Dept. of Water Resourses
Perris	4	1:24,000	Dept. of Water Resourses
Pigeon Pass	1	1:24,000	Neste, Brudin & Stone, Inc.
Pigeon Pass	2	1:24,000	Neste, Brudin & Stone, Inc.
Pigeon Pass	3	1:24,000	Neste, Brudin & Stone, Inc.
Prado	2	1:24,000	US Corps of Engineers
Prado	3	1:24,000	US Corps of Engineers
Prenda	1	1:9,600	Neste, Brudin & Stone, Inc.
Prenda	2	1:9,600	Neste, Brudin & Stone, Inc.
Prenda	3	1:9,600	Neste, Brudin & Stone, Inc.
Railroad Canyon	1	1:63,360	Krieger & Stewart
Robert A. Skinner	2	1:24,000	Nelson N. Lee
Robert A. Skinner	3	1:24,000	Nelson N. Lee
Sycamore	1	1:9,600	Neste, Brudin & Stone, Inc.
Sycamore	2	1:9,600	Neste, Brudin & Stone, Inc.
Tahchevah	1	1:24,000	Neste, Brudin & Stone, Inc.
Vail	1	1:24,000	James M. Montgomery
Vail	2	1:24,000	James M. Montgomery
Vail	3	1:24,000	James M. Montgomery
Wide Canyon	1	1:24,000	Riverside County FCWCD
Woodcrest	1	1:9,600	Neste, Brudin & Stone, Inc.
Woodcrest	2	1:9,600	Neste, Brudin & Stone, Inc.
Woodcrest	3	1:9,600	Neste, Brudin & Stone, Inc.

EARTHQUAKES

Coverage Description: Earthquake epicenters within Riverside County.
Coverage distribution file name: quakes.e00 (represents all earthquakes under 3.0 magnitude); quakes3.e00 (represents all earthquakes over 3.0. in magnitude)

Import Location:

VITAL STATISTICS: quakes.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	See below
Source Media:	Paper maps
Source Projection:	vary
Source Units:	vary
Source Scale:	1:24,000
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	points
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: quakes.e00
RECORD LENGTH: 45,693

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Year	-	I
2	Latitude	-	F
3	Longitude	-	F
4	Depth_km	-	I
5	Magnitude	-	I

VITAL STATISTICS: quakes3.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	
Source Media:	Paper maps
Source Projection:	vary
Source Units:	vary
Source Scale:	1:24,000
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	points
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: quakes3.e00
RECORD LENGTH:

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Year	-	I
2	Latitude	-	F
3	Longitude	-	F
4	Depth_km	-	I
5	Magnitude	-	I

Earthquake locations within Riverside County were acquired from (references):

Earthquake locations for events occurring prior to 1931 (1858 – 1931)
Blake, T. F., 1996, EQFAULT- Computer software for deterministic site parameters, Version 2.20.

Earthquake locations for events occurring between 1932 to 1980
Earthquake data recorded by the Southern California Seismic Network (SCSN), and catalogued by the Southern California Earthquake Center (SCEC), which operated jointly by the Seismological Laboratory at Caltech and the U.S. Geological Survey, Pasadena, California.

Earthquake locations for events occurring between 1981 to 1999
Hauksson, E., 1999 (in press), Crustal structure and seismicity distribution adjacent to the Pacific and North America plate boundary in southern California: submitted to Journal of Geophysical Research, 1999.

FAULTS

Coverage Description: Faults in Riverside County
Coverage distribution file name: faults.e00
Import Location:

VITAL STATISTICS: faults.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	
Source Media:	Paper maps, Mylar maps and reports
Source Projection:	vary
Source Units:	vary
Source Scale:	1:9,600 - 1:126,700
Capture Method:	Digitized

Accuracy: The overall map is good to an accuracy of 1:100,000, although a significant portion of the map is accurate to 1:24,000.

Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polylines
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polylines
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: faults.e00
RECORD LENGTH: 4,347

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Ltype	35	C
2	Name	50	C
3	Activity	35	C
4	Activity_Zone	-	I

FAULTZONES

Coverage Description: Fault Zones in Riverside County
Coverage distribution file name: apzones.e00 (ap zone polygons); apzonept.e00 (ap zone points); apcounty.e00 (county ap zones); ap-eci.e00 (Earth Consultants proposed areas of concern)
Import Location:

VITAL STATISTICS: apzones.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	State of California, County of Riverside, Earth Consultants
Source Media:	Paper maps, Digital
Source Projection:	vary
Source Units:	vary
Source Scale:	1:24,000
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polylines
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polylines
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: apzones.e00
RECORD LENGTH: 34

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH		TYPE
1	Fault zone	10	C	

The faults shown on this map are typically accurate to within 100 to 500 feet; however, some faults are better constrained than others as a consequence of the geologic field relations (exposures of the fault), or the quality of the geologic maps in which the data were acquired. Most of the faults that are Holocene to Late Quaternary in age are accurate to within 100 to 300 feet because their locations were typically retrieved from detailed (small-scale) geologic maps. However, in regions where these faults are "concealed" by younger sediments, their locations become progressively less accurate.

Many of the Holocene to Late Quaternary age faults are shown to exist under young alluvium due to their potential to rupture to the surface sometime in the future. Alternatively, the older faults (Pre Quaternary) are typically not shown to reside under sediments because of the unlikely possibility that these faults will rupture in the future.

The source map used for this coverage was a 1974 State of California, The Resources agency, Department of Conservation 7.5 minute quadrangle topographic map. This coverage may not show all potentially active faults, either within the special studies zones (see FAULT ZONES) or outside their boundaries. The faults shown on the map were not field checked and the "quality of data used is highly varied.

References for the maps used for fault locations on the final ECI fault location map for Riverside County. This reference list represents the maps that contained data that was eventually used in our fault location map.

Notes: "E-room" data for the San Gorgonio Pass Fault Zone region was used to initiate the data collection. This data was ultimately determined to be from Matti et al, 1992 and Kerry Sieh's student Doug Yule.

Bortugno, E.J., Spittler, T.E., 1986, Geologic Map of the San Bernardino Quadrangle, California Division of Mines and Geology, Regional Geologic Map Series, Map No. 3A (Geology), map scale 1:250,000.

Calzia, J.P., 1988, Mineral resources and resource potential map of the Pyramid Peak roadless area, Riverside County, California: United States Geological Survey, Miscellaneous Field Studies MF-1999, map scale 1:62,500.

Clark, M.M., 1984 (p.4), Map showing recently active breaks along the San Andreas Fault and associated faults between Salton Sea and Whitewater River – Mission Creek, California: U.S. Geological Survey Miscellaneous Investigations Series Map I-1483, 2 sheets scale 1:24,000.

Dibblee, T.W., Jr., 1982, Geologic Quadrangle Maps of the San Jacinto Mountains and vicinity, California: South Coast Geological Society, Geologic Maps SCGS 1, 2, 3, 4 and 5, (15-minute quadrangle maps: Perris, Banning, Palm Springs, Hemet, Idyllwild), map scale 1:62,500.

Fault-Rupture Hazard Zones in California, 1980-1995, issued by the California Division of Mines and Geology, map scale 1:24,000.

Greenwood, Richard B., Morton, Douglas M., Jachens, Robert C., Chapman, Rodger H., 1991, Geology and geophysics of the Santa Ana 1:100,000 quadrangle, Southern California; a progress report: Abstracts with Programs - Geological Society of America, vol. 23, n. 5, p. 478. [This map is also available on the internet: (http://wrgis.wr.usgs.gov/open-file/of99-172/) Open-File Report **99-172**. Preliminary digital geologic map of the Santa Ana 30' x 60' quadrangle, Southern California, version 1.0, Compiled by: D.M. Morton, preparation by: Rachel M. Hauser and Kelly R. Ruppert].

Jennings, C.W., 1967, Geologic Map of California Salton Sea Sheet: California Division of Mines and Geology, Regional Geologic Map Series, GAM-13, map scale 1:250,000.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas, with locations and ages of recent volcanic eruptions: California Division of Mines and Geology, Geologic Data Map No. 6, map scale 1:250,000.

Hamilton, W.B., 1984, Generalized Geologic map of the Big Maria Mountains region, northeastern Riverside county, southeastern California: U.S. Geological Survey Open File Report 84-407, 7 p., (scale 1:48,000).

Howard, K.A., Allen, C.M., 1988, Geologic Map of the Southern Part of the Dale Lake 15-minute quadrangle, San Bernardino and Riverside Counties, California: United States Geological Society, Open File Report OFR 88-534, map scale 1:62,500.

Howard, K.A., Horringa, E.D., Miller, D.M., Stone, P., 1989, Geologic Map of the eastern parts of the Cadiz Lake and Cadiz Valley 15-minute quadrangles, San Bernardino and Riverside Counties, California: United States Geological Society, Miscellaneous Field Studies Map MF-2086, map scale 1:62,500.

Kennedy, M.P., 1977, Recency and Character of faulting along the Elsinore Fault Zone in Southern Riverside County, California: California Division of Mines and Geology Special Report 131, map scale 1:24,000.

Matti, J.C., Morton, D.M., Cox, B.F., 1992, The San Andreas Fault System in the Vicinity of the Central Transverse Ranges Province, Southern California: United States Geological Survey Open File Report 92-354, map scale 1:250,000.

Matti, J.C., Cox, B.F., Iverson, S.R., 1983, Mineral resource potential of the Raywood Flat roadless areas, San Bernardino and Riverside Counties, California: United States Geological Society, Miscellaneous Field Studies MF-1563-A, map scale 1:62,500.

Matti, J.C., Cox, B.F., Powell, R.E., Oliver, H.W., Kuizon, L., 1983, , Mineral resources and resource potential map of the Pyramid Cactus Spring roadless area, Riverside County, California: United States Geological Survey, Miscellaneous Field Studies MF-1650, map scale 1:24,000.

Onderdonk, N.W., Sylvester, A.G., 1998, The Quaternary fault structure of a left-stepover within the San Jacinto Fault Zone, Riverside County, California: Geological Society of America Abstracts with Programs, v. 30, n. 5, p. 57.

Onderdonk, N.W., (personal communication), 1998, Geologic maps of the Hot Springs, Thomas Mountain and Claremont Faults of the San Jacinto Fault Zone, map scale 1:24,000.

Powell, R.E., 1981, Geology of the crystalline basement complex, eastern Transverse Ranges, southern California: Constraints on regional tectonic interpretation [Ph.D. thesis]: Pasadena, California, California Institute of Technology, map scale 1:125,000.

Proctor, R.J., 1968, Geology of the Desert Hot Springs – Upper Coachella Valley Area, California: California Division of Mines and Geology, Special Report 94, 50p, map scale is 1: 62,500.

Rogers, T.H., 1966, Geologic Map of California Santa Ana Sheet: California Division of Mines and Geology, Regional Geologic Map Series, map scale 1:250,000.

Schell, B.A., Schell, W.A., 1994, Blue Cut Fault, Riverside County, California: *in* Murbach, D., and Baldwin, J., (editors), Mojave Desert: South Coast Geological Society Annual Field Trip Guidebook No. 22, pp. 208-221, map scale ~1:350,000.

Sieh, K, Yule, D., 1999 (personal communication).

Sharp, R.V., 1972, Map showing recently active breaks along the San Jacinto Fault Zone between the San Bernardino Area and Borrego Valley, California: United States Geological Survey Miscellaneous Geologic Investigations Map I-675, map scale 1:24,000.

Weber, F.H., Jr. 1977, Seismic hazards related to geologic factors, Elsinore and Chino fault zones,

northwest Riverside County, California: California division of Mines and Geology Open-File Report 77-4, 96 p, map scale is 1:2000.

Weldon, R.J., Sheridan, J.M., 1999, (personal communication), Geologic map of the Southeastern Mecca Hills, California, map scale 1:12,000.

VITAL STATISTICS: apzonept.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	State of California, County of Riverside, Earth Consultants
Source Media:	Paper maps, Digital
Source Projection:	vary
Source Units:	vary
Source Scale:	1:24,000
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	points
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: apzonept.e00
RECORD LENGTH: 1,058

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Quad	10	C

VITAL STATISTICS: apcounty.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	County of Riverside
Source Media:	Paper maps, Digital
Source Projection:	vary
Source Units:	vary
Source Scale:	1:24,000
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polylines
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polylines
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: apcounty.e00
RECORD LENGTH: 8

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Fault Zone	10	C

VITAL STATISTICS: ap-eci.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	Earth Consultants
Source Media:	Paper maps, Digital
Source Projection:	vary
Source Units:	vary
Source Scale:	1:24,000
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polylines
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polylines
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: ap-eci.e00
RECORD LENGTH: 55

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Zone	15	C

The source map used for this coverage was a 1974, 1980, 1988, 1993 and 1995 State of California, The Resources agency, Department of Conservation 7.5 minute quadrangle topographic map. This coverage shows the outlines of the special studies area used in the fault coverage.

Uses and Limitations of Seismic Hazard Zone Maps

A Seismic Hazard Zone Map does NOT show areas that automatically should be excluded from development. Instead, it shows areas where the potential for damage from the mapped hazard is great enough so as to make it prudent to conduct geologic investigations to identify and mitigate the hazard prior to development. It is less costly to incorporate hazard mitigation into a structure before it is built than to try to try to later add mitigating features.

Cookie-cutter design of mitigation features is not feasible. The hazards present at each site and the multiplicity of structural configurations makes it impossible to predict how much mitigation will cost. In some areas, it may be possible to adequately mitigate liquefaction hazard by strengthening the foundation to withstand displacements of 11/2 feet, typically costing only $3,000-4,000. Expert engineers indicate that in many locations this simple measure could have reduced the payout for repair of liquefaction damage from an average of $65,000 to $70,000 to about $10,000 to $15,000-a substantial savings. Insurance industry representatives indicate that such potential savings could be passed on to consumers in the form of lower earthquake insurance premiums. However, the cost of mitigation of hazards on sites likely to experience more that 1 foot of liquefaction-caused displacement or having a significant landslide hazard is likely to be much greater.

In the past, land-use planners have often assumed that lower density developments should occur where geologic hazards are present. However, planners may find that the high cost of mitigating liquefaction hazards along streams, bays, canals, and coastal zones requires a higher density of development to be economically feasible.

Other things to note:
1. Seismic Hazard Zone Maps may not show all areas that have the potential for liquefaction, landsliding, strong ground shaking or other earthquake and geologic hazards.
2. A single earthquake capable of causing liquefaction or triggering landslide failures will not uniformly affect the entire area zoned.
3. Seismic Hazard Zone Maps do not show Alquist-Priolo Earthquake Fault Zones. Please refer to the latest Official Maps of Earthquake Fault Zones for disclosures and other actions required by the Alquist-Priolo Earthquake Fault Zoning Act.
4. The identification and location of liquefaction and earthquake-induced landslide hazard areas are based on available data. The quality of data used is varied. The information depicted on the maps has been drawn as accurately as possible at 1:24,000-scale.
5. Information on the Seismic Hazard Zone Maps is not sufficient to serve, as a substitute for the geologic and geotechnical site investigations requires under the Seismic Hazard Mapping Act or the Alquist-Priolo Earthquake Fault Zoning Act.

Alquist-Priolo Maps

Map Name	Date of Map
Alber Hill	1980
Beaumont	1995
Bucksnort Mtn	1974
Cabazon	1995
Cathedral City	1974
Clark Lake NE	1974
Collins Valley	1974
Corona South	1980
Desert Hot Springs	1980
Durmid	1974
El Casco	1995
Elsinore	1980

Frink NW	1988
Hemet	1980
Indio	1974
Joshua Tree South	1993
Lake Mathews	1980
Lake View	1988
Mecca	1974
Mortmar	1974
Murrieta	1990
Myoma	1974
NE Hemet	1974
NE Thousand Palms	1974
NW Idyllwild	1974
Orocopia	1974
Pechanga	1990
Redlands	1977
Salton	1974
San Jacinto	1980
SE Idyllwild	1974
SE Morongo Valley	1974
SE San Gorgonio Mtn	1974
Seven Palms Valley	1980
Sunnymead	1974
SW Idyllwild	1974
SW Lost Horse	1974
SW Morongo Valley	1974
SW Palm Desert	1974
SW San Gorgonio Mtn	1974
Temecula	1990
Thermal Canyon	1974
Whitewater	1995
Wildomar	1980
Yucca Valley South	1993

FLOOD

Coverage Description: Flood plain and zone boundaries in Riverside County
Coverage distribution file name: flood.e00
Coverage Area: Riverside County

VITAL STATISTICS: flood.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	FEMA (Q3), FIRM, USGS and Earth Consultants
Source Media:	Paper maps, Digital files
Source Projection:	vary
Source Units:	vary
Source Scale:	1:4,800 -1:24,000
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: flood.e00
RECORD LENGTH: 1,567

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Reference	20	C
2	Zone	3	C
3	Subzone	5	C
4	Subzone Description	254	C

Flooding coverage comes from a collection of resources. Federal Insurance Rate Maps (FIRM) maps were compared to the existing County data. The combined maps were then compared to the natural hazard loss estimation methodology software (HAZUS) data set from Federal Emergency Management Agency (FEMA). The United States Geological Survey (USGS) flood prone information was then used to complete the flooding map.

The following procedures were followed during the creation of the Flood and Inundation Susceptibility Map of Riverside County:

- Flood Insurance Rate Maps (FIRM) from the Federal Emergency Management Agency (FEMA) was digitized for unincorporated parts of Riverside County.
  - FEMA has three categories for flood zones:
    - Zone A- Special flood hazard areas inundated by 100-year flood.
      - Subzone A- No base flood elevations determined.
      - Subzone AE- Base flood elevations determined.
      - Subzone AH- Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
      - Subzone AO- Flood depths of 1 to 3 feet (usually sheet flow or sloping terrain); average depths determined for areas of alluvial fan flooding, velocities also determined.
      - Subzones A1-30- Areas of 100-year flood; base flood elevations and flood hazard factors determined.
      - Subzone A99- To be protected from 100-year flood by federal flood protection system under construction; no base elevations determined.
    - Zone B- Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with the average depths less than one (1) foot or where the contributing drainage area is less than one (1) square mile; or areas protected by levees from the base flood.
    - Zone X- Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood
    - Zones X and B are attributed with blue polygons.
    - Zone A is attributed with red polygons.
- HAZUS data obtained from FEMA was then added to the map containing the FIRM data to cover incorporated as well as unincorporated parts of the county that the FIRM data did not cover.
  - FEMA has two categories for flood zones:
    - Zone A- Areas of 100-year flooding. Attributed as red polygons.
    - Zone B- Areas of 500-year flooding. Attributed as blue polygons.
- United States Geological Survey (USGS) 7.5' quadrangle Flood Prone Areas maps were digitized and added to the map to cover areas not mapped by FEMA.
  - The USGS only covers 100-year flooding in its Flood Prone Areas maps. Zone A is defined as flood-prone areas that have a 1 in 100 chance, on the average, of being inundated during any year. Flood prone areas have been delineated without consideration of present or future flood control storage that may reduce flood levels. Four subzones are represented:
    - Subzone L- Approximate area occasionally flooded if levees are breached.
    - Subzone O- Approximate area occasionally flooded.
    - Subzone I- Flood prone area subject to inundation from local thunderstorms.
    - Subzone S- Flood prone areas from sheet flow.

- The current flood map for the county of Riverside was compared to the map compiled by Earth Consultants International (ECI) to insure that all county data was represented in the new map. One small area in the city of Riverside was taken from the county map and added to the new map.
- Areas prone to 100-year flooding were added by ECI on the west side of the Salton Sea and the western parts of Blythe for areas not covered by any of the afore mentioned data sets. It is ECI's opinion that these areas are susceptible to flooding and that the data sets for these areas are missing or nonexistent. The flood level elevations of the surrounding areas, as well as the topography of the areas, were taken into account when designating the two areas as flood prone.

References:

Edwards, K.L., Master Drainage Plan for the Wildomar Area. Riverside County Flood Control and Water Conservation District, Riverside California, August 1980.

Edwards, K.L., Master Drainage Plan for the Sedco Area. Riverside County Flood Control and Water Conservation District, Riverside California, March 1982.

Edwards, K.L., Master Drainage Plan for the Murrieta Creek Area. Riverside County Flood Control and Water Conservation District, Riverside California, March 1986.

FIRM (Federal Insurance Rate Maps)

Number	Name	Scale	Date
060245 2065 B	Panel 2065 of 3600	1:12000	9/30/88
060245 0775 B	Panel 775 of 3600	1:24000	9/30/88
060245 2765 B	Panel 2765 of 3600	1:12000	11/20/96
060245 2770 B	Panel 2770 of 3600	1:12000	9/30/88
060245 2150 B	Panel 2150 of 3600	1:24000	9/30/88
060245 0695 B	Panel 695 of 3600	1:12000	3/22/83
060245 0755 B	Panel 755 of 3600	1:12000	9/30/88
060245 2055 B	Panel 2055 of 3600	1:12000	9/30/88
060245 2130 B	Panel 2130 of 3600	1:12000	9/30/88
060245 2135 B	Panel 2135 of 3600	1:12000	9/30/88
060245 2125 B	Panel 2125 of 3600	1:24000	9/30/88
060245 1555 B	Panel 1555 of 3600	1:12000	3/22/83
060245 0745 B	Panel 745 of 3600	1:12000	9/30/88
060245 2265 B	Panel 2265 of 3600	1:12000	3/22/83
060245 1495 B	Panel 1495 of 3600	1:12000	9/30/88
060245 1480 B	Panel 1480 of 3600	1:12000	9/30/88
060245 1355 B	Panel 1355 of 3600	1:12000	3/22/83
060245 2095 B	Panel 2095 of 3600	1:12000	11/20/96
060245 2300 B	Panel 2300 of 3600	1:24000	3/22/83
060245 1560 B	Panel 1560 of 3600	1:12000	3/22/83
060245 0925 B	Panel 925 of 3600	1:24000	9/30/88
060245 0875 B	Panel 875 of 3600	1:24000	3/22/83
060245 2255 B	Panel 2255 of 3600	1:24000	3/22/83
060245 1585 B	Panel 1585 of 3600	1:24000	9/30/88
060245 1595 B	Panel 1595 of 3600	1:24000	9/30/88
060245 2235 A	Panel 2235 of 3600	1:12000	4/15/80
060245 2180 A	Panel 2180 of 3600	1:12000	4/15/80
060245 1540 A	Panel 1540 of 3600	1:12000	4/15/80
060245 2850 A	Panel 2850 of 3600	1:24000	4/15/80
060245 2875 A	Panel 2875 of 3600	1:24000	4/15/80
060245 3000 A	Panel 3000 of 3600	1:24000	4/15/80
060245 0810 A	Panel 810 of 3600	1:24000	4/15/80
060245 0820 A	Panel 820 of 3600	1:12000	4/15/80
060245 0720 A	Panel 720 of 3600	1:12000	4/15/80

060245 1515 A	Panel 1515 of 3600	1:12000	4/15/80
060245 2270 A	Panel 2270 of 3600	1:12000	4/15/80
060245 1625 C	Panel 1625 of 3600	1:24000	11/20/96
060245 2155 A	Panel 2155 of 3600	1:12000	4/15/80
060245 1450 D	Panel 1450 of 3600	1:24000	11/20/96
060245 3355 D	Panel 3355 of 3600	1:12000	11/20/96
060245 0900 D	Panel 900 of 3600	1:24000	11/20/96
060245 2260 D	Panel 2260 of 3600	1:24000	11/20/96
060245 1580 C	Panel 1580 of 3600	1:12000	11/20/96
060245 0790 C	Panel 790 of 3600	1:12000	11/20/96
060245 1475 C	Panel 1475 of 3600	1:24000	11/20/96
060245 1490 C	Panel 1490 of 3600	1:12000	9/30/88
060245 1360 C	Panel 1360 of 3600	1:12000	11/20/96
060245 2085 C	Panel 2085 of 3600	1:12000	11/20/96
060245 2080 C	Panel 2080 of 3600	1:12000	11/20/96
060245 2070 C	Panel 2070 of 3600	1:24000	11/20/96
060245 2060	Panel 2060 of 3600	1:12000	11/20/96
060245 2090 C	Panel 2090 of 3600	1:12000	11/20/96
060245 2730 C	Panel 2730 of 3600	1:12000	11/20/96
060245 2710 C	Panel 2710 of 3600	1:12000	11/20/96
060245 2050 C	Panel 2050 of 3600	1:24000	11/20/96
060245 0690 C	Panel 690 of 3600	1:12000	11/20/96
060245 2745 C	Panel 2745 of 3600	1:12000	11/20/96
060245 3360 C	Panel 3360 of 3600	1:12000	11/20/96
060245 0225 B	Panel 225 of 3600	1:24000	9/30/88
060245 1380 B	Panel 1380 of 3600	1:12000	11/20/96
060245 0685 B	Panel 685 of 3600	1:12000	11/20/96
060245 0020 B	Panel 20 of 3600	1:12000	11/20/96
060245 1410 B	Panel 1410 of 3600	1:12000	11/20/96
060245 1405 B	Panel 1405 of 3600	1:12000	11/20/96
060245 1370 B	Panel 1370 of 3600	1:12000	11/20/96
060245 1390 B	Panel 1390 of 3600	1:12000	11/20/96
060245 0840 B	Panel 840 of 3600	1:12000	9/30/88
060245 0795 B	Panel 795 of 3600	1:12000	11/20/96
060245 0850 B	Panel 850 of 3600	1:24000	9/30/88
060245 1460 C	Panel 1460 of 3600	1:12000	11/20/96
060245 1455 C	Panel 1455 of 3600	1:12000	11/20/96
060245 2030 C	Panel 2030 of 3600	1:12000	11/20/96
060245 2035 C	Panel 2035 of 3600	1:12000	11/20/96
060245 0710 A	Panel 710 of 3600	1:12000	4/15/80
060245 1385 A	Panel 1385 of 3600	1:12000	4/15/80
060245 1335 A	Panel 1335 of 3600	1:12000	4/15/80
060245 1435 D	Panel 1435 of 3600	1:12000	11/20/96
060245 0670 A	Panel 670 of 3600	1:12000	4/15/80
060245 0065 A	Panel 65 of 3600	1:12000	4/15/80
060245 0045 A	Panel 45 of 3600	1:12000	4/15/80
060751 2745 A	Panel 2745 of 3600	1:12000	11/20/96
060245 0705 A	Panel 705 of 3600	1:12000	4/15/80
060751 2710 A	Panel 2710 of 3600	1:12000	11/20/96
060751 2730 A	Panel 2730 of 3600	1:12000	11/20/96
060751 2740 A	Panel 2740 of 3600	1:12000	11/20/96
060245 0120 A	Panel 120 of 3600	1:12000	4/15/80
060245 0115 A	Panel 115 of 3600	1:12000	4/15/80
060245 0070 A	Panel 70 of 3600	1:12000	4/15/80
060245 0090 A	Panel 90 of 3600	1:12000	4/15/80
060245 0040 A	Panel 40 of 3600	1:12000	4/15/80
060245 0815 A	Panel 815 of 3600	1:12000	4/15/80

060245 0805 A	Panel 805 of 3600	1:12000	4/15/80
060245 0785 A	Panel 785 of 3600	1:12000	4/15/80
060245 0680 A	Panel 680 of 3600	1:12000	4/15/80
060704-0005-D	CATHEDRALCITY	1:12,000	7/7/99
060253-0005-D	HEMET	1:12,000	8/19/97
065074-0020B	MORENO VALLEY	1:12,000	5/17/93
060629-0003D	PALM DESERT	1:6,000	6/18/96
060629-0005-C	PALM DESERT	1:6,000	9/4/86
060259-0003-C	RANCHO MIRAGE	1:4,800	6/18/96
06259-0001-C	RANCHO MIRAGE	1:4,800	6/18/96

USGS Flood Prone Areas Maps

Name	Scale	Date
Alberhill	1:24,000	1973
Beaumont	1:24,000	1975
Blythe	1:24,000	1974
Blythe NE	1:24,000	1975
Desert Hot Springs	1:24,000	1971
El Casco	1:24,000	1976
Fontana	1:24,000	1976
Guasti	1:24,000	1977
Indio	1:24,000	1976
Lake Mathews	1:24,000	1974
McCoy Wash	1:24,000	1975
Mecca	1:24,000	1973
Mortmar	1:24,000	1976
Oasis	1:24,000	1976
Palm Springs	1:24,000	1973
Palo Verde	1:24,000	1976
Rancho Mirage	1:24,000	1976
Redlands	1:24,000	1975
Ripley	1:24,000	1975
San Jacinto	1:24,000	1976
Seven Palms Valley	1:24,000	1971
Sitton Peak	1:24,000	1974
Steele Peak	1:24,000	1974
Sunnymead	1:24,000	1974
Temecula	1:24,000	1973
Thermal Canyon	1:24,000	1973
Whitewater	1:24,000	1971
Wildomar	1:24,000	1973
Yucaipa	1:24,000	1976

GEOLOGY - GENERAL GEOLOGY AND ENGINEERING GEOLOGY

Coverage Description: Geologic Units and Engineering Geologic Materials of Riverside County
Coverage distribution file name: geology.shp
Import Location:

VITAL STATISTICS: geology.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	State of California, USGS
Source Media:	Paper maps, Digital, Mylar
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: geology.shp
RECORD LENGTH: 6,703

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Area	-	F
2	Perimeter	-	F
3	Geology	-	I
4	Geology_ID	-	I
5	Ptype	35	C
6	Etype	35	C
7	Description	250	C

Map Name	Work Space File Name	Projection	Digitizing Geocoding Error	Scale
Preliminary Geologic Map of the Blythe 30' by 60' Quadrangle, CA and AZ	Geology	UTM NAD 83 Zone 11	0.005	1:100,000
Geologic Map of California, Salton Sea Sheet	SaltonSea250	UTM NAD 27 Zone 11	.002-.01	1:250,000
Geologic Map of California, Santa Ana Sheet	SantaAna250	UTM NAD 27 Zone 11	.002-.004	1:250,000
Distribution and Geologic Relations of Fault Systems in the Vicinity of the Central Transverse Ranges, Southern California	Transverse	UTM NAD 83 Zone 11	.006-.017	1:250,000
Geologic Map of California, San Bernardino Quadrangle	SanBern250	UTM NAD 27 Zone 11		1:250,000
Geologic Map of the Big Maria Mountains NE Quadrangle, Riverside County, California, and Yuma County Arizona	Big Maria-NE	UTM NAD 27 Zone 11		1:24,000
Geologic Map of California, Needles Sheet	Needles	UTM NAD 27 Zone 11		1:250,000
Digital map of the Santa Ana Sheet, California – provided by Dr. Morton of the USGS	Santa Ana Geology			1:100,000

Explanation of geologic and engineering geology unit symbols:

There are many ways to group rock and sediments with similar characteristics. For planning purposes, it is most appropriate to group features based on engineering properties, that is, the characteristics that have most importance to the built environment. For this report, more that 60,000 polygons *(area features)* were digitized from the geologic map data outlined above (Table 2-1) for Riverside County. These diverse geologic units were combined based on similar engineering properties. The properties were assigned based on the units' descriptions in the literature that accompanies the geologic maps (Table 2-1). Thus the assignments include many assumptions. The map is meant to provide general guidance to support land use decisions and policies. It should not replace or preclude site-specific observation and testing.

The general explanation of geologic and engineering geology unit symbols included with the digital data is as follows:

- The PType (petrologic type) was taken from the geologic maps at the time of digitization. 'Petrologic' includes the type of rock or sediment and its history of formation.
- The description for each of the PTypes was reviewed from the legend or other supporting literature.
- An abbreviated code of engineering attributes, named EType (engineering type), was created based on the Ptype analyses.

A matrix was developed to convert the geologic units (PType) to engineering type (Etype) based on:

•Rock Type (sedimentary, igneous, metamorphic);
•Age (Holocene, Holocene-Pleistocene, Pleistocene, Tertiary-Pleistocene, Tertiary or older);
•Degree of Consolidation (unconsolidated, weakly consolidated, moderately consolidated, indurated, deeply weathered, friable);

•Depositional Environment (alluvial, eolian, marine, lucustrine);
•Texture (fine, coarse, undifferentiated);
•Structure (massive, bedded, slide complex, foliated, fractured).

Ptype	Etype	Description
E	SEDTINDmaub	Eocene, marine sedimentary rocks, interbedded massive friable sandstones, siltsones, mudstones, and conglomerates.
gr	IGp	Mesozoic granitic rocks undifferentiated, granite, alaskite, quartz monzonite, granodiorite, quartz diorite, diorite, aplite and pegmatite dikes.
gr-m	IGMETfol	Pre Cenozoic, granitic and metamorphic rocks, mixed rocks consisting of strongly foliated migmatites, including bodies of schist and quartz diorite, undifferentiated.
gr?	IGp	Mesozoic granitic rocks undifferentiated, granite, alaskite, quartz monzonite, granodiorite, quartz diorite, diorite, aplite and pegmatite dikes.
Jbc	METfol	Bedford Canyon Formation (Jurassic) - Interlayered argillite, slate, graywacke, impure quartzite, and small masses of limestone; slightly metamorphosed.
Jbc?	METfol	Bedford Canyon Formation (Jurassic) - Interlayered argillite, slate, graywacke, impure quartzite, and small masses of limestone; slightly metamorphosed.
Jbm	METm	Marble (limestone) - Fine-grained limestone marble; gray-weathering.
Jhd	IGp	(Jurassic) Hornblende diorite and minor gabbro.
JKgd	IGp	(Jurassic or Cretaceous) granodiorite.
Jp	IGpfol	Plutonic, porphyritic granitoid rocks mostly medium- to coarse-grained, strongly foliated to unfoliated porphyritic granodiorite.
Jpgb	IGp	Hornblende gabbro.
Jpgd	IGpfol	Foliated granodiorite and diorite.
JTRs	METSEDm	Sedimentary rocks (Jurassic and Triassic), variably metamorphosed, sedimentary rocks: quartzite, conglomerate (quartzite, carbonate, granitic).
JTRu	IGSED	Volcanic and sedimentary rocks, undivided (Jurassic and Triassic).
jTRv	IGvMETfol	Jurassic and/or Triassic metavolcanic rocks; flow breccia, dacite, tuff, possibly including some plutonic rocks.
Ju	SEDmMETfol	Upper Jurassic marine, interbedded argillite, slate, quartzite, graywacke, conglomerate, and recrystallized limestone, can be metamorphosed.
Jv	IGvMETfol	Jurassic volcanic rocks: primarly rhyolitic to dacitic, massive quartz phorphry, commonly foliated and metamorphosed to greenschist to lower amphibolite facies.
Katg	IGp	Granodiorite of Arroyo del Toro pluton (Cretaceous) - Biotite-hornblende granodiorite; light gray, medium-grained, massive, homogeneous.
Kba	IGpfol	Amphibolitic gabbro of Box Springs plutonic complex (Cretaceous) - Hornblende-gabbro; dark gray to black, fine- to medium-grained, foliated.
Kbfg	IGpfol	Rocks of Box Springs plutonic complex (Cretaceous) - Biotite granodiorite and

tonalite;		foliated.
Kbfgi tonalite;	IGp	Rocks of Box Springs plutonic complex (Cretaceous) - Biotite granodiorite and contains abundant mesocratic inclusions.
Kbft	IGpfol	Tonalite of Box Springs plutonic complex (Cretaceous) - Biotite-hornblende tonalite; light-to medium-gray, medium- to coarse-grained, foliated.
Kbg	IGpfol	Rocks of Box Springs plutonic complex (Cretaceous) - Biotite granodiorite and subordinate tonalite; light gray, porphyritic, foliated.
Kbhg	IGp	Rocks of Box Springs plutonic complex (Cretaceous) - Granodiorite and subordinate tonalite; porphyritic, compositionally heterogeneous.
Kbhg1	IGpfol	Rocks of Box Springs plutonic complex (Cretaceous) - Granodiorite; porphyritic, has pronounced layering, heterogeneous grain size.
Kbht	IGpfol	Tonalite of Box Springs plutonic complex (Cretaceous) - Biotite tonalite; light-gray, inequigranular, medium- to coarse-grained, foliated. Heterogeneous composition.
Kbpg	IGp	Monzogranite of Bernasconi Pass (Cretaceous) - Biotite and biotite-hornblende monzogranite; pale tan to tan when weathered, medium-grained, hypidiomorphic-granular or porphyritic.
Kbpm Monzogranite	IGp	Migmatitic rocks within monzogranite of Bernasconi Pass (Cretaceous) - containing abundant masses of mafic rock.
Kbt	IGpfol	Tonalite of Box Springs plutonic complex (Cretaceous) - Biotite tonalite; massive, but some has faint, regular layering.
Kcg	IGp	Monzogranite of Cajalco pluton (Cretaceous) - Hornblende-biotite monzogranite and lesser granodiorite; fine- to medium-grained.
Kcgb	IGp	Granodiorite and gabbro, undifferentiated of Cajalco pluton (Cretaceous) - Intermixed granodiorite and gabbro.
Kcgd	IGp	Granodiorite of Cajalco pluton (Cretaceous) - Biotite and hornblende-biotite monzogranite and granodiorite; medium-grained.
Kcgq	IGp	Granodiorite and quartz-latite, undifferentiated of Cajalco pluton (Cretaceous) – Intermixed granodiorite and quartz latite porphyry; near-equal amounts of each.
Kct	IGp	Tonalite of Cajalco pluton (Cretaceous) - Biotite-hornblende tonalite, massive.
Kcto rock,	IGp	Tourmalinized monzogranite and granodiorite (Cretaceous) - Massive tourmaline commonly contains minor amounts of quartz and felsic minerals.
Kd	IGp	Diorite, undifferentiated of southern California batholith (Cretaceous) - Mainly hornblende diorite; fine- to medium-grained, massive.
Kd(s)	IGp	Diorite, undifferentiated of southern California batholith (Cretaceous) - Mainly hornblende diorite; fine- to medium-grained, massive. Submerged in Perris Reservoir.

Kdqd (Cretaceous)	IGp	Diorite and quartz diorite, undifferentiated of southern California batholith - Mainly mixed biotite-hornblende quartz diorite and hornblende diorite.
Kdvg	IGp	Granodiorite to tonalite of Domenigoni Valley pluton (Cretaceous) - Hornblende-biotite granodiorite to tonalite; contains equant mafic inclusions.
Kg	IGp	Granitic dikes of southern California batholith (Cretaceous) - Variety of leucocratic granitic dikes composed mainly of quartz and alkali feldspars.
Kgaa	IGp	Anorthositic gabbro of Green Acres gabbroic complex (Cretaceous) - Gabbro; abundant plagioclase of labradorite to anorthite composition. Leucocratic, gray-weathering.
Kgab	IGp	Heterogeneous mixture of olivine, pyroxene, and hornblende gabbros of Green Acres gabbroic complex (Cretaceous) - Olivine-pyroxene-hornblende gabbro; variable composition.
Kgah	IGp	Hornblende-rich gabbro of Green Acres gabbroic complex (Cretaceous) - Hornblende gabbro; fine- to medium-grained, melanocratic.
Kgam gabbro.	IGpMET	Metagabbro of Green Acres gabbroic complex (Cretaceous) - Metamorphosed Occurs as small masses included within mixed granitic rocks.
Kgao	IGp	Olivine gabbro of Green Acres gabbroic complex (Cretaceous) - Olivine-gabbro; predominatly coarse-grained.
Kgat	IGp	Troctolite of Green Acres gabbroic complex (Cretaceous) - Subporphyritic troctolite; contains large phenocrysts of anorthitic plagioclase.
Kgb to	IGp	Gabbro of southern California batholith (Cretaceous) - Hornblende gabbro; medium- very coarse-grained, commonly weathers brown.
Kgbf	IGp	Fine-grained hornblende gabbro, Rail Road Canyon area (Cretaceous) - Hornblende gabbro; fine-grained dikes, sills, and small plutons.
Kgct	IGp	Coarse-grained biotite-hornblende tonalite of Gavilan ring complex (Cretaceous) – Biotite-hornblende tonalite; coarse-grained to extremely coarse-grained.
Kgd	IGp	Granodiorite, undifferentiated of southern California batholith (Cretaceous) – Intermediate composition granitic rocks, mainly biotite-hornblende and biotite granodiorite.
Kgg	IGp	Hypersthene monzogranite of Gavilan ring complex (Cretaceous) - Hypersthene monzogranite; black, massive, weathers dark brown.
Kgh	IGp	Hypabyssal tonalite of Gavilan ring complex (Cretaceous) - Tonalite and subordinate granodiorite; fine-grained to nearly aphanitic, massive.
Kght	IGp	Heterogeneous tonalite of Gavilan ring complex (Cretaceous) - Biotite-hornblende tonalite; admixed with biotite hornblende granodiorite.
KgMz	IGpMETfol	Intermixed Mesozoic schist and Cretaceous granitic rocks (Mesozoic) – Heterogeneous mixture of schist and granitic rocks.

Kgp lineated,	lGpMETfol	Gneissic porphyritic granite (Cretaceous), distinctly to indistinctly foliated and medium- to coarse-grained.
KgPz	lGpMETfol	Intermixed Rocks (Cretaceous and Paleozoic?) - Intermixed Paleozoic (?) schist and gneiss and Cretaceous granitic rocks, mostly of tonalite and granodiorite composition.
Kgr	lGp	Granophyre (Cretaceous) - Granophryic-textured granitic rock; pale gray, aphanitic-to very fine-grained.
Kgt	lGp	Massive-textured tonalite of Gavilan ring complex (Cretaceous) - Biotite-hornblende tonalite, hypersthene-bearing; massive, relatively heterogeneous composition, brown-weathering.
Kgtf	lGpfol	Foliated tonalite of Gavilan ring complex (Cretaceous) - Biotite-hornblende tonalite; medium-grained, foliated.
Kgti	lGp	Tonalite containing abundant mesocratic inclusions of Gavilan ring complex (Cretaceous) - Biotite-hornblende tonalite; relatively fine-grained.
Kgu	lGp	Granite, undifferentiated of southern California batholith (Cretaceous) - Granite; leucocratic, fine- to coarse-grained, massive.
Khg	lGp	Heterogeneous granitic rocks of southern California batholith (Cretaceous) - Includes heterogeneous, compositionally diverse granitic rocks mostly of tonalitic and granodioritic composition.
Khg(s)	lGp	Heterogeneous granitic rocks of southern California batholith (Cretaceous) - Includes heterogeneous, compositionally diverse granitic rocks mostly of tonalitic and granitic composition.
Khqd	lGp	Hypersthene quartz diorite (Cretaceous) - Hypersthene-biotite quartz diorite; fine- to medium-grained, massive.
KJma	METSEDcb	Quartzite, minor chert and quartzite clasts conglomerate interbedded with mudstone and siltstone (Cretaceous or Jurassic).
KJmb	METSEDfb	Mudstone and siltstone interbedded with quartzite and limestone (Cretaceous or Jurassic).
KJmc	lGvSEDudb	Volcanic lithic sandstone, siltstone, mudstone and minor conglomerate (Cretaceous or Jurassic).
KJmd	lGvSEDfb	Phyllitic shale and silty to sandy shale, interbedded with minor volcanic-lithic sandstone and conglomerate containing clasts of quartzite and volcanic rocks.
KJme	lGvSEDfb	Phyllitic shale and arkosic and volcanic lithic sandstone, minor conglomerate. Calcareous shale near the top. (Creataceous or Jurassic).
KJqm	lGp	Quartz Monzonite of Pleasant View Ridge (Cretaceous or Jurassic).
Kl	SEDTMCmud	Ladd Formation (Upper Cretaceous) - Conglomerate, sandstone, siltstone, and shale; marine and locally nonmarine.
Klbc	SEDTMCmcb	Baker Canyon Conglomerate Member of Ladd Formation (Upper Cretaceous) – Conglomerate, conglomeratic sandstone and pebble conglomerate; marine and locally

		nonmarine.
Klct sphene-	lGp	Tonalite of Lamb Canyon (Cretaceous) - Hornblende-biotite tonalite; massive, bearing.
Klhs	SEDTMCmfb	Holz Shale Member of Ladd Formation (Upper Cretaceous) - Sandstone, siltstone and shale; entire unit is marine. Unit subdivided where sandstone and conglomerate predominate.
Klmc	lGp	Comb-layered (Cretaceous) - Gabbro, comb-layered. Found along south margin of Lakeview Mountains pluton.
Klmg	lGp	Hypersthene-hornblende gabbro (Cretaceous) - Hypersthene-hornblende gabbro; forms small masses in Lakeview Mountains.
Klml	lGp	Leucocratic rocks of Lakeview Mountains pluton (Cretaceous) - Plagioclase-quartz rock; white. Occurs as localized elongate masses.
Klmm	lGp	Melanocratic rocks of Lakeview Mountains pluton (Cretaceous) - Melanocratic and hypermelanic rock consisting primarily of biotite and hornblende. Occurs as lenticular masses.
Klmt	lGpfol	Tonalite of Lakeview Mountains pluton (Cretaceous) - Biotite-hornblende tonalite containing no potassium-feldspar; medium- to coarse-grained, massive to foliated.
Klmtg	lGp	Lakeview Mountains tonalite and granodiorite, undifferentiated (Cretaceous) – Intermixed tonalite and granodiorite.
Klst	lGpfol	La Sierra Tonalite (Cretaceous) - Biotite-hornblende tonalite; medium-gray, weak to strong alteration.
Klt	lGpfolfract	Tonalite near mouth of Laborde Canyon (Cretaceous) - Biotite-hornblende tonalite; medium-grained, foliated, intensely fractured.
Kmeg	lGpfol	Granite of Mount Eden (Cretaceous) - Granite; white to gray, leucocratic, medium-to coarse-grained, massive to foliated.
Kmf	SEDTINDmudb	McCoy Mountains Formation, member F, (Cretaceous), fine- to coarse-grained sandstone and conglomerate, interbedded with shale.
Kmg	SEDTINDmudb	McCoy Mountains Formation, member G, (Cretaceous), shale, sandstone and conglomerate (quartzite and carbonate). Upper fine-grained arkosic to volcanic lithic sandstone.
Kmh	SEDTINDmudb	McCoy Mountains Formation, member H, (Cretaceous), fine-grained arkosic sandstone, conglomeratic sandstone, and shale.
Kmhg	lGp	Mount Hole Granodiorite (Cretaceous) - Hornblende-biotite granodiorite; pale gray, massive.
Kmi	SEDTINDmcb	McCoy Mountains Formation, member I, (Cretaceous), medium- to coarse-grained arkosic and micaceous sandstone, conglomeratic sandstone and conglomerate.
Kmi?	SEDTINDmcb	McCoy Mountains Formation, member I, (Cretaceous), medium- to coarse-grained arkosic and micaceous sandstone, conglomeratic sandstone and conglomerate.

Kmj	SEDTINDmcb	McCoy Mountains Formation, member J, (Cretaceous), medium- to coarse-grained arkosic to volcanic lithic sandstone and conglomerate (granitic and volcanic) interbedded.
Kmk	SEDTINDmfb	McCoy Mountains Formation, member K, (Cretaceous), fine-grained, arkosic and volcanic-lithic sandstone, phyllitic shale and minor conglomerate (volcanic and granitic in composition).
Kml	SEDTINDmcb	McCoy Mountains Formation, member L, (Cretaceous), arkosic sandstone, conglomerate (quartzite, volcanic, granitic), and minor shale.
Kmp	IGpfol	Micropegmatite granite (Cretaceous) - Micropegmatitic granite; leucocratic, has pale pink tint.
Kmpc	IGpfol	Micropegmatite and granodiorite of Cajalco pluton, undifferentiated (Cretaceous) – Micropegmatitic granite and granitic rocks of the Cajalco pluton, undifferentiated.
Kmrg	IGp	Granite of Mount Rubidoux (Cretaceous) - Fayalite-hypersthene-biotite-hornblende granite; coarse-grained, black, massive.
Kp	IGp	Granitic pegmatite dikes (Cretaceous) - Pegmatitic textured granitic dikes; leucocratic, most are roughly tabular bodies; occur in Lakeview Mtns pluton, Box Springs plutonic complex.
Kpvg	IGp	Monzogranite to granodiorite of Paloma Valley Ring Complex (Cretaceous) - Biotite monzogranite, and less abundant hornblende-biotite granodiorite; gray, medium-grained, hypidiomorphic-granular, massive.
Kpvgb	IGp	Granodiorite and gabbro, undifferentiated, of Paloma Valley Ring Complex (Cretaceous) - Mixed biotite granodiorite and hornblende gabbro.
Kpvgr	IGp	Granophyre of Paloma Valley Ring Complex (Cretaceous) - Porphyritic granophyre; gray, very fine-grained.
Kpvt	IGpfol	Tonalite of Paloma Valley Ring Complex (Cretaceous) - Biotite-hornblende tonalite; foliated.
Kqd	IGp	Quartz diorite, undifferentiated of southern California batholith (Cretaceous) - Mainly biotite-hornblende quartz diorite; coarse-grained.
Krct	IGpfol	Tonalite of Reinhardt Canyon pluton (Cretaceous) - Biotite-hornblende tonalite; gray, medium-grained, most is well foliated.
Krg	IGpfol	Granite of the Riverside area (Cretaceous) - Leucocratic biotite granite; medium- to coarse-grained, massive to faintly foliated.
Ksmg	IGp	Monzogranite of Squaw Mountain (Cretaceous) - Biotite monzogranite; coarse-grained, moderately leucocratic, massive.
Ksv	METSEDIGv	Intermixed Estelle Mountain volcanics of Herzig (1991) and Mesozoic sedimentary rocks (Mesozoic) - Predominantly Mesozoic metasedimentary rocks, but including some volcanic rocks.
Kt	IGp	Tonalite, undifferentiated of southern California batholith (Cretaceous) - Mainly biotite-hornblende tonalite not associated with specific plutons.

Ktbh	IGpfol	Tonalite of Bernasconi Hills (Cretaceous) - Biotite-hornblende tonalite; gray, medium-grained, hypidiomorphic-granular, massive to indistinctly foliated.
Ktcg	IGp	Monzogranite of Tres Cerritos (Cretaceous) - Biotite monzogranite; leucocratic, medium- to coarse-grained, subporphyritic.
Ktd	IGp	Tonalite dikes of Mount Rubidoux (Cretaceous) - Mafic-rich tonalite; fine- to medium-grained.
Ktm (Cretaceous)	IGp	Tonalite and mafic rocks, undifferentiated of southern California batholith - Mainly biotite-hornblende tonalite containing subequal amounts of mafic inclusions. Inclusion borders mostly gradational and ill-defined.
Ktr	SEDTWCacm	Trabuco Formation (Upper Cretaceous) - Conglomerate locally interbedded with sandstone and siltstone; brown to maroon, massive, unfossiliferous, nonmarine.
Kts	IGp	Tonalite of Slaughterhouse Canyon (Cretaceous) - Biotite-hornblende tonalite; dark gray, fine-grained, massive.
Kvem andesite;	IGv	Estelle Mountain volcanics of Herzig (1991) (Cretaceous) - Rhyolite and rare heterogeneous mix of extrusive and volcaniclastic rocks.
Kvr	IGv	Rhyolite of Estelle Mountain volcanics of Herzig (1991) (Cretaceous) - Rhyolite; relatively homogeneous extrusive rocks.
Kvs	IGv	Intermixed Estelle Mountain volcanics of Herzig (1991) and Cretaceous (?) sedimentary rocks - Rhyolitic volcanic rocks and Mesozoic sedimentary rocks. Tectonically and probably stratigraphically mixed.
Kvsp	IGvfract	Santiago Peak Volcanics (Cretaceous) - Andesitic basalt, andesite, dacite, and rhyolite; mainly extrusive rocks, but some associated volcaniclastic rocks.
Kvspi	IGp	Intrusive rocks associated with Santiago Peak Volcanics (Cretaceous) - Hypabyssal dikes, sills and small intrusions.
Kvt gray,	IGpfol	Val Verde Tonalite of Val Verde pluton (Cretaceous) - Biotite-hornblende tonalite; medium grained, foliated.
Kvti	IGp	Inclusion-rich tonalite of Val Verde pluton (Cretaceous) - Tonalite; contains abundant melanocratic inclusions, most with compositionally gradational borders.
Kvtk	IGp	Potassium feldspar-bearing tonalite of Val Verde pluton (Cretaceous) - Biotite-hornblende tonalite; contains small amounts of potassium feldspar, heterogeneous.
Kwl	SEDTMCud	Williams and Ladd Formations, undifferentiated (Upper Cretaceous) - Sandstone, conglomerate and siltstone.
Kwsr	SEDTWCmc	Schulz Ranch Sandstone Member of Williams Formation (Upper Cretaceous) – Sandstone, coarse-grained; marine.
landslide	landslide	Mapped landslides.
ls	METSEDud	Metasedimentary (prebatholitic) rocks of uncertain composition. Part of (ms)

		limestone and marble.
m	MET	Paleozoic (?) Marble: Coarse- to very coarse-grained marble bodies.
m1	METfol	Sheared and deformed metamorphic rocks of uncertain age, (Precambrian to Mesozoic), gneissic in part cataclastically deformed, (Mesozoic and Pre Mesozoic).
m2	METfol	Sheared and deformed metamorphic rocks of uncertain age, (Precambrian to Mesozoic), mylonitic rocks (Mesozoic?).
Mc	SEDTaudb	Unnamed (Miocene) continental deposits, sandstone, conglomerate, siltstones, and mudstones, minor limestone, commonly interbedded with volcanic flows and tuffs.
MCs	METSEDb	(Mississippian to Cambrian) sedimentary rocks: variably metamorphosed massive limestone and marble, massive limestone and dolimitic limestone, thinly banded limestone.
Mib	IGv	Miocene shallow intrusive rocks, basaltic.
ms	METSEDfol	Metasedimentary (prebatholithic) rocks of uncertain age; quartzite, phyllite,and schist.
mss part	METSED	Metaquartzite, marble, and pelitic gneiss and schist, (Paleozoic and Precambrian) of San Bernardino Mnt block (sbb).
mv	METIGv	Pre Cretaceous metavolcanic rocks, undifferentiated metavolcanic amphibolites in Ramona quadrangle.
Mzd	IGpfol	Diorite of Transverse Ranges (Mesozoic) - Hornblende-biotite diorite and quartz diorite; medium- to coarse-grained, massive to incipiently foliated.
Mzdc	MET	Marble associated with metadunite (Mesozoic) - Silicate-bearing marble; pale gray, coarse-grained, spatially associated with dunite.
Mzds altered	METfol	Metadunite and serpentinite (Mesozoic) - Talc-bearing olivine dunite and dunite to magnesite-bearing serpentinite; brown-weathering.
Mzdx	METfol	Amphibole and pyroxene-bearing rocks associated with metadunite-serpentinite (Mesozoic) - Heterogeneous mixture of amphibolite, pyroxenite and altered schist.
Mzg	METSED	Graywacke (Mesozoic) - Predominately lithic metagraywacke.
Mzgp	METSEDfol	Intermixed graywacke and phyllite (Mesozoic) - Intermixed lithic metagraywacke and phyllite.
Mzi	METfol	Interlayered phyllite (or schist) and quartzite (Mesozoic) - In low metamorphic grade rocks, relatively pure quartzite interlayered with phyllite. In higher grade metamorphic rocks, quartzite interlayered with biotite schist.
Mzm	MET	Marble (Mesozoic) - Light colored tremolite and diopside-bearing marble and calc-silicate rock.
Mzmg	IGp	Mylonitic and cataclastic granitic rocks of Transverse Ranges (Mesozoic) - Cataclastic granodiorite, tonalite and quartz diorite, fine- to coarse-grained.
Mzp	METfol	Phyllite (Mesozoic) - Phyllite, black, fissile.

MzPfg	METfol	Fine-grained gneiss, (Mesozoic or Proterozoic), quartzofeldspathic gneiss.
MzPgn	METfol	Gneissic rocks, undivided (Mesozoic and Proterozoic) - Strongly foliated and lineated mylonitic and augen gneiss.
Mzq	METSED	Quartz-rich rocks (Mesozoic) - Impure quartzite and quartz-rich metasandstone.
Mzqg lithic	METSED	Intermixed quartzite and graywacke (Mesozoic) - Intermixed impure quartzite and metagraywacke.
Mzs	METfol	Schist (Mesozoic) - Wide variety of fissile schist including andalusite biotite schist, cordierite biotite schist, sillimanite biotite schist, and less commonly garnet-bearing schist.
Mzu	METSEDfol	Mesozoic metasedimentary rocks, undifferentiated (Mesozoic) - Quartz-bearing metasedimentary rocks, chiefly biotite schist; includes unknown Mesozoic metasedimentary rocks.
Oc	SEDTWCaud	(Oligocene), nonmarine.
Pc	SEDTWCaud	Undivided (Pliocene) nonmarine, conglomerate, sandstone, siltstone, shale.
Pc?	SEDTWCaud	Undivided (Pliocene) nonmarine, conglomerate, sandstone, siltstone, shale.
PCc including	IGpMET	Precambrian igneous and metamorphic rocks complex, intimate mixture of Precambrian plutonic rocks (diorite-granite), and Precambrian metamorphics migmatites.
pCg	IGp	Granitic rocks.
pCgr	IGpfol	Undivided (Precambrian) granitic rocks, plutonic igneous rocks, granite to diorite and gabbro, generally slightly to highly foliated gneiss.
PCs	METSED	Sedimentary rocks (Permian to Cambrian); PPs and MCs together.
Pgn	METfol	Gneiss and amphibolite (Proterozoic).
Pml	SEDTMCmfb	(Middle to lower Pliocene), marine, interbedded claystone, siltstone and sandstone, abundant oystershell reefs, some pebble conglomerate.
Pmlc sandstone,	SEDTMCaudb	(Middle to lower Pliocene), nonmarine, interbedded conglomerate, breccia, and siltstone with clasts of gneiss.
PP	METSED	Paleozoic marine metasedimentary rocks, including metadolomite, marble and quartzite.
Ppg	IGpMETfol	Porphyritic granite and augen gneiss, (Proterozoic), coarse-grained, variably foliated and metamorphosed plutonic rocks.
PPls	METSEDTINDm	Paleozoic marine, sedimentary and metasedimentary rocks, limestone member, marble localy cherty and fossiliferous.
PPs	METSEDTINDm	Sedimentary rocks, (Permian to Pennsylvanian), variably metamorphosed

sedimentary		rocks; cherty to noncherty limestones, dolomite, marble, and quartz sandstone.
prb	IGpMETfol	Peninsular ranges block (Mesozoic, Paleozoic, and Precambrian?) granitoid rocks and prebatholithic metasedimentary rocks moderate to pronounced foliation.
ps	METfol	Pelona Schist (Cretaceous and Paleocene), massive amphibole, minor quartzite, metamorphic age = Paleocene, protolith age unknown.
Pv	IGv	Pliocene volcanic undifferentiated, rhyolite, andesite, basalt, and pyroclastic rocks.
Pvb	IGv	Pliocene volcanic basalt flows.
Pza	METfol	Amphibolite (Paleozoic?) - Black hornblende-plagioclase amphibolite.
Pzc	METfol	Calc-silicate rocks (Paleozoic?) - Heterogeneous, massive to well-layered calc-silicate rocks.
Pzm	MET	Marble (Paleozoic?) - Marble; white to light-gray, locally bluish-gray, and blue, coarse- to extremely coarse-grained.
Pzms rock,	METfol	Marble and schist, undifferentiated (Paleozoic?) - Intermixed marble, calc-silicate and biotite schist.
Pzq	METfol	Impure quartzite (Paleozoic?) - Quartzite; impure, light-gray to light-greenish-gray, fine-to medium-grained, layered to massive.
Pzs to	METfol	Biotite schist (Paleozoic?) - Biotite schist and biotite-quartz-feldspar schist; medium-dark-gray, fine-grained.
Pzu	METfol	Paleozoic (?) rocks, undifferentiated - Biotite schist, quartzite, gneiss, and lesser amounts of hornblende gneiss, marble and associated skarn and calc-silicate rock.
Q	SEDHUCaud	Alluvium, unconsolidated, poorly-sorted stream, fan and basin deposits, clay to boulder size.
Qa	SEDHUCaud	Axial channel deposits (late Holocene) - Active and recently active fluvial deposits restricted to canyon floors; gravel, sand and silt, unconsolidated.
Qaf	SEDHUCaud	Artificial fill (Recent) - Deposits of fill resulting from human construction or mining activities; most large deposits mapped, but in some areas, no deposits are shown.
Qal	SEDHUCaud	Alluvium, (Holocene), river and stream fill, fan deposits, unconsolidated.
Qc	SEDPUCaud	Pleistocene nonmarine sedimentary deposits, undeformed or slightly deformed dissected alluvial fan deposits.
Qco	SEDPUCaud	Pleistocene nonmarine sedimentary deposits extensively folded, faulted, and dissected alluvial fan deposits.
Qcol	SEDPUCaud	Pleistocene nonmarine sedimentary deposits, undeformed or slightly deformed dissected alluvial fan deposits.
Qdf	SEDPMCaud	Deposits of older dissected alluvial fans (Pleistocene), surfaces moderately to well dissected soil profiles, well developed argillic horizons.

Qdf?	SEDPMCaud	Deposits of older dissected alluvial fans (Pleistocene), surfaces moderately to well dissected soil profiles, well developed argillic horizons.
Qf	SEDHUCaud	Alluvial fan deposits (late Holocene) - Deposits of active and recently active alluvial fans and headward drainages of fans; bouldery, cobbly, gravelly, sandy, or silty.
Qfa	SEDHUCaf	Alluvial fan deposits (late Holocene) - Deposits of active and recently active alluvial fans and headward drainages of fans; dominantly sand; unconsolidated.
Qfag	SEDHUCac	Alluvial fan deposits (late Holocene) - Deposits of active and recently active alluvial fans and headward drainages of fans; dominantly sandy gravel; unconsolidated.
Qfgs	SEDHUCaf	Alluvial fan deposits (late Holocene) - Deposits of active and recently active alluvial fans and headward drainages of fans; dominantly gravelly silt; unconsolidated.
Ql	SEDHMClf	Lacustrine deposits (late Holocene) - Clay, silt and fine-grained sand; unconsolidated to moderately consolidated.
Qls	landslide	Landslide deposits (late Holocene) - Active or recently active landslides; unconsolidated to consolidated. Includes many early Holocene landslides that in part have been reactivated during late Holocene
Qlv	SEDHUClf	Lacustrine and fluvial deposits (late Holocene) - Mixed lacustrine and fluvial deposits. Clay, silt and fine-grained sand; unconsolidated to moderately consolidated.
Qo	SEDPWCaud	Older alluvium, dissected alluvial deposits (Pleistocene).
Qoa	SEDPWCaud	Old axial channel deposits (late to middle Pleistocene) - Gravel, sand and silt; gray, unconsolidated to indurated.
Qoa1	SEDPWCaud	Old axial channel deposits, Unit 1 (middle Pleistocene) - Gravel, sand and silt; gray, unconsolidated to indurated. Old part of Qoa.
Qoaa	SEDPWCaud	Old axial channel deposits (late to middle Pleistocene) - Gravel, sand and silt; gray, unconsolidated to indurated.
Qoaag	SEDPWCaud	Old axial channel deposits (late to middle Pleistocene) - Gravel, sand and silt; gray, unconsolidated to indurated.
Qoag	SEDPWCaud	Old axial channel deposits (late to middle Pleistocene) - Gravel, sand and silt; gray, unconsolidated to indurated.
Qoc	SEDPWCcc	Old colluvium deposits (late to middle Pleistocene) - Cobble- to boulder-colluvium; indurated.
Qocb	SEDPWCcc	Old colluvium deposits (late to middle Pleistocene) - Cobble- to boulder-colluvium; indurated. Dominantly boulders.
Qocg	SEDPWCcc	Old colluvium deposits (late to middle Pleistocene) - Cobble- to boulder-colluvium; indurated. Dominantly gravels.
Qof	SEDPWCaf	Old alluvial fan deposits (late to middle Pleistocene) - Sandy alluvium; reddish brown, indurated; surface of most fans slightly dissected.
Qof1g	SEDPWCac	Old alluvial fan deposits, Unit 1 (middle Pleistocene) - Sandy alluvium; reddish brown, indurated, surface of most fans slightly dissected. Dominantly gravel. Old part of Qof.

Qofa	SEDPWCaf	Old alluvial fan deposits (late to middle Pleistocene) - Sandy alluvium; reddish brown, indurated, surface of most fans slightly dissected.
Qofag	SEDPWCac	Old alluvial fan deposits (late to middle Pleistocene) - Sandy gravel alluvium; reddish brown, indurated, surface of most fans slightly dissected.
Qofb	SEDPWCac	Old alluvial fan deposits (late to middle Pleistocene) - Bouldery alluvium; reddish brown, indurated, surface of most fans slightly dissected.
Qofc	SEDPWCaf	Old alluvial fan deposits (late to middle Pleistocene) - Clayey alluvium; reddish brown, indurated, surface of most fans slightly dissected.
Qofg	SEDPWCac	Old alluvial fan deposits (late to middle Pleistocene) - Gravelly alluvium; reddish brown, indurated, surface of most fans slightly dissected.
Qofva	SEDPHMCaf	Old alluvial fan deposits and young alluvial valley deposits (late Pleistocene) - Sandy alluvium; reddish brown, moderately indurated. Has thin, discontinuous cover of Qyv.
Qols	SEDPsc	Old landslide deposits (late to middle Pleistocene) - Rock debris; most is fragmented, unconsolidated to consolidated.
Qova	SEDPUCaf	Old alluvial valley deposits (late to middle Pleistocene) - Sandy alluvium on valley floors; gray, unconsolidated to indurated.
Qowa	SEDPUCaf	Old alluvial wash deposits (late to middle Pleistocene) - Sand and gravelly sand flanking Santa Ana River.
Qp	SEDTPaud	(Plio-Pleistocene), nonmarine, silt, sand, gravel, and conglomerate (commonly volcanic composition, may be weakly indurated and tilted or deformed).
Qpf?	SEDPWCaf	Pauba Formation (Pleistocene) - Siltstone and sandstone. Two informal members.
Qpff	SEDPWCaud	Fanglomerate member of Pauba Formation (Pleistocene) - Fanglomerate and mudstone; grayish-brown, poorly sorted, well-indurated.
Qpfs	SEDPWCaf	Sandstone member of Pauba Formation (Pleistocene) - Sandstone containing sparse cobble- to boulder-conglomerate beds; brown, cross-bedded, moderately well-indurated.
Qpv	IGv	Pleistocene volcanics, rhyolite, andesites, basalts, and pyroclastics.
Qpvb	IGv	Pleistocene volcanic, basalt (flows and minor andesite and pyroclastic, members of Qpv).
Qr	SEDPDWud	Regolith (Pleistocene) - Deeply weathered rock and soil regolith.
Qra	SEDHUCaf	River Alluvium, flood-plain silt, fine sand and subordinate coarser sediments.
Qs	SEDHUCef	Wind blown sand (Quaternary), unconsolidated sand dunes and sheets.
Qsc	SEDHUCaud	Stream channel deposits (Holocene), (Whitewater river deposits).
Qt	SEDPMCaud	(Quaternary) nonmarine terrace, local stream terrace deposits, extensively dissected and locally folded.

Qt-Qal	SEDPHMCaud	(Quaternary) nonmarine terrace, local stream terrace deposits, extensively dissected and locally folded to Alluvium, (Holocene), river and stream fill.
QTa	SEDTPHUCaud	Alluvial fan and fluvial (Quaternary and Tertiary?), unconsolidated to weakly consolidated. Fan: angular, poorly sorted gravels and sands. Fluvial: commonly cross-bedded.
QTc Pleistocene	SEDTPINDac	Conglomeratic sedimentary rocks of Riverside West 7.5' quadrangle (early to late Pliocene?) - Conglomerate, nonmarine. Upper part contains boulders from Peninsular Ranges; lower part contains cobbles from San Bernardino Mtns.
QTcw	SEDTPINDac	Conglomerate unit of Wildomar area (Pleistocene and late Pliocene) - Conglomerate; cobbles and boulders.
QTdf	SEDTPWCaud	Dissected fan deposits (Quaternary or Tertiary), weakly consolidated, gravel and sand (local), fluvial deposits (Quaternary or Tertiary), weakly consolidated, gravel.
QTdfs	SEDTPWCaud	Dissected fan deposits (Quaternary or Tertiary), weakly consolidated, gravel and sand (local), fluvial deposits (Quaternary or Tertiary), weakly consolidated, gravel.
QTfg	SEDTPWCac	Fluvial gravel, primarily rounded gravel.
QTfs	SEDTPWCaf	Fluvial sand, primarily well-sorted sand and minor rounded gravel, common cross bedding.
QTn –	SEDPINDac	Late Cenozoic sedimentary rocks of Norco area (early Pleistocene to late Pliocene?) Conglomerate and conglomeratic sandstone in Norco area, nonmarine. Contains cobbles derived locally and from Transverse Ranges.
QTs	SEDPINDac	Unnamed late Cenozoic sedimentary rocks in Riverside and Corona areas (early Pleistonce to late Pliocene?) - Sandstone and conglomerate, nonmarine. Contains clasts from San Bernardino Mtns. and local clasts southeast of Riverside.
QTst	SEDTPWCaud	San Timoteo Formation, nonmarine sandstone, siltstone, conglomerate, and shale; forms extensive badlands topography (Pleistocene and Pliocene).
Qtsta	SEDPMCac	Conglomeratic sandstone beds of San Timoteo beds of Frick (1921) (Pleistocene) – Locally derived conglomeratic sandstone; nonmarine.
QTstu	SEDPMCacb	Upper member of San Timoteo beds of Frick (1921) (Pleistocene) - Interbedded sandstone and conglomerate;nonmarine; gray, coarse-grained, moderately indurated.
QTsw	SEDPMCaf	Sandstone unit of Wildomar area (Pleistocene and late Pliocene) - Sandstone; pale yellow-green, moderately-indurated.
QTt	SEDPMCac	Conglomerate of Temescal area (early Pleistocene to late Pliocene?) - Cobble conglomerate on Paleocene (?) surface.
Qvoa	SEDPMCaud	Very old axial channel deposits (middle to early Pleistocene) - Gravel, sand and silt; reddish-brown, well-indurated, surfaces well-dissected.
Qvoaa	SEDPMCaf	Very old axial channel deposits (middle to early Pleistocene) - Gravel, sand and silt; reddish-brown, well-indurated, surfaces well-dissected. Dominantly sand.
Qvoaac	SEDPMCaf	Very old axial channel deposits (middle to early Pleistocene) - Gravel, sand and silt;

		reddish-brown, well-indurated, surfaces well-dissected. Dominantly sandy clay.
Qvoag	SEDPMCac	Very old axial channel deposits (middle to early Pleistocene) - Gravel, sand and silt; reddish-brown, well-indurated, surfaces well-dissected. Dominantly gravel.
Qvof	SEDPMCaud	Very old alluvial fan deposits (middle to early Pleistocene) - Sandy alluvium; reddish-brown, well-indurated, fan surfaces well-dissected.
Qvof1	SEDPMCaud	Very old alluvial fan deposits, Unit 1 (early Pleistocene) - Gravel, sand and silt; reddish-brown, fan surfaces well-dissected. Old part of Qvof.
Qvof1a	SEDPMCaf	Very old alluvial fan deposits, Unit 1 (early Pleistocene) - Gravel, sand and silt; reddish-brown, fan surfaces well-dissected. Old part of Qvof. Dominantly sand
Qvof1g	SEDPMCac	Very old alluvial fan deposits, Unit 1 (early Pleistocene) - Gravel, sand and silt; reddish-brown, fan surfaces well-dissected. Old part of Qvof. Dominantly gravel.
Qvofa	SEDPMCaf	Very old alluvial fan deposits (middle to early Pleistocene) - Sandy alluvium; reddish-brown, well-indurated, fan surfaces well-dissected. Dominantly sand.
Qvofag	SEDPMCac	Very old alluvial fan deposits (middle to early Pleistocene) - Sandy alluvium; reddish-brown, well-indurated, fan surfaces well-dissected. Dominantly sandy gravel.
Qvofc	SEDPMCaf	Very old alluvial fan deposits (middle to early Pleistocene) - Sandy alluvium; reddish-brown, well-indurated, fan surfaces well-dissected. Dominantly clay.
Qvofg	SEDPMCac	Very old alluvial fan deposits (middle to early Pleistocene) - Sandy alluvium; reddish-brown, well-indurated, fan surfaces well-dissected. Dominantly gravel.
Qvols	SEDPMCsc	Very old landslide deposits (middle to early Pleistocene) - Rock debris; moderately well- to well-consolidated. Almost no primary landslide morphology preserved.
Qvsc	SEDHUCaud	Active valley deposits (late Holocene) - Active and recently active fluvial deposits along valley floors; gravel, sand and silt, unconsolidated.
Qw	SEDHUCaud	Wash deposits (late Holocene) - Alluvium in active and recently active washes; bouldery to sandy, unconsolidated.
Qwa	SEDHUCaf	Wash deposits (late Holocene) - Alluvium in active and recently active washes; dominantly sand, unconsolidated.
Qwag	SEDHUCaud	Wash deposits (late Holocene) - Alluvium in active and recently active washes; dominantly sandy gravel, unconsolidated.
Qya	SEDPHUCaud	Young axial channel deposits (Holocene and late Pleistocene) - Gravel, sand and silty alluvium; gray, unconsolidated.
Qyaa	SEDPHUCaf	Young axial channel deposits (Holocene and late Pleistocene) - Gravel, sand and silty alluvium; gray, unconsolidated. Dominantly sand.
Qyaag	SEDPHUCac	Young axial channel deposits (Holocene and late Pleistocene) - Gravel, sand and silty alluvium; gray, unconsolidated. Dominantly sandy gravel.
Qyag	SEDPHUCac	Young axial channel deposits (Holocene and late Pleistocene) - Gravel, sand and silty alluvium; gray, unconsolidated. Dominantly gravel.
Qye	SEDPHUCef	Young eolian deposits (Holocene and late Pleistocene) - Very fine- to medium-grained

		sand, unconsolidated; dune morphology apparent.
Qyf	SEDPHUCaud	Young alluvial fan deposits (Holocene and late Pleistocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated
Qyf1a	SEDPHUCaf	Young deposits of alluvial fans, Unit 1 (early Holocene and late Pleistocene) - Sandy alluvial fan deposits, may contain boulders; unconsolidated. Oldest Qyf unit.
Qyf1g Gravelly	SEDPHUCac	Young deposits of alluvial fans, Unit 1 (early Holocene and late Pleistocene) - alluvial fan deposits, may contain boulders; unconsolidated. Oldest Qyf unit.
Qyf1gs Gravelly	SEDPHUCaf	Young deposits of alluvial fans, Unit 1 (early Holocene and late Pleistocene) - silt alluvial fan deposits, may contain boulders; unconsolidated. Oldest Qyf unit.
Qyf2	SEDHUCaud	Alluvial fan deposits (Holocene) with slightly to moderately dissected surfaces and soil profiles lacking argillic horizons.
Qyf3gs	SEDHUCaf	Young deposits of alluvial fans, Unit 3 (late and middle Holocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated. Dominantly gravelly sand.
Qyf4 mixtures,	SEDHUCaud	Young deposits of alluvial fans, Unit 4 (late Holocene) - Gravel, sand and silt, some contain boulders; unconsolidated. Most recent Qyf unit.
Qyf4gs	SEDHUCaf	Young deposits of alluvial fans, Unit 4 (late Holocene) - Gravelly silt alluvial fan deposits, some contain boulders; unconsolidated. Most recent Qyf unit.
Qyfa	SEDPHUCaf	Young alluvial fan deposits (Holocene and late Pleistocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated. Dominantly sand.
Qyfag	SEDPHUCaf	Young alluvial fan deposits (Holocene and late Pleistocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated. Dominantly sandy gravel.
Qyfbg	SEDPHUCac	Young alluvial fan deposits (Holocene and late Pleistocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated. Dominantly bouldery gravel.
Qyfg	SEDPHUCac	Young alluvial fan deposits (Holocene and late Pleistocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated. Dominantly gravel.
Qyfga	SEDPHUCaf	Young alluvial fan deposits (Holocene and late Pleistocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated. Dominantly gravelly sand.
Qyfgs	SEDPHUCaf	Young alluvial fan deposits (Holocene and late Pleistocene) - Gravel, sand and silt, mixtures, some contain boulders; unconsolidated. Dominantly gravelly silt.
Qyls	SEDPHUCsc	Young landslide deposits (Holocene and late Pleistocene) - Rock debris and rubble, unsorted. All or parts of many Qyls landslides subject to renewed movement; primary landslide morphology typically preserved.
Qyls?	SEDPHUCsc	Young landslide deposits (Holocene and late Pleistocene) - Rock debris and rubble, unsorted. All or parts of many Qyls landslides subject to renewed movement; primary landslide morphology typically preserved.
Qyv1a	SEDPHUCaf	Young alluvial valley deposits, Unit 1 (early Holocene and late Pleistocene) - Silty to sandy alluvium west of Casa Loma Fault; gray, unconsolidated. Dominantly sand.

Qyva alluvium	SEDPHUCaf	Young alluvial valley deposits (Holocene and late Pleistocene) - Silty to sandy on valley floors; gray, unconsolidated. Dominantly sand.
Qyvca alluvium	SEDPHUCaf	Young alluvial valley deposits (Holocene and late Pleistocene) - Silty to sandy on valley floors; gray, unconsolidated. Dominantly clayey sand.
Qyvcs alluvium	SEDPHUCaf	Young alluvial valley deposits (Holocene and late Pleistocene) - Silty to sandy on valley floors; gray, unconsolidated. Dominantly clayey silt.
Qyvsa alluvium	SEDPHUCaf	Young alluvial valley deposits (Holocene and late Pleistocene) - Silty to sandy on valley floors; gray, unconsolidated. Dominantly silty sand.
Qyvsc alluvium	SEDPHUCaf	Young alluvial valley deposits (Holocene and late Pleistocene) - Silty to sandy on valley floors; gray, unconsolidated. Dominantly silty clay.
Qywa dominantly	SEDPHUCaf	Young alluvial wash deposits (Holocene and late Pleistocene) - Deposits of sand flanking active Santa Ana River; unconsolidated.
Qywag dominantly	SEDPHUCaf	Young alluvial wash deposits (Holocene and late Pleistocene) - Deposits of sandy gravel flanking active Santa Ana River; unconsolidated.
sbb	IGMET	Granitoid, prebatholithic, sedimentary, metasedimentary, and metaplutonic rocks of Mesozoic, Paleozoic and Precambrian age (San Bernardino Mnts. block).
sgb	IGMET	Granitoid, prebatholithic, metasedimentary, and metaplutonic rocks of Mesozoic, Paleozoic and Precambrian age (San Gabriel Mtns. block).
QTdfs	SEDTPWCaud	Dissected fan deposits (Quaternary or Tertiary), weakly consolidated, gravel and sand (local), fluvial deposits (Quaternary or Tertiary), weakly consolidated.
Tbt	SEDTINDud	Tufa, thin (<2m) locally extensive sheets of limestone coating Miocene and older bedrock units; locally includes conglomerates.
Tbx	SEDTMCsc	Sedimentary breccia - unbedded, unsorted deposits of angular gravel and slideblock; interpreted as landslide deposits. Largest slide block shown.
Tc	SEDTINDmf	Capistrano Formation (early Pliocene and Miocene) - Marine sandstone. Includes one member and two facies.
Tcg	SEDTINDac	Conglomerate in the Lake Mathews area (Miocene?) - Cobble conglomerate; coarse-grained sandstone matrix, massively bedded, indurated. Lacks red rhyolite clasts of Tcgr.
Tcga	SEDTMCac	Conglomerate at Arlington Mountain (Paleogene?) - Cobble conglomerate; composed of exotic welded tuff clasts.
Tcgr	SEDTINDac	Rhyolite-clast conglomerate of Lake Mathews area (Miocene?) - Cobble conglomerate; coarse-grained sandstone matrix, massively bedded, indurated. Cobble clasts are red rhyolite.

Tch	SEDTMCmac	Sandstone and conglomerate in southeastern Chino Hills (early Pliocene and Miocene) - Sandstone and conglomerate; marine and nonmarine.
Tep	SEDTMCac	Sandstone of Elsinore Peak (Paleogene?) - Sandstone and pebbly sandstone.
Tf	SEDTMCmud	Fernando Formation (Pliocene) - Siltstone, sandstone, pebbly sandstone, and conglomerate; marine. Includes two members separated by regional erosional unconformity.
Tfbx	SEDTMCsc	Fanglomerate, sedimentary breccia and slide block, undivided (Miocene and Oligocene).
Ti	IGp	Tertiary intrusive.
TiB	IGp	Felsic intrusive rocks (Miocene and Oligocene?), fine-grained, hypabyssal, probable rhyolitic to dacitic.
Tl-Ql?	SEDTPWClfb	Lake deposits of Tertiary or Quaternary age? Lake deposits, interbedded fossiliferous shale and sandstone to playa deposits.
Tlm	SEDTafm	Lake Mathews Formation (Miocene) - Mudstone, minor conglomerate, and poorly bedded sandstone; massively bedded, nonmarine.
Tlm?	SEDTafm	Lake Mathews Formation (Miocene) - Mudstone, minor conglomerate, and poorly bedded sandstone; massively bedded, nonmarine.
Tmea	SEDTMCac	Arkosic sandstone member of Mount Eden Formation of Fraser (1931) (Miocene) – Nonmarine sandstone, pebbly sandstone and conglomerate, coarse-grained, thick-bedded.
Tmeb	SEDTMCac	Tonalite boulder breccia of Mount Eden Formation of Fraser (1931) (Miocene) – Tongues of monolithologic tonalite boulder breccia in Tmea.
Tmec	SEDTMCac	Conglomeratic sandstone member of Mount Eden Formation of Fraser (1931) (Miocene) - Nonmarine coarse-grained and pebbly sandstone, and conglomerate; massive to indistinctly bedded.
Tmels	SEDTMCaud	Lower sandstone member of Mount Eden Formation of Fraser (1931) (Miocene) – Nonmarine sandstone, pebbly sandstone and minor limestone.
Tmem	SEDTINDaffract	Mudrock member of Mount Eden Formation of Fraser (1931) (early Pliocene and Miocene) - Nonmarine mudrock, dark gray-green, hackly fracturing to locally fissile.
Tmeus	SEDTINDafbfract	Upper sandstone member of Mount Eden Formation of Fraser (1931) (early Pliocene and Miocene) - Nonmarine sandstone, fissle to hackly fracturing mudrock; pale brown, well-sorted, thin-to medium-bedded, indurated.
Tns	SEDTUCaud	Sandstone of Norco area (Pliocene) - Sandstone containing local conglomerate lenses; greenish-yellow, unconsolidated.
TP	SEDTMCmudb	Puente Formation (early Pliocene and Miocene) - Marine shale, siltstone, sandstone, and conglomerate. Includes four members.
Tps	SEDTMCmfb	Soquel Member of Puente Formation (Miocene) - Predominately sandstone and siltstone.

Tpsc	SEDTMCmcm	Sycamore Canyon Member of Puente Formation (early Pliocene and Miocene) – Predominately sandstone and pebble conglomerate.
Tpy	SEDTMCmfb	Yorba Member of Puente Formation (Miocene) - Predominately siltstone and sandstone.
TRd	IGpMETfol	Triassic? diorite and gabbro; locally metamorphosed to amphibolite.
TRgd	IGpfol	Mount Lowe granodiorite, foliated, monzonite to diorite.
TRqm	IGp	Triassic quartz monzonite and monzodiorite.
Tsa	SEDTMCmfb	Santiago Formation (middle Eocene) - Sandstone and conglomerate, marine and nonmarine.
Tsb	SEDTMCsc	Slide blocks, (Miocene and Oligocene?), angular blocks and slabs. (Mesozoic? and Paleozoic) carbonate rocks and quartzite, (interpretation: landslides).
Tsi	SEDTDWamud	Silverado Formation (Paleocene) - Sandstone, siltstone and conglomerate; nonmarine and marine. Much of unit is thoroughly weathered.
Tstd	SEDTMCaf	Beds of San Timoteo beds of Frick (1921) (Pliocene) - Highly deformed sandstone, pebbly sandstone and conglomerate in Tstm; restricted to western part; nonmarine.
Tstl fine-	SEDTMCaf	Lower member of San Timoteo beds of Frick (1921) (Pliocene) - Sandstone, gray, grained, well-sorted; contains subordinate pebble lenses; nonmarine. Moderately weathered.
Tstlc	SEDTMCafb	Beds of San Timoteo beds of Frick (1921) (Pliocene) - Interval of claystone, shale, siltstone, and very fine-grained sandstone in Tstl; nonmarine.
Tstm	SEDTINDac	Middle member of San Timoteo beds of Frick (1921) (Pliocene) - Sandstone and conglomerate; contains abundant red-hued stratigraphic intervals; nonmarine.
Tt	SEDTMCmud	Topanga Formation (middle Miocene) - Marine sandstone, siltstone and locally conglomerate.
Tta	SEDTINDaf	Temecula Arkose (Pliocene) - Sandstone, medium- to coarse-grained, indurated, fluvial.
Tv	IGv	Tertiary volcanic.
Tvep	IGv	Basalt of Elsinore Peak (Miocene) - Vesicular basalt flows.
Tvh	IGv	Basalt of Hogbacks (Miocene) - Remnant of a channel-filling basalt flow.
Tvs	SEDTmudb	Vaqueros and Sespe Formations, undifferentiated (early Miocene, Oligocene and late Eocene) - Interbedded sandstone and conglomerate; marine and nonmarine.
Tvsr	IGv	Santa Rosa basalt of Mann (1955) (Miocene) - Vesicular basalt flows.
Tvss	SEDTmudb	Vaqueros, Sespe, Santiago, and Silverado Formations, undifferentiated (early Miocene, Oligocene and Paleocene) - Sandstone, siltstone, and conglomerate; nonmarine and marine.

Tvt	IGv	Basalt of Temecula area (Miocene) - Vesicular basalt flows.
ub	IGp	Mesozoic ultrabasic intrusive rocks; pyroxenite, hornblendite, metaperidotite, and metapyroxenite.
water	water	water body

GROUNDWATER - SHALLOW

Coverage Description: Depth to Groundwater in Riverside County
Coverage distribution file name: gwcntrs.e00 (groundwater contours); gwwells.e00 (groundwater wells)
Import Location: Only that area where groundwater exists within the upper 400 feet was mapped.

VITAL STATISTICS: gwcntrs.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	
Source Media:	Paper maps, reports
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polylines
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polylines
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: gwcontrs.e00
RECORD LENGTH: 243

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Depth_to_GW	-	I

VITAL STATISTICS: gwwells.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	SAWPA, USGS, and Western Municipal Water District
Source Media:	Paper maps, Digital, repots
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	points
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: gwwells.e00
RECORD LENGTH: 1,114

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Well_ID	10	C
2	City	10	C
3	Site	10	C
4	Long	-	F
5	Lat	-	F
6	Well_Elev	-	F
7	Depth_To_GW	-	F
8	Elev_of_GW	-	F
9	Well_Depth	-	I
10	Date	-	D

Groundwater was mapped using data from the Regional Water Quality board, SAWPA, and USGS reports on groundwater within Riverside County. The groundwater is reported as the highest recorded elevation. Groundwater is only mapped in areas where sufficient data was available. There could be areas of perched water that have not been mapped throughout the county. Contours were created based on data collected from the various water districts through Santa Ana Watershed Project Authority. Reports located at the Regional Water Quality board were used to augment the data collected from the various water districts. All data was analyzed for highest historical recorded elevation. This data should be only considered for regional analysis only.

FALL 1998 COOPERATIVE WELL MEASURING PROGRAM, STEVEN E. MAINS, Geo-hydrologist, Regional Programs & Projects, and Western Municipal Water District. Western Municipal Water District distributed groundwater data in the Fall, 1998 Cooperative Well Measurement Report. This report includes data from 56 agencies for over 2,300 wells. This report contains water levels from monitoring wells at selected service stations within Riverside and San Bernardino Counties. The report includes abandoned or destroyed wells. The rationale for this is that knowing if a well did exist at a specific location, a well log may be available and historical data on water levels and water quality may be found. Please note that because the data are shown to two decimal places, this does not imply that degree of accuracy. Due to a flaw in the computer spreadsheet program (or my abilities to use it), we are unable to intermix varying number of decimal points. Many measuring point elevations are estimated from topographic maps and may be 5 to 10 feet in error. Also many agencies supply data using airlines that may have an accuracy of +/- several feet. California Regional Water Quality Control Board, Santa Ana Region; Leaking Underground Storage Tank Information System (LUSTIS).

Case No.	Site Name
083301358T	Stearns Downtown Liquor
083302925T	Mobil S5 #18-D3H
083302039T	Alameda Management #542 Tesoro
083300337T	Sears Service Center
083300039T	Arco Service Station (Gasup)
083301226T	Mobil SS #18-465
083301291T	Texaco/Former Gulf Oil
083301901T	Fastrip #16
083300601T	Exxon Service Station #2899
083303149T	Mobil SS #18-D9M
083300084T	Campbell Oil Company
083300247T	Mobil SS #18-D8H
083300511T	Texaco SS (Former Exxon SS)
083302230T	Circle K Store #0911
083302519T	Texaco Service Station
083303273T	Thrifty #342 / Arco #9712
083302389T	Arco Service Station #5168
083302721T	US Army (Camp Anza) Tank C2-A
083302407T	Georgia Pacific Corp.
083301613T	Indian Hills Country Club
083302686T	Bourns Inc.
083302339T	Inland Frame & Design
083300766T	Mobil Bulk Plant
083300182T	Hamblins Body & Paint Shop
083300478T	ROHR Industries Inc.
083302723T	US Army (Camp Anza) Tank B10
083301173T	Fairmount Park Golf Course
083300500T	Devoe Marine Coating Company
083301920T	"Parflite, Inc. / Texaco"
083302500T	Riverside Air Service
083302038T	Riverside Marketing / Texaco SS
083302534T	Arco Service Station #1941
083302378T	Unocal Service Station #5714
083302835T	Unocal Service Station #5714

083301831T	Shearer's Serv U Self
083300737T	Prudential Overall Supply Co.
083301716T	NewCo
083300158T	"Fleetwood Homes of CA., Inc."
083302866T	Alvord Unified School District
083301259T	Johnson Machinery
083301649T	M.W.D. Lake Mathews
083301196T	Mobil SS #18-182
083302111T	Alameda Management #503
083302778T	Mobil SS #18-H59
083302647T	Texaco Service Station
083301604T	Riverside Partners
083303117T	Unocal Service Station #6975
083302338T	La Sierra Soft Touch
083300401T	Texaco Service Station
083301395T	"Humphries, Clarence, Real Prop"
083302829T	Chevron S S #5520
083301311T	Wall's Hauling Service
083303276T	L V W Brown Estates
083300131T	E-Z Serve Station #0090/Unocal
083301765T	Pepsi-Cola West
083302211T	Riverside Landfill
083301717T	Cal Target / Pronto Marketing
083302877T	Texaco Service Station
083302540T	Unocal Service Station #3779
083301863T	USA Gasoline #240
083302548T	Brookhurst Mill
083301853T	Chevron S S #4702
083302914T	Texaco Service Station
083301223T	Arco Service Station #1916
083301964T	National Convenience Stores
083301612T	Thrifty Oil SS #340
083300823T	Unocal Service Station #0014
083302651T	Southland #16652
083302900T	G & K Petro Inc.
083301728T	Slamal Property
083301758T	Las Plumas Lumber Co.
083300480T	Certain-Teed Corporation
083300106T	Cheveron S S #7743
083302352T	Mission Carwash / Koin Karwash
083302467T	Stop-N-Go (Circle K)
083302177T	Circle K Store
083302618T	Cheveron S S #2987
083300621T	Mobil SS #18-HTY
083302921T	Mobil SS #18-HTY
083302569T	Unocal Service Station
083302233T	Mobil SS #18-FNY
083302275T	Unocal Service Station #2865
083301028T	Exxon Service Station #1776
083303186T	Thrifty #335 / Arco #9705
083302608T	Mobil SS
083303187T	Thrifty #339 / Arco #9709
083302639T	Unocal Service Station #6216
083301507T	Thirfty Oil SS #337
083301644T	Chevron S S #3563
083300977T	Orange Heights
083300965T	Thrifty Oil SS #352

083301506T	Arco Service Station #3033
083301314T	Circle K Store #0552
083300034T	Cheveron S S #0070
083301107T	Circle K Store #0604
083300483T	Chevron S S #3540
083302056T	"Lake Elsinore, City of"
083302648T	Thrifty Oil SS #348
083302975T	Circle K Store #0912
083301187T	Arco Service Station #1807
083301895T	Chevron S S #7568
083301646T	Thrifty Oil SS #338
083301335T	Circle K Store #0339
083300828T	Thrifty Oil SS #351
083301719T	Arco Service Station #1250
083302114T	Circle K Store #0575
083301200T	Arco Service Station #1841

References:

Dibblee, T.W., Burnham, W.L. and Dutcher, L.C., Geologic Map of the San Timoteo-Smiley Heights Area, Upper Santa Ana Valley, Southern California, Showing Water Levels for 1967., 1968.

Moreland, J.A., Map of the Eastern Part of the Upper Santa Margarita River Watershed, Riverside and San Diego Countys, California, 1972.

Moyle, W.R, 1973, Map of the Santa Rosa Rancho and Vicinity Riverside and San Diego Counties, California, Showing Reconnaissance Geology and Location of Wells and Springs.

USGS Water Resources Investigation Report 88-4029.

USGS Water Resources Investigation Report 94-4127. Beneath Various Land Uses, Riverside and San Bernardino Counties, CA 1991-93.

USGS Water Resources Investigation Report 98-4102. Geohydrology of the Winchester Subbasin, Riverside County, California.

Williams, Daniel. Groundwater Modeling Moreno and Perris Valley, March 1998.

HIGHFIRE

Coverage Description: Area of high probability for occurrence of wildfires in Riverside County
Coverage distribution file name: fire.e00
Import Location:

VITAL STATISTICS: highfire.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	State of California, USGS,
Source Media:	Paper maps, Digital, Mylar
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: fire.e00
RECORD LENGTH: 414

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Zone	-	I
2	Fire_Hazard	15	C

AREAS OF THE COUNTY WHERE, DUE TO VEGETATION COMMUNITY TYPE AND SLOPE, THERE IS A HIGH PROBABILITY FOR OCCURRENCE OF WILDFIRES. THESE AREAS HAVE BUILDING RESTRICTIONS AS TO MATERIALS USED IN CONSTRUCTION.

Very high:
Fuel load heavy and slope over 40%, (average of 36.96 tons/acre), Predominant fuel type: Woods-brushwood including timber, woodland, large brush types over 6 feet in height and crown density >20%

High:
Medium fuel load and slope over 40%, (average of 17.33 tons/acre), Predominant fuel type: Scrub including brush and other perennial shrubs less than 6 feet in height and crown density of >20%

Or

Heavy fuel load, (average of 36.96 tons/acre), Predominant fuel type: Woods-brushwood including timber, woodland, large brush types over 6 feet in height and crown density >20%

Moderate:
Light fuel load and slope over 60%, (average of 2.22 tons/acre), Predominant fuel type: Grasslands including grass, annual herbs, weeds, small shrubs

Or

Medium fuel load and slope under 40%, (average of 17.33 tons/acre), Predominant fuel type: Scrub including brush and other perennial shrubs less than 6 feet in height and crown density of >20%

Low:
Light fuel load and slope over 40%, (average of 2.22 tons/acre), Predominant fuel type: Grasslands including grass, annual herbs, weeds, small shrubs

Very Low:
Light fuel load, (average of 2.22 tons/acre), Predominant fuel type: Grasslands including grass, annual herbs, weeds, small shrubs

None:
No fuel load, Developed areas with no natural vegetative fuel type

Determination for fire hazard potential was accomplished by evaluating vegetation density and type, slope, and their relation to urbanization. Vegetation data was obtained from the California Gap Analysis Project ñ University of California Santa Barbara. These data consist of land coverage and vegetation information for the state of California, including canopy dominant species, canopy density, presence of regional endemic species, and inclusion of wetland habitats. All reference and attribute information for this dataset may be found at this website: http://www.biogeog.ucsb.edu/projects/gap/data/meta/landcovdd.html#section1

Evaluation of the California Gap Analysis vegetation data was performed by identifying the primary, secondary and tertiary vegetation community type for each polygon and then assigning a rating for the potential for fire hazard based on fuel loading, in accordance with the HUD Study System (1973) and the Bates Bill Process (AB337, 1992). These initial assignments of fuel hazard ratings for grasslands, shrublands, and woodlands consisted of light, medium, and heavy, respectively. These ratings were then normalized based on the primary, secondary and tertiary type of vegetation communities. Some of these data were modified based on their slope angle and whether they occurred in highly urbanized areas. Slopes of 0-40%, 41-60%, and over 60% were used because an increased slope is recognized as a greater fire spreading potential characteristic. This modification to

the fuel hazard ratings produced fire hazard potential ratings consisting of none, very low, low, moderate-low, moderate, high, and very high.

Listing by Natural Data Base Riverside	California Gap Analysis Project Descriptions	HUD Study System	Bates Bill Proces	Wildfire Potential	Wildfire Potential Rating
11100	URBAN OR BUILT-UP LAND	0	0	low	2
11200	AGRICULTURAL LAND	0	0	low	2
11210	ORCHARDS AND VINEYARDS	0	0	low	2
11520	PERMANENTLY-FLOODED LACUSTRINE HABITAT	0	0	none	0
11730	SANDY AREAS OTHER THAN BEACHES	0	0	none	0
11740	BARE EXPOSED ROCK	0	0	none	0
11750	STRIP MINES, QUARRIES AND GRAVEL PITS	0	0	none	0
22000	DESERT DUNES	0	0	none	0
32300	VENTURAN COASTAL SAGE SCRUB	8	2	high	4
32300	VENTURAN COASTAL SAGE SCRUB	8	2	high	4
32500	DIEGAN COASTAL SAGE SCRUB	8	2	high	4
32700	RIVERSIDEAN SAGE SCRUB	8	2	high	4
33100	SONORAN CREOSOTE BUSH SCRUB	8	2	low	2
33200	SONORAN DESERT MIXED SCRUB	8	2	low	2
34100	MOJAVE CREOSOTE BUSH SCRUB	8	2	low	2
34210	MOJAVE MIXED WOODY SCRUB	8	2	low	2
34220	MOJAVE MIXED STEPPE	8	2	moderate-	3
34240	MOJAVE MIXED WOODY AND SUCCULENT SCRUB	8	2	low	2
34300	BLACKBUSH SCRUB	8	2	low	2
35210	BIG SAGEBRUSH SCRUB	8	2	low	2
36110	DESERT SALTBUSH SCRUB	8	2	low	2
37120	SOUTHERN MIXED CHAPARRAL	8	2	high	4
37200	CHAMISE CHAPARRAL(CHAMISAL)	8	2	high	4
37300	REDSHANK CHAPARRAL	8	2	high	4
37400	SEMI-DESERT CHAPARRAL	8	2	high	4
37510	MIXED MONTANE CHAPARRAL	8	2	high	4
37530	MONTANE CEANOTHUS CHAPARRALS	8	2	high	4
37810	BUCK BRUSH CHAPARRAL	8	2	high	4
37830	HOARY-LEAFED CHAPARRAL	8	2	high	4
37840	BIG POD CHAPARRAL	8	2	high	4
37900	SCRUB OAK CHAPARRAL	8	2	high	4
37A00	INTERIOR LIVE OAK CHAPARRAL	8	2	high	4
37B00	UPPER SONORAN MANZANITA CHAPARRAL	8	2	high	4
37G00	COASTAL SAGE-CHAPPARAL SCRUB	8	2	high	4
42110	VALLEY NEEDLEGRASS GRASSLAND	1	1	very high	5
42200	NON-NATIVE GRASSLAND	1	1	very high	5
46000	ALKALI PLAYA	0	0	very low	1
52410	COASTAL AND VALLEY FRESHWATER MARSH	1	2	low	2
61310	SOUTHERN COAST LIVE OAK RIPARIAN FOREST	16	3	moderate-	2

61330	SOUTHERN COTTONWOOD-WILLOW RIPARIAN	16	3	moderate-	2
62200	DESERT DRY WASH WOODLAND	16	3	low	2
62400	SOUTHERN SYCAMORE-ALDER RIPARIAN	16	3	low	2
63310	MULE FAT SCRUB	8	2	moderate	3
71160	COAST LIVE OAK WOODLAND	16	3	moderate-	3
71182	DENSE ENGELMANN OAK WOODLAND	16	3	moderate-	3
72200	MOJAVEAN PINYON AND JUNIPER WOODLANDS	16	3	moderate-	4
72300	PENINSULAR PINYON AND JUNIPER WOODLANDS	16	3	moderate-	4
81310	COAST LIVE OAK FOREST	16	3	moderate-	4
81320	CANYON LIVE OAK FOREST	16	3	moderate-	4
84140	COULTER PINE FOREST	16	3	high	4
84150	BIGCONE SPRUCE-CANYON OAK FOREST	16	3	high	4
84210	WESTSIDE PONDEROSA PINE FOREST	16	3	high	4
84230	SIERRAN MIXED CONIFER FOREST	16	3	high	4
85210	JEFFREY PINE-FIR FOREST	16	3	high	4
85320	SOUTHERN CALIFORNIA WHITE FIR FOREST	16	3	high	4
86500	SOUTHERN CALIFORNIA SUBALPINE FOREST	16	3	high	4
99999	No secondary or tertiary type	0	0	NA	0

References:
Detailed descriptions of the rating systems may be found at http://www.prefire.ucfpl.ucop.edu/fire_map.htm
Those rating systems used for comparison by ECI are described in detail in the following paragraphs.

HUD Study System
As a result of concerns over fire hazards in California, in April of 1973 the California Department of Forestry and Fire Protection (CDF) published a report funded by the Department of Housing and Urban Development (HUD) under agreement with the Governor's Office of Planning and Research. This CDF report was prepared by Roger Helm, Barritt Neal, and Leroy Taylor. Similar to other studies, it came as a response to a disaster; in this case the 1970 wildfires which burned over 580,000 acres in 773 fires from September 22 through October 4, 1970. This study uses fuel loading, fire weather, and slope as the three rating factors. It combines fuel loading based on United States Geological Survey (USGS) life forms, fire weather based on the California Wildland Fire Danger Rating System (CWFDRS), and three slope classes also taken from CWFDRS.
These criteria are described below:

FUEL LOADING:
Fuel loading includes three classes. *Light* fuels occupy the uncolored areas on the USGS maps and represent flammable grass and annual herbs. *Medium* fuels are shown as "scrub" on the USGS maps and include brush and other perennial shrubs less than six feet in height and having a crown density of 20 percent or more. *Heavy* fuels are shown as "woods-brushwood" on the USGS maps and include the heavier brush species, woodland types, and timber types over six feet in height and having a crown density of 20 percent or more.

Light (grass): average of 2.22 tons/acre Fuel Severity Factor = 1
Medium (scrub): average of 17.33 tons/acre Fuel Severity Factor = 8
Heavy (woods-brushwood): average of 36.96 tons/acre Fuel Severity Factor =16

The vegetative types were accurate to the nearest acre. This system was used because the three types listed above could easily be determined from the USGS maps, and they represented a fairly accurate description of fuels found in California without having to undertake a major vegetation mapping project. The alternatives considered included the 1946 Weislander and Jensen system found in Forest Survey Release Number 4, the 1960 Cooperative Soil Vegetation Survey maps which were not available for the entire state, and the U.S. Forest Service Region V fuel type maps.

FIRE WEATHER SEVERITY:

Fire Weather also includes three classes. Each class is related to the frequency of critical fire weather days occurring in each of the state's Fire Danger Rating Areas over a 10-year period. The *Low* class (Class I) includes all those Fire Danger Rating Areas which have experienced fire weather in the "very high" or "extreme" ranges an annual average of less than one day, the *High* class (Class II) an annual average of 1 to 9.5 days, and the *Extreme* class (Class III) an annual average of more than 9.5 days. Each USGS topographic map in the state is keyed to one of the Fire Danger Rating Areas and assigned that Area's critical fire weather frequency classification.

I (<1 day per year) Fire Weather Severity Factor = 1
II (1-9.5 days per year) Fire Weather Severity Factor = 2
III (>9.5 days per year) Fire Weather Severity Factor = 8

These ratings were listed for 354 stations throughout California, and averaged from adjacent stations for 151 Fire Danger Rating Areas. The periods from June through December were analyzed over a ten-year period, and each area was ranked using the scale above. It was found that 75% of the 678 fires of over 300 acres in size from 1959-69 occurred in areas where the Fire Weather Severity ranking was III, and 79% of the 109 fires of over 5,000 acres in size during the same period occurred in the same areas. The HUD Study System used California's Interagency Wildland Fire Danger Rating System (WFDRS) to describe the collection of weather information and the calculation of the various factors as described under Fire Weather Severity above.

SLOPE:
Slope also includes three classes: 0-40 percent, 41-60 percent, and over 60 percent. Each class is assigned a value, derived from the WFDRS. Slope is recognized by this system as having an effect on fire behavior similar to the effect of wind; i.e., an increase in slope produces an increase in the rate of fire spread. The system therefore assigns values to slope, which modify the various fire danger indexes accordingly.

I (>40%) Slope Severity Factor = 1.0
II (41-60%) Slope Severity Factor = 1.6
III (>60%) Slope Severity Factor = 2.0

A slope class is used because it often determines how a wildland fire is fought, and by using the WFDRS it can be directly correlated to wind speed equivalents, which is a critical factor.

Fire Hazard Severity Scale:
As shown above, each class of fuel loading, fire weather, and slope is assigned a severity factor. The values are multiplied in a matrix form to produce a Fire Hazard Severity Scale. The scale was determined by multiplying the three factors together to determine a numerical rating. The gaps between the numerical categories below are due to the limitations of the factor values, from which only certain numbers can result.

Moderate Hazard 1 - 12.8 Points
High Hazard 16 - 32 Points
Extreme Hazard 51 - 256 Points

Due to fiscal and time constraints a map of California showing the three classes wasn't prepared. HUD did list the Critical Fire Weather Frequency Class for each of the USGS Quads for California, and the Fuel Loading is taken directly from the Quads. The slope can be either mechanically calculated or automatically calculated with a software program containing the USGS Quads (e.g. TopoScout).

Bates Bill Process
As described in Chapter II, the Bates Bill (AB 337) was a direct result of the great loss of homes and lives in the Tunnel Fire of 1991 in the Oakland/Berkeley Hills. CDF, given the responsibility but not the resources to carry out the state mandate, formed a working group to determine how to proceed. The group, comprised of state and local representatives, decided upon a workable system involving fuel, topography (slope), weather, and dwelling density as the foundation for the system, and added additional mitigation factors both plus and minus to adjust the score upward or downward. The basic system had a four-point minimum score with a thirteen-point maximum. The raters (in almost all cases one local representative and one CDF or Contract County representative) had the opportunity to adjust the score down by one point for certain mitigation measures. They also had the option of

increasing the score by one point for certain factors known to contribute to fire spread. To qualify as a Very High Fire Hazard Severity Zone (VHFHSZ), an area had to score 10 or more points. Potentially, the range of scores (including the mitigating factors) could range from a low of 1 to a high of 16. The recommended system was given an extensive field test by different members of the working group, and was then implemented. A copy of the rating form is found below.

CRITERIA - CLASSIFICATION POINTS
A. Fuel (NFPA 299). For each zone a fuel hazard rating shall be assigned. Where fuel types vary within a zone, the rating assigned for the zone shall be that which best represents the predominant fuel type.

1. Small, light fuels (Grass, Weeds, Shrubs) +1
2. Medium fuels (Brush, Large Shrubs, Small Trees) +2
3. Heavy fuels (Timber, Woodland, Large Brush, or Heavy Planting of Ornamentals) +3

B. Topography—Slope (NFPA 299 and FEMA). For each zone a Slope Hazard Rating shall be assigned. Where slopes vary within an area, the rating for the area shall be that which best represents the predominant slope range.

1. Flat to Mild Slope (0-9.9%) +1
2. Mild to Medium Slope (10-19.9%) +2
3. Medium to Moderate Slope (20-39.9%) +3
4. Moderate to Extreme Slope (40% +) +4

C. Dwelling Density (1991 Census or a local ordinance with higher standards). For each zone a dwelling rating shall be assigned. A check with each area for local ordinances regarding swelling density must be accomplished before setting this factor.

1. Low (less than one structure per 10 acres) +1
2. Medium (one structure per 5 to 10 acres) +2
3. High (one structure per 0 to 5 acres) +3

D. Weather (instructions for zoning fire hazard severity in State Responsibility lands in California). The ratings (EXH 1) show what each county is rated. This information is obtained for each county by using the Burning Index (BI). Weather is a major part of the BI system. The information for developing BI systems came from weather stations throughout the state.

1. Moderate +1
2. High +2
3. Very High +3

By adding the highest number for the four factors, you will have a total of 13 points. The point spread between ten (10) and thirteen (13) points represents the combination of factors needed to make up a Very High Fire Hazard Severity Zone.

MITIGATION MEASURES
These mitigation measures are points, plus or minus, that a local agency may use to mitigate a rating within its area, and could cause a higher or lower rating for the benefit of the local agency.

FACTORS—MINUS POINTS
1. Infrastructure—meets or exceeds minimums of ISO 8, NFPA 1231, PUC 103, or PRC 4290 -1
2. Housing or roofing ordinances (Class A, B, or better roof), sprinklers required, firesafe construction fuel modification, local option -1
3. PRC 4291 Ordinance or better (Natural Resource Protection) -1

OTHER FACTORS—PLUS
1. Rough topography with steep canyons or draws that would impede responding personnel and equipment. +1

2. Area with a history of high fire occurrence, related to surrounding areas, because of heavy lightning, railroad fires, debris burning, arson, etc. +1
3. Area subject to severe fire weather such as strong winds and lightning, and has constant seasonal weather patterns that contribute to increased fire activity. +1
4. Heavy concentration of flammable ornamentals or vegetation introduced by humans +1

TOTAL POINTS_____ VERY HIGH FIRE HAZARD SEVERITY ZONE? YES / NO
DESCRIPTION OF ZONE:
1. LATITUDE AND LONGITUDE_____
2. TOWNSHIP, SECTION, RANGE_____
3. NARRATIVE OF ZONE_____
_____
_____
DATE_____ SIGNATURE OF RATER_____

This rating system appears to be reasonable, and could be adopted as is, or with minor modifications, in most of California. Modifications might include reducing the minimum size of the area rated from 640 acres to perhaps 320 acres or even smaller, such as a subdivision. The weather component could be adjusted to reflect local conditions rather than county-wide conditions, which in some cases result in coastal areas rated too high and other areas too low. The fuel types on the rating form are easy to determine using the descriptions provided. The slope percent may require some field work with an abney or other device, or one could locate a county map showing these slope classes through the USGS, one's county or local planning department, or on the CDF Home Page (http://www.fire.ca.gov). Ordinances for adoption of state mandates are found in the Appendix.

In summary, the Bates system with or without modification does work, and has the advantage of being applicable statewide. A disadvantage is that a large number of local agencies decided not to acknowledge it. This means that the actual number of Very High Fire Hazard Severity Zones should be much higher than the number identified as part of the original Bates review. If fuels, topography, and weather with these criteria could be mapped using remote sensing to assure objectivity and uniformity, this system could produce a much more accurate hazard assessment. The information could then be used by local agencies, perhaps with additional criteria, to achieve hazard maps that are useful to individual jurisdictions.

LANDSLIDE HAZARD AREA

Coverage Description: Landslide Susceptible areas in Riverside County
Coverage distribution file name: Landslide.shp; Landman.e00 (Slope instability zones)
Import Location:

VITAL STATISTICS: landslide.shp

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	Geology and DEM (slope)
Source Media:	Created from Geology and Slope Maps
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: landslide.shp
RECORD LENGTH: 515,899

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Zone	-	I
2	Susptibility	30	C

VITAL STATISTICS: landman.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	Same as above
Source Media:	Same as above
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: landman.e00
RECORD LENGTH:

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Zone	-	I
2	Description	50	C

Earthquake-Induced Landslides and Earthquake-Induced Landslide Hazard Zones

Earthquakes have caused rockfalls, rock avalanches, debris flows, bluff collapse, and other types of potentially damaging landslide movements. The photo to the right shows a home that was undermined by a landslide triggered by the 1994 Northridge earthquake (LA Times Photo). Landslides were widespread during the 1906 San Francisco earthquake. Landslides tend to occur in loosely consolidated, saturated soils on sloping terrain. Landslides also tend to form distinctive landforms (scarps, troughs, disrupted drainages, etc.) that can be recognized by most trained geologists. Other types of oversteepened slopes (cliffs, stream banks, saturated soil-filled swales, man-made cuts and fills, etc.) are often prone to collapse when shaken by an earthquake. Research has shown that landslide deposits and certain geologic formations and other earth materials are prone to landslide failure. Water often is a contributing factor to landslide movement; thus springs, seeps, and man-introduced water sources (lawn watering, leach fields, storm drains, and water lines) can influence landslide creation, movement, and extent of damage.

These are the procedures followed during the creation of the Landslide and Slope Instability Map of Riverside County:

- Created a slope map for Riverside County by creating a grid map of the United States Geological Survey (USGS) Digital Elevation Model (DEM) for the county in Vertical Mapper. A 60m-grid cell size was used.
- Created a grid map of the Engineering Geology map in Vertical Mapper using a 60m-grid cell size.
- Queried both grid maps for areas that meet the parameters for slope instability and landslide susceptibility.

References:

CDMG Special Publication 117 (http:///www.consrv.ca.gov/dmg/pubs/sp/117/)

Randall W. Jibson, Edwin L. Harp and John A. Michael, A Method for Producing Digital Probabilistic Seismic Landslide Hazard Maps: An Example from the Los Angeles California, Area. USGS Open File Report 98-113, 1998.

Sadler, Peter, M. and Morton, Douglas, M., Landslides in a Semi-Arid Environment with emphasis on the Inland Valleys of Southern California. Inland Geological Society, 1989.

Landslide Susceptible e-types from Engineering Geology Map

SEDmMETfol
METSEDud
METSEDfol
METSEDb
METIGv
METfol
IGvMETfol
IGpMETfol
IGMETfol
IGvfract
IGpfolfract
IGpfol
SEDTWCaud
SEDTUCaud
SEDTPWCIfb
SEDTPWCaud
SEDTPaud
SEDTmudb
SEDTMCud
SEDTMCmudb
SEDTMCmud
SEDTMCmfb
SEDTMCmcb
SEDTMCaudb
SEDTMCaud
SEDTMCafb
SEDTMCaf
SEDTINDmudb
SEDTINDmfb
SEDTINDmf
SEDTINDmcb
SEDTINDaffract
SEDTINDafbfrac
SEDTaudb
SEDTafm
SEDPWCaf
SEDPDWud
METSEDfb
METSEDcb
IGvSEDudb
IGvSEDfb
SEDTaud
SEDTMCmb

Soil Classification for soils

Soils susceptible to disrupted soil slide	***Suscetpible to Soils slumps or soil block slides***
SEDPHUCac	SEDPHUCef
SEDHUCac	SEDPHUCaud
SEDHMClf	SEDPHUCaf
	SEDHUClf
	SEDHUCef
	SEDHUCaud
	SEDHUCaf
	SEDPHUCef
	SEDPHUCaud

Lithologies in Existing Landslides

SEDTMCsc
SEDPsc
SEDPMCsc
SEDPHUCsc
landslide

Lithologies Susceptible to Bedrock Slides

METSEDTINDm
METSEDm
METSEDIGv
METSED
METm
MET
IGpMET
IGMET
IGv
IGSED
IGp

SEDTWCmc
SEDTMCmcm
SEDTMCmac
SEDTMCac
SEDTINDud
SEDTINDmaub
SEDTINDaf
SEDTINDac
SEDTDWamud

Slope Map Classifications

Class	***Slope Angle (°)***
1	0 to 4.99
2	5 to 9.99
3	10 to 14.99
4	15 to 19.99
5	20 to 29.99
6	30 to 39.99
7	40 to 50

Landslide Susceptibility Zones

Data Source		Susceptible e-types	Engineering Geology Soil #1	Soil #2	Bedrock
	1	-	-	-	-
	2	-	-	2	-
Slope	3	6	-	3	-
Class	4	6	4	3	-
	5	7	4	3	-
	6	8	4	3	-
	7	9	4	3	5

Landslide Susceptibility Zones Explanation

9	Very High
8	High
7	Moderate-High
6	Moderate-Low
5	Bedrock Slides
4	Disrupted Soil Slide
3	Soil Slumps
2	Soil Block slides

Management Zones

- Derived using landslide.e00
- Buffer zones: .1 to .5 miles

Landslide e00 (zones)	Landslide e00 (susceptibility)	Landman (zone)
9	Very High	9
8	High	9
7	Moderate-High	9
6	Moderate-Low	9
5	Bedrock Slides	9
4	Disrupted Soil Slide	1
3	Soil Slumps	1
2	Soil Block slides	1

- Management zones (landman zones)
  - o 1 High susceptibility for soil slumps and block slides
  - o 9 Moderate to high slope instability
  - o 100 Previously mapped landslides

LIQUEFACTION

Coverage Description: Liquefaction Hazards in Riverside County
Coverage distribution file name: lique.e00
Import Location:

VITAL STATISTICS: lique.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	Geology and Groundwater
Source Media:	Created from Geology and Groundwater Maps
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: lique.e00
RECORD LENGTH: 5,012

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Zone	-	I
2	Susceptibility	254	C
3	Definition_1	254	C
4	Definition_2	254	C
5	Definition_3	254	C
6	Definition_4	254	C

Areas of the County where a potential for liquefaction exists, therefore these areas have requirements or liquefaction reports prior to approval of certain projects.

The source of this information is the 2000 Riverside County Seismic Safety Element Technical Report, prepared by Earth Consultants International for the County of Riverside.

Liquefaction and Liquefaction Hazard Zones

Liquefaction is a process by which water-saturated materials (including soil, sediment, and certain types of volcanic deposits) lose strength and may fail during strong ground shaking. Liquefaction is defined as "the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore-water pressure" (Youd, 1973, p. 1). Liquefaction occurs worldwide, commonly during moderate to great earthquakes. In California, liquefaction-related ground failures occurred in 1857 (Fort Tejon earthquake), 1906 (San Francisco earthquake), 1933 (Long Beach earthquake), 1971 (San Fernando earthquake), 1973 (Point Mugu earthquake), 1979 and 1981 (Imperial Valley earthquakes), 1989 (Loma Prieta earthquake), and 1994 (Northridge earthquake), and others. Four kinds of ground failure commonly result from liquefaction: lateral spread, flow failure, ground oscillation, and loss of bearing strength.

Lateral Spread
Lateral displacement of surficial blocks of sediment as the result of liquefaction in a subsurface layer is called a lateral spread. Once liquefaction transforms the subsurface layer into a fluidized mass, gravity plus inertial forces that result from the earthquake may cause the mass to move downslope towards a cut slope or free face (such as a river channel or a canal). Lateral spreads most commonly occur on gentle slopes that range between 0.3° and 3°, and commonly displace the surface by several meters to tens of meters. Such movement typically damages pipelines, utilities, bridges, and other structures having shallow foundations. During the 1906 San Francisco earthquake, lateral spreads causing displacement of only a few feet damaged every major pipeline that broke. Thus, liquefaction compromised the ability to fight the fires that caused about 85 percent of the damage to San Francisco.

Flow Failure
The most catastrophic mode of ground failure caused by liquefaction, flow failure usually occurs on slopes greater than 3°. The flows are principally liquefied soil or blocks of intact material riding on a liquefied subsurface zone. Displacements are commonly tens of meters, but in favorable circumstances, has displaced material tens of miles at velocities of tens of miles per hour. The extensive damage to Seward and Valdez, Alaska, during the 1964 Alaska earthquake was caused by submarine flow failures.

Ground Oscillation
When liquefaction occurs at depth but the slope is too gentle to permit lateral displacement, the soil blocks that are not liquefied may decouple from one another and oscillate on the liquefied zone. The resulting ground oscillation may be accompanied by the opening and closing of fissures and sand boils, potentially damaging structures and underground utilities.

Loss of Bearing Strength
When a soil loses strength and liquefies, loss of bearing strength may occur beneath a structure, possibly causing the building to settle and tip. If the structure is buoyant, it may float upward. During the 1964 Niigata, Japan, earthquake, buried septic tanks rose as much as 3 feet and structures in the Kwangishicho apartment complex tilted as much as 60°.

Research into the process and consequences of liquefaction in past earthquakes have linked liquefaction to certain hydrologic and geologic settings, characterized by water-saturated, cohesionless, granular materials situated at depths of less than 50 feet. In simplified terms, the procedure used to delineate areas having significant potential for liquefaction requires development of a liquefaction susceptibility map and a liquefaction opportunity map. The former depicts areas where the geology and hydrology are favorable for liquefaction, and the latter summarizes information about the potential for strong earthquake shaking. When considered together, the two maps determine the liquefaction potential- the relative likelihood that an earthquake will cause liquefaction in an area. The following areas are those identified as being favorable for liquefaction:
1. Areas known to have experienced liquefaction during historic earthquakes.

2. Areas of uncompacted fills containing liquefaction susceptible material that are saturated, nearly saturated, or may be expected to become saturated.
3. Areas where sufficient existing geotechnical data and analyses indicate that the soils are potentially liquefiable.
4. Areas containing young (less than 15,000 years) soils where there is limited or no geotechnical data.

GUIDELINES FOR DELINEATING LIQUEFACTION HAZARD ZONES

Introduction
California Department of Conservation, Division of Mines (DMG) is the principal State agency charged with implementation of the provisions of the 1990 Seismic Hazard Mapping Act. These guidelines are developed to assist DMG in mapping Liquefaction Hazard Zones (LQ-Zones). The zones establish where site-specific geotechnical investigations must be conducted to assess liquefaction potential and, if required, provide technical basis to mitigate the liquefaction hazard.

Liquefaction Mapping Criteria

Liquefaction Hazard Zones are areas meeting one or more of the following criteria:
1. Areas known to have experienced liquefaction during historic earthquakes.

Field studies following past earthquakes indicate liquefaction tends to recur at many sites during successive earthquakes (Youd, 1984). There are many published accounts of liquefaction occurrences and these areas so delineated should be included in the Liquefaction Hazard Zones.

2. All areas of uncompacted fills containing liquefaction susceptible material that are saturated, nearly saturated, or may be expected to become saturated.

In some areas there has been a practice of creating useable land by dumping artificial fill on tidal flats or in large deep ravines. Standard geologic criteria are of little use in characterizing soils within these fills which are less homogeneous than natural deposits. There is no reason to assume lateral stratification in these fills and the validity of extrapolating subsurface data is questionable. Evidence for filling can be found using maps showing old shorelines, comparing old and modern topographic maps, by studying logs of boreholes, and by obtaining reports or original plans of specific projects involving reclaimed land.

3. Areas where sufficient existing geotechnical data and analyses indicate that the soils are potentially liquefiable.

The vast majority of liquefaction hazard areas are underlain by recently deposited sand and/or silty sand. These deposits are not randomly distributed, but occur within a narrow range of sedimentary and hydrologic environments. Geologic criteria for assessing these environments are commonly used to delineate bounds of susceptibility zones evaluated from other criteria, such as geotechnical analysis (Youd, 1991). Ground water data should be compiled from well logs and geotechnical borings. Analysis of aerial photographs of various vintages may delineate zones of flooding, sediment accumulation, or evidence of historic liquefaction. The Quaternary geology should be mapped and age estimates assigned based on ages reported in the literature, stratigraphic relationships and soil profile descriptions. In many areas of Holocene and Pleistocene deposition, geotechnical and hydrologic data are compiled. Geotechnical investigation reports with Standard Penetration Test (SPT) and/or Cone Penetration Test (CPT) and grain size distribution data can be used for liquefaction resistance evaluations.

For sand and silty sand, there are at present two accurate and reliable in-situ approaches available for quantitative evaluation of the soil's resistance to cyclic pore pressure generation and/or liquefaction. These are: (1) correlation's and analyses based on in-situ Standard Penetration Test (SPT) (ASTM D1586) (ASTM, 1990) data, and (2) correlation's and analyses based on in-situ Cone Penetration Test (CPT) (ASTM D3441) (ASTM, 1990) data.

Seed, et al. (1984, 1985, 1986), provide guidelines for performing "standardized" SPT, and also provide correlation's for conversion of penetration resistance's obtained using most of the common alternate combinations of equipment and procedures in order to develop equivalent "standardized" penetration resistance's-- (N1)60. This "standardized" penetration resistance can then be used as a basis for evaluation of liquefaction resistance.

Cone penetration test (CPT) tip resistance (qc) may also be used as a basis for evaluation of liquefaction resistance, either by direct empirical comparison between qc-values to "equivalent" SPT resistance and use of correlation's between (N1)60 data and case histories of seismic performance (Robertson, et al., 1985; Seed and De Alba, 1986)
.

In addition to sandy and silty soils, some gravelly soils are potentially vulnerable to liquefaction. At present, the best available technique for quantitative evaluation of the liquefaction resistance of this type of deposits involve correlation and analysis based on in-situ penetration resistance measured using the very large scale Becker Hammer system (Harder, 1988).

The correlation's of Seed et al. (1985), and the (N1)60 data can be used to assess liquefaction susceptibility. Since geotechnical analyses are usually made using limited available data the susceptibly zones should be delineated by use of geologic criteria. Geologic cross sections, tied to boreholes and/or trenches, should be constructed for correlation purposes. The units characterized by geotechnical analyses are correlated with surface and subsurface units and extrapolated for the mapping project.

Liquefaction opportunity is a measure, expressed in probabilistic terms, of the potential for ground shaking strong enough to generate liquefaction. Analyses of in-situ liquefaction resistance require assessment of liquefaction opportunity. The minimum level of seismic excitation to be used for such purposes with LQ-Zones will be that level defined by M7.5-weighted peak ground surface acceleration (PGA) for UBC S2 soil conditions with a 10% probability of accedence over a 50-year period.

1. Areas where geotechnical data are insufficient.
In areas of limited or no geotechnical data, susceptibility zone are identified by geologic criteria as follows:
* (a) Areas containing soil deposits of late Holocene age (current river channels and their historic floodplains, marshes and estuaries), where the M7.5-weighted peak acceleration that has a 10% probability of being exceeded in 50 years is greater than or equal to 0.10 g and the water table is less than 40 feet below the ground surface; or
* (b) Areas containing soil deposits of Holocene age (less than 11,000 years), where the M7.5-weighted peak acceleration that has a 10% probability of being exceeded in 50 years is greater than or equal to 0.20 g and the historic high water table is less than or equal to 30 feet below the ground surface; or
* (c) Areas containing soil deposits of latest Pleistocene age (between 11,000 years and 15,000 years), where the M7.5-weighted peak acceleration that has a 10% probability of being exceeded in 50 years is greater than or equal to 0.30 g and the historic high water table is less than or equal to 20 feet below the ground surface.

The Quaternary geology may be taken from existing maps, where available, and hydrologic data should be compiled. Application of these criteria allows compilation of hazard maps which are useful for preliminary evaluations, general land-use planning and delineation of special studies zones where site-specific studies may be required before major development is approved (Youd, 1991).

Liquefaction

The following procedures were used during the creation of the Liquefaction Susceptibility Map for the county of Riverside:

- Vertical Mapper was used to grid the Groundwater and Engineering Geology maps at a cell size of 60m.
- An abbreviated code of engineering attributes (e-types) was created by reviewing the descriptions of the petrologic types (p-types) in the legends and supporting materials of the geologic maps of the area.
- The e-types in the Engineering Geology table were separated into three different liquefaction-potential categories:

Liquefaction-potential Categories

High	Moderate	Low
Dark yellow Etypes	Light yellow and Dark Orange Etypes	*Light yellow*
SEDPHUCef	*SEDPHUCac*	*SEDTWCacm*
SEDPHUCaud	*SEDHUCac*	*SEDTPWCac*
SEDPHUCaf	*SEDHMClf*	*SEDTPINDac*
SEDHUClf	*SEDTPWCaf*	*SEDPWCcc*
SEDHUCef	*SEDTPHUCaud*	*SEDPWCac*
SEDHUCaud	*SEDPWCaud*	*SEDPMCacb*
SEDHUCaf	*SEDPUCaud*	*SEDPMCac*
	SEDPUCaf	*SEDPINDac*
	SEDPMCaud	
	SEDPMCaf	
	SEDPHMCaud	
	SEDPHMCaf	
	SEDHPMCar	

- The depth to groundwater data from the Groundwater table was separated into five different categories:

Depth-to-groundwater Categories

  - **High**: depth less than 30
  - **Moderate**: 30 to 50 feet depth to groundwater
  - **Low**: 50 to 100 feet depth to groundwater
  - **Deep groundwater**: depths greater than 100 feet to groundwater
  - **No Data**: no groundwater data found

- Engineering types (e-types) and depth to groundwater data in the Engineering Geology and Groundwater tables were compared to create the liquefaction categories.

General Liquefaction Potential Zones for Riverside County

Rank	Ground Water Depth#	General+ Sediment Type	Recommended Policies*	
	General Construction	Critical Facilities		
High	< 30 feet	very susceptible	study required	study required
Moderate	< 30 feet	susceptible	study required	study required
	30-50 feet	very susceptible	study required	study required
Low	> 30 feet	susceptible	none	study required
Very Low	30-50 feet	susceptible	none	study required
	50-100	very susceptible	none	study required
Extremely Low	50-100 feet	susceptible	none	study required

None	> 100 feet	susceptible	none	none
	no data	bedrock	none	none

*: Ground shaking potential in easternmost Riverside County is considered below the threshold for liquefaction, and site-specific investigations should not be required for general construction projects
#: Ground water depth is based on the historic high measurement
+: Very susceptible sediment type includes generally granular Holocene sediments; susceptible includes generally granular Pleistocene sediments.

Recommended hazard mitigation policies for proposed projects in Riverside County based on the detailed liquefaction mapping may be summarized as follows:

- ***General Construction***: special site-specific liquefaction hazard studies should be required in all areas mapped as "Shallow Ground Water, Susceptible Sediments" with the exception of the Blythe (Uniform Building Code Zone 3) region.
- ***Critical Facilities/Lifelines***: special site-specific liquefaction hazard studies should be required in all areas of susceptible sediments, including the Blythe (Uniform Building Code Zone 3) region.

1. Very High Liquefaction - Groundwater is 0-30 feet from the surface and the sediments are composed of Holocene-age fine-grained unconsolidated sediments.
2. High Liquefaction - Groundwater is 0-30 feet from the surface and the sediments are Holocene coarse-grained or Pleistocene fine-grained or groundwater is 30-50 feet from the surface and the sediments are Holocene fine-grained.
3. Moderate Liquefaction - Groundwater is 0-30 feet from the surface and the sediments are composed of Pleistocene coarse-grained or groundwater is 30-50 feet from the surface with sediments of Holocene coarse-grained or Pleistocene fine-grained sediments or groundwater is 50-100 feet from the surface with Holocene fine-grained sediments or groundwater is >100 (or no data) with Holocene fine-grained sediments.
4. Low Liquefaction - Groundwater is 30-50 feet from the surface and the sediments are Pleistocene coarse-grained or groundwater is 50-100 feet from the surface with sediments of Holocene coarse-grained or Pleistocene fine-grained or groundwater is >100 feet (or no data) with sediments composed of Holocene coarse-grained or Pleistocene fine-grained.
5. Very Low Liquefaction - Groundwater is 50-100 feet below surface with sediments of Pleistocene coarse-grained or groundwater is >100 feet (or no data) with sediments of Pleistocene coarse-grained.

Map defined color scheme.

High groundwater - dark yellow = very high
High groundwater - light yellow = high
High groundwater - dark orange = high
High groundwater - light orange = moderate

Medium groundwater - dark yellow = high
Medium groundwater - light yellow = moderate
Medium groundwater - dark orange = moderate
Medium groundwater - light orange = low

No groundwater - dark yellow = moderate
No groundwater - light yellow = low
No groundwater - dark orange = low
No groundwater - light orange = very low

STREAMS, RIVERS AND CANALS

Table Description:
Table distribution file name: Rivers.shp
Import Location:

VITAL STATISTICS: Rivers.shp

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	US Census Bureau Tiger files
Source Media:	Digital
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polylines
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polylines
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: rivers.shp
RECORD LENGTH: 4,927

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Name	30	C
2	CSCC	3	C
3	Smart_Label	35	C

Subsidence Hazard

Coverage Description: Subsidence Hazard Map of Riverside County
Coverage distribution file name: subside.e00
Import Location:

VITAL STATISTICS: subside.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	Geology, County Reports, USGS
Source Media:	Paper
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: subside.e00
RECORD LENGTH: 3,286

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Zone	-	I
2	Susceptibility	25	C

SUBSIDENCE AND UNSTABLE SOILS

Certain areas of Riverside County are prone to regional downwarping and rapid subsidence. Withdrawal of underground fluids, and tectonic elevation changes produced during extremely large earthquakes are most important in terms of potential causes. This section focuses on land subsidence initiated exclusively by the withdrawal of oil and water. Consistent with non-earthquake-related geologic hazards, a review of collapsible and expansive soils is also presented to emphasize that potential geologic impacts, as well as geotechnical constraints, can largely be avoided through adequate planning and investigation.

Subsidence Caused by Ground Water Withdrawal

Subsidence caused by ground water withdrawal is documented throughout the southwestern United States in areas such as the San Joaquin, Santa Clara, Temecula, and San Jacinto Valleys in California, and the Phoenix and Tucson Basins in Arizona. There are several areas in Riverside County that are also potentially sensitive to withdrawal of ground water. Depending on the depth and mechanical properties of the aquifer and overlying sediment, alluvial areas such as the Salton Sea (in Riverside County) can subside if ground water management resources are not managed properly. Hydrocompaction is a common cause of subsidence and has resulted in extensive fissuring of the ground surface in many agricultural areas of the Southwest (Holzer and Clark, 1981).

Subsidence was identified as an issue in the Antelope Valley as early as 1956 by Miller (1966) and appears to continue today. The U.S. Geological Survey Water Resources Division is currently studying subsidence and ground fissuring on the Edwards Air Force Base (Bill McKafery, 1990 Personal Communication). Considering the ongoing rapid growth in the area, subsidence is also a critical issue in the remainder of Antelope Valley. Severe damage to urban development could result if ground fissures develop in response to subsidence, and alarmingly, such ground rupture has been documented in the Antelope Valley. T.L Holzer and M.M. Clark (1981), in an unpublished report for the Soil Conservation Service, described an arcuate earth fissure approximately 600 meters long and up to 2.3 meters deep about 11 kilometers east-northeast of Lancaster. Additional fissuring north of Quartz Hill and in other localized areas is also reported but no regional studies have been conducted to determine the extent of the potential problem (Bill McKafery, 1990 Personal Communication). If several jurisdictions are utilizing a continuous ground water aquifer resource in the Antelope Valley, and ground water extraction is found to be the cause, subsidence management would require regional cooperation among these agencies.

Collapsible Soils

Collapsible soils are low density, silty to very fine-grained, predominantly granular soils, containing minute pores and voids. When saturated, these soils undergo a rearrangement of their grains and a loss of cementation, resulting in substantial and rapid settlement under relatively low loads. A rise in the ground water table or an increase in surface water infiltration, combined with the weight of a building or structure, can initiate rapid settlement and cause foundations and walls to crack. Collapsible soils generally result from rapid deposition close to the source of the sediment where the materials have not had contact with enough moisture to form a compact soil after their deposition. Collapsible soils are associated with recently deposited Holocene alluvium in arid and semi-arid environments. They also coincide with other Holocene alluvium and older unconsolidated sediments with the same properties. Collapsible soils are most commonly associated with wind laid sands and silts, and mudflow sediments deposited during flash floods.

Collapsible soils exist in the Antelope Valley and many other alluvial areas of the County, including the Santa Clarita Valley. Although also found in the northern canyons of the Repetto and Whittier Hills, including such areas as Hacienda Heights and Rowland Heights, collapsible soils indigenous to these areas may not collapse unless they are subject to excessive loads (greater than 2 to 3 feet of overburden). In the Antelope Valley, collapsible soils may fail with a minimal amount of increased overburden. The rapid increase in population and building activity in the Antelope and Santa Clarita Valley necessitates awareness of this problem by public officials, consultants, developers, future homeowners, and contractors. The raw data for mapping this hazard exists in the form of Bureau of Reclamation Soil Survey Maps and Quaternary sediment mapping performed by Ponti and Burke (1980). While the mapping of collapsible soils is beyond the scope of this project, a future study should be directed at preparing a collapsible soils distribution map, especially for the Antelope Valley.

Expansive Soils

Expansive soils, more commonly referred to as adobe, swell when they become wet and shrink when they dry out. Consequences of this expansion and contraction are cracked building foundations and, sometimes, severe structural distress of buildings themselves. The economic impact on the private sector and public property due to expansive soils is an ongoing problem in Riverside County. Although expansive soils are now routinely alleviated through the County Building Code, problems related to past inadequate codes constantly appear. Expansive soils can result in cracked foundations, interior and exterior wall separations, disjointed slabs or porch steps, tilted posts or fences (soil creep), and sometimes ruptured utilities.

Although their occurrence in the County is often associated with geologic units having marginal stability characteristics, the distribution of expansive soils can be widely dispersed. They can occur in hillside areas as well as low lying alluvial basins. Determination of the origin of structural distress in an existing structure requires assessment not only of expansive soils but also recognition of the impact of poor compaction practices, settlement, and landsliding. Once verified, mitigation can be achieved through reinforcement of the existing foundation, or alternatively, through the excavation and removal of the expansive soils material in the effected area. Moisture control and modified drainage can also minimize the effects of expansive soils. For new development, future problems with expansive soils can be largely prevented through proper site investigation, soils testing, foundation design, and quality assurance during grading operations.

Conclusions

Subsidence related to ground water withdrawal, or tectonic strain, is an ongoing phenomenon in the Riverside County.

- Prudent ground water management practices need to be followed in Temecula, Riverside, and other valleys in the County. Future objectives in areas proven sensitive to subsidence include:

  - Increased level mg for vertical changes in elevation and mapping of ground fissures;

  - synthesis of well data and gravity, seismic, and other geophysical methods to characterize the underlying aquifer; and

  - cooperation of involved ground water jurisdictions to prevent or mitigate subsidence in an alluvial basin.

- Increased awareness of collapsible and expansive soils by public officials, consultants, developers future homeowners, and contractors will encourage proper investigation, foundation design, and use of drought resistant landscaping to mitigate potential problems before they occur.

- Expansive soils are widely distributed in Riverside County. Proper site investigation, soil testing, foundation design, and enforcement of construction grading practices, as defined in the County Building Code, are the most efficient planning tools for locating, assessing the severity of, and mitigating expansive soils in a proposed development.

- Existing County programs for managing hazards such as expansive and collapsible soils should be regularly reevaluated for improvements.

Subsidence analysis and prediction

Surface Classification - In order to facilitate the subsidence analysis and prediction, the ground surface of the study area was divided into three categories based upon the information shown on the map:

1 Areas of documented subsidence
2 Areas of potential subsidence
3 Areas of low to no potential for subsidence

References:

Ikeharn, Marti, E., Predmore, Steven K., and Swope, Daniel J., Geodetic Network to Evaluate Historical Changes and to Monitor Land Subsidence in Lower Coachella Valley, California. USGS Water Resources Investigation Report 97-4237

Dibblee, Thomas, W., Geologic Map of the Perris Quadrangle, California. SCGS-1, 1981.

QUADS - 7.5 MINUTE

Coverage Description: USGS Quad map boundaries for 7.5 minute series maps
Coverage distribution file name: quad75.e00
Import Location:

VITAL STATISTICS: quad75.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	USGS
Source Media:	Digital
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	points
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: quad75.e00
RECORD LENGTH: 153

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	CO_Index	3	I
2	Quad_Name	32	C

CO-INDEX#
The county index number is the number that the county has assigned to the quad sheet.

QUAD-NAME
The quad name is the name (shown at the bottom of each sheet) that U.S.G.S gives to the quad sheet. For example:
PERRIS
RIVERSIDE EAST
STEELE PEAK

NOTE: U.S.G.S. publishes a series of maps showing a variety of different topological features in 15 an 7.5 minute (longitude and latitude) sizes.

WATER BODIES

Coverage Description: This layer contains water bodies and rivers for the County
Coverage distribution file name: lake_region.shp
Import Location:

VITAL STATISTICS: lake_region.shp

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	US Census Bureau Tiger files and reports
Source Media:	Digital and paper
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: lake_region.shp
RECORD LENGTH: 494

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Name	30	C
2	CSCC	3	C
3	Smart_Label	30	C

WIND HAZARD AREA

Coverage Description: Wind Hazard Areas in Riverside County
Coverage distribution file name: wind.e00
Import Location:

VITAL STATISTICS: wind.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	STATSGO, USGS and NOAA
Source Media:	Digital and paper
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:100,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygons
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	polygons
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: wind.e00
RECORD LENGTH: 205

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE	
1	MUID	7	C	
2	IDS		3	C
3	Soil_Name	100	C	
4	WER	7	I	

Wind-induced soil movement, or wind erosion, is a common and serious environmental problem attracting global attention. Wind erosion damages land and natural vegetation by removing soil from one place and depositing it in another. It mostly affects dry, sandy soils in flat, bare areas, but wind erosion may occur anywhere that soil is loose, dry, and finely granulated. It causes soil loss, dryness, deterioration of soil structure, nutrient and productivity losses, air pollution, and sediment transport and deposition. The presence of dust particles in the air is a source of several major health problems. Atmospheric dust causes respiratory discomfort, may carry pathogens that cause eye infections and skin disorders, and reduces highway and air _ traffic visibility. Dust storms can cause additional problems. Buildings, fences, roads, crops, trees and shrubs can all be damaged by blowing soil, which acts as an abrasive.

Soil movement is initiated as a result of wind forces exerted against the surface of the ground. For each specific soil type and surface condition there is a minimum velocity required to move soil particles. This is called the threshold velocity. Once this velocity is reached, the quantity of soil moved is dependent upon the particle size, the cloddiness of particles, and the wind velocity. Suspension, saltation, and surface creep are the three types of soil movement, which occur during wind erosion (Figure 2-10). While soil can be blown to virtually any height, over 93% of soil movement takes place within one meter of the ground.

Wind and wind-blown sand are an environmentally limiting factor throughout much of Riverside County. Approximately 20% of the land area of Riverside County is vulnerable to "high" and "very high" wind erosion susceptibility (Figure 2-11). The Coachella Valley, the Santa Ana River Channel in northwestern Riverside County, and the community of Hemet are zones of high wind erosion susceptibility.

A digital Wind Erosion Susceptibility Map was prepared as part of this study. The wind hazard map is generally considered accurate to 1:100,000, and is presented in Plate 2-5 at a scale of 1:250,000.

Map information for the STATSGO data base was captured as 1:250,000 scale USGS topographic quadrangle units in a Universal Transverse Mercator ground based system. The horizontal datum reference system was the North American Datum of 1927 which is based upon the Clarke 1866 spheroid. The topographic quadrangle units were projected into an Albers Equal Area projection and merged into statewide coverage. Wind data was taken from the United States Department of Agriculture State Soil Geographic (STATSG0) Data Base (http://www.gisdatadepot.com/catalog/US/61069/group23.html). STATSGO included a soils map of the state of California that was refined for Riverside County only. These data included a classification of the soil within each polygon for wind erodibility. This wind erodibility number was used to assign each polygon a WER (Wind Erodibility Rating). WER classification was assigned as follows:

1 = Very Highly erodible
2 = High erodibility
3 = Moderate erodibility
4 = Low erodibility
5 = Water

References:
USDA Natural Resources Conservation Service, April 1996, Soil Quality Information Sheet
Soil Quality Resource Concerns: Soil Erosion
USDA Natural Resources Conservation Service, 1998, Keys to Soil Taxonomy: Eighth Edition

weg 1
Wind Erodibility Group 1
Surface texture - VFS,FS,S,COS. Percent aggregates - 1, Wind erodibility index 310 t/a/y.

weg 2
Wind Erodibility Group 2
Surface texture - LVFS,LFS,LCOS,Sapric material. Percent aggregates - 10, Wind erodibility index - 134 t/a/y.

weg 3
Wind Erodibility Group 3

Surface texture - VFSL,FSL,SL,COSL. Percent aggregates - 25, Wind erodibility index - 86 t/a/y.

weg 4
Wind Erodibility Group 4
Surface Texture - C,SIC,noncalcareous CL,SICL(>35% CLAY). Percent aggregates - 25, Wind erodibility index 86 t/a/y.

weg 4L
Wind Erodibility Group 4L
Surface texture – calcareous L/SIL/CL,SICL. Percent aggregates - 25, Wind Erodibility index - 86 t/a/y.

weg 5
Wind Erodibility Group 5
Surface textue – noncalcareous L/SIL(<20% CLAY),SCL,SC. Percent aggregates - 40, Wind erodibility index 56 t/a/y.

weg 6
Wind Erodibility Group 6
Surface texture – noncalcareous L/SIL(>20% CLAY),CL(<35% CLAY). Percent aggregates - 45, Wind erodibility index - 48 t/a/y.

weg 7
Wind Erodibility Group 7
Surface texture - SI,noncalcareous SICL(<35% CLAY). Percent aggregates 50, Wind erodibility index –38 t/a/y.

weg 8
Wind Erodibility Group 8
Erosion not a problem.

WIND STATIONS

Coverage Description: Wind Stations in Riverside County
Coverage distribution file name: windstat.e00
Import Location:

VITAL STATISTICS: windstat.e00

Datum:	NAD 83
Projection:	State Plane Feet - Zone VI
Units:	Decimal Degrees
Source:	NOAA
Source Media:	Digital
Source Projection:	vary
Source Units:	vary
Source Scale:	vary
Capture Method:	Digitized
Accuracy:	The overall map is good to an accuracy of 1:24,000.
Conversion Software:	MapInfo 6.0
Data Structure:	Vector
ARC/INFO Coverage Type:	Points
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	degrees of longitude/latitude
Number of Features:	points
Data Updated:	Last update July 2000

DATA DICTIONARY:

DATAFILE NAME: windstat.e00
RECORD LENGTH: 69

Non-standard POLYGON attribute fields:

COLUMN	ITEM NAME	WIDTH	TYPE
1	Year	-	I
2	Month	-	I
3	Day	-	I
4	Time_CST	4	C
5	Sequence	-	I
6	US_Office	3	C
7	Fatalities	-	I
8	Injuries	-	I
9	Wind_MPH	-	I
10	Wind_Comments	7	C
11	Damage	40	C

Appendix I-1:
Noise Element Data

Appendix I-1: Noise Element Data

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Table 1: Definitions of Acoustical Terms

Term	Definition
Decibel, dB	A unit of level that denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{02}, L_{08}, L_{50}, L_{90}	The fast A-weighted noise levels that are equaled or exceeded by a fluctuating sound level 2 percent, 8 percent, 50 percent, and 90 percent of a stated time period.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time-varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 decibels to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 decibels to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurement and Noise Control 1991.

Table 2: Common Sound Levels and Their Noise Sources

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Evaluations
Near Jet Engine	140	Deafening	128 times as loud
Civil Defense Siren	130	Threshold of Pain	64 times as loud
Hard Rock Band	120	Threshold of Feeling	32 times as loud
Accelerating Motorcycle at a Few Feet Away	110	Very Loud	16 times as loud
Pile Driver; Noisy Urban Street/Heavy City Traffic	100	Very Loud	8 times as loud
Ambulance Siren; Food Blender	95	Very Loud	
Garbage Disposal	90	Very Loud	4 times as loud
Freight Cars; Living Room Music	85	Loud	
Pneumatic Drill; Vacuum Cleaner	80	Loud	2 times as loud
Busy Restaurant	75	Moderately Loud	
Near Freeway Auto Traffic	70	Moderately Loud	Reference Level
Average Office	60	Quiet	½ times as loud
Suburban Street	55	Quiet	
Light Traffic; Soft Radio Music in Apartment	50	Quiet	¼ times as loud
Large Transformer	45	Quiet	
Average Residence without Stereo Playing	40	Faint	⅛ times as loud
Soft Whisper	30	Faint	
Rustling Leaves	20	Very Faint	
Human Breathing	10	Very Faint	Threshold of Hearing
	0	Very Faint	

Source: Compiled by LSA Associates, Inc., 2004.

Table 3: Short-Term Ambient Noise Monitoring Results (15 minutes)

ID	Location	Start Time	L_{eq} (dBA)	Noise Sources	Remarks
1	20 feet (ft) from the street, on the southwest corner of Riverside Drive and Wineville Avenue.	3:21 p.m.	73.2	Traffic on SR-60, I-15, and Riverside Drive and Wineville Avenue.	Intersection is a four-way controlled stop. Land uses are all industrial.
2	30 ft from the street, on the northwest corner of the Etiwanda Avenue and Cantu Galleano Ranch Road.	2:41 p.m.	67.4	Traffic on Etiwanda Avenue and Cantu Galleano Ranch Road.	Four-legged signalized intersection. Land use is light industry, sports ground, and empty space.
3	5 ft from the street, on the southeast corner of Jurupa Road and Troth Street.	3:54 p.m.	69.1	Traffic on Jurupa Road and Troth Street.	Intersection is a four-way controlled stop. Commercial other than residential house on southeast corner.
4	10 ft from the street, on the southwest corner of Magnolia Avenue and McKinley Street.	1:34 p.m.	70.2	Traffic on McKinley Street and Magnolia Avenue.	Intersection is signal-controlled; both streets are major streets with heavy traffic in each direction. Land use is commercial, preschool, and residential area away from intersection.
5	20 ft south of Indiana Avenue at bend in street, near intersection of Indiana Avenue and Barker Lane.	12:53 p.m.	58.0	Traffic on Indiana Avenue; children playing and talking at nearby residence.	Airplanes flying over the sound meter and train passing screened out. Land use is residential and mountain area.
6	20 ft from the street, on the northeast corner of Cajalco Road and Eagle Canyon Road.	10:43 a.m.	72.5	Cars and heavy trucks traffic on Cajalco Road and Eagle Canyon Road.	Three-legged intersection with a stop sign for Eagle Canyon Road and Cajalco Road has right-of-way (ROW) – heavy trucks consistently exiting and entering Eagle Canyon Road. Land use is empty space at intersection of Cajalco Road and Eagle Canyon Road, and a few residential areas on eastside.
7	5 ft east of 34th Street and 75 ft from northeast corner of Armstrong Road and 34th Street.	4:38 p.m.	62.8	Traffic on Armstrong/Valley Road and 34th Street.	Four-legged signalized intersection. Land use is residential or empty space.
8	30 ft from the street, on the northeast corner of McAllister Street and El Sobrante Road.	5:04 p.m.	68.1	Traffic on McAllister Street and El Sobrante Road.	Three-legged intersection with a stop sign for McAllister Street; residential on the northwest corner.
9	140 ft west of Via Lakistas, on sidewalk, 3 ft south from Eureka Street.	1:34 p.m.	44.3	Traffic on Eureka Street and Via Lakistas.	Intersection is a two-way controlled stop; Via Lakistas has ROW. Land use is residential.
10	20 ft from the street, on the southeast corner of Center Street and Mt. Vernon Avenue.	5:27 p.m.	63.7	Traffic on Center Street and Mt. Vernon Avenue (more traffic).	Four-way stop sign intersection. Land use is residential, open space, and agricultural.
11	20 ft from Washington Street, on the northwest corner of Washington Street and Van Buren Boulevard.	4:23 p.m.	65.2	Cars passing on Washington Street and Van Buren Boulevard; cars pulling in/out lot on Washington Street close by the sound meter.	Four-legged signalized intersection; commercial 7-11 market located in the northwest corner of intersection.

Table 3: Short-Term Ambient Noise Monitoring Results (15 minutes)

ID	Location	Start Time	L_{eq} (dBA)	Noise Sources	Remarks
12	5 ft from the street, on the southeast corner of Cajalco Road and El Sobrante Road.	3:38 a.m.	74.8	Traffic on Cajalco Road and El Sobrante Road.	Three-legged intersection with a signal.
13	15 ft south of Ellis Avenue; SH-74 to the North.	10:10 a.m.	71.7	Traffic on SH-74 and Ellis Avenue.	Heavy traffic on SH-74; intersection 250 ft south from Ellis Avenue is signal-controlled. Land use is low-density residential or empty space.
14	25 ft from southbound SH–74, driveway to residential area.	9:40 a.m.	71.0	Traffic on SH-74.	High speed on SH-74; low density residential area.
15	20 ft south of Ramona Expressway, on the northwest corner of Hansen Avenue and Reservoir Avenue.	11:25 a.m.	73.5	Traffic on Ramona Expressway; traffic on Davis/Hansen Avenue.	Heavy traffic and many heavy trucks on Ramona Expressway. Land use is composed of commercial, sports field, and empty space.
16	10 ft east of Olson Avenue, near intersection of McWade Avenue and Olson Avenue.	4:55 p.m.	56.5	Traffic on Olson; light traffic on McWade Avenue.	Light traffic on Olson Avenue and McWade Avenue. Children talking and playing outside, a few dogs barking. Land use is residential.
17	25 ft west of SR-79, on the northwest corner of SR-79 and Scott Road, 150 ft north from Scott Road.	3:20 p.m.	71.1	Heavy traffic and high speed on SR-79; traffic on Scott Road.	Intersection is signal controlled. Land use is empty space.
18	20 ft from south of De Portola Road (nearby address #34265).	12:55 p.m.	46.3	Very low traffic and slow speed on De Portola Road, community noise, farmer working and talking near by.	Helicopters flying over the sound meter but screened out during monitoring work. Land use is farmland.
19	10 ft from the street, on northeast corner of Cherry Valley Boulevard and Beaumont Avenue.	12:40 p.m.	66.3	Traffic on Cherry Valley Boulevard and Beaumont Avenue.	Intersection is signal-controlled; moderate traffic levels on Cherry Valley Boulevard and Beaumont Avenue; aircraft flying over the sound meter (screened out); more traffic on Beaumont Avenue. Land use is commercial, community center, and a school.
20	15 ft from the street, on southeast corner of Mayberry Avenue and Cornell Street.	4:20 p.m.	58.1	Traffic on Cornell Street and Mayberry Avenue.	Intersection is a two-way controlled stop; Cornell Street has ROW; low traffic both roadways. Land use is residential.
21	10 ft south of SR 79, Radec junction of SR 79, and Sage Road.	2:00 p.m.	69.4	Traffic on SR 79 and Sage Road.	Heavy traffic on SR 79; low traffic on Sage Road. Land use is commercial and residential, and one commercial building located northwest is closed.
22	15 ft from the street, on the northwest corner of Broadway Road and Bonita Avenue.	9:53 a.m.	62.0	Traffic on Broadway Road and Bonita Avenue.	Intersection is a two-way controlled stop on Bonita Avenue; Broadway Road has ROW; residential developments in the southwest corner of the intersection. Windy conditions.

Table 3: Short-Term Ambient Noise Monitoring Results (15 minutes)

ID	Location	Start Time	L_{eq} (dBA)	Noise Sources	Remarks
23[1]	In front of entrance gate to windmill farm (Green Power); on north corner of Ruppert Street and 19th Avenue.	4:30 p.m.	51.7	Windmill noise. Traffic on I-10, 2,000 ft away from the sound meter but faint.	Aircraft flying over the sound meter but screened out; quiet area. Land use is office, light industrial, and windmill farm.
24	10 ft from the street, on the southwest corner of Ramon Road and Desert Moon Drive.	3:45 p.m.	69.8	Traffic on Ramon Road and Desert Moon Drive.	Intersection is a two-way controlled stop; Ramon Road has ROW; more traffic on Ramon Road. Land use is residential, commercial, and empty.
25	30 ft from the street, on the northwest corner of Adams Street and 42nd Avenue.	3:00 p.m.	65.6	Traffic on Adams Street and 42nd Avenue.	Intersection is a four-way controlled stop; residential development on three corners. Bermuda Dunes Country Club is located south of 42nd Avenue.
26	15 ft from south of SH-74 across Pinyon 30 Fire Station.	12:40 p.m. (Nov. 5, 2010)	68.1	Traffic on SH-74, faint radio sound, faint people talking.	Posted speed limits on SH-74 are 35 mph but actual speeds are higher than that; roadway pavement condition was rough.
27	30 ft from the street, on the northwest corner of Highway 86 and 62nd Avenue.	2:00 p.m.	69.3	Heavy and high speed traffic on Highway 86 and lower speed traffic on 62nd Avenue.	Intersection is a two-way controlled stop; Highway 86 has ROW. Roadway construction activities occurred approximately 2,000 ft away from the sound meter but faint noise. Land use is farmland. A little windy weather conditions.
28	15 ft south from Ragsdale Road; 150 ft west from Desert Center Rice Road.	4:35 p.m.	61.8	Traffic on I-10 (approximately 1,000 ft south from the sound meter), low speed trucks on Ragsdale Road, and parking activities.	Trucks are idling in the parking lot and moving slowly. Land use is commercial, parking lot, and empty space.
29	20 ft from the street, on the southeast corner of Arrow-head Boulevard and 28th Avenue.	2:15 p.m.	63.2	Traffic on 28th Street and Arrowhead Boulevard, two tractors on Arrowhead, and agricultural equipment nearby.	Intersection is a three-legged intersection; free flowing traffic on 28th Avenue; Arrowhead Boulevard has a stop sign. Land use is farmland.

Source: LSA Associates, Inc., March 2011.
[1] This measurement was conducted within the City of Palm Springs because the proposed monitoring location was not available.
dBA = A-weighted decibels SH = State Highway
L_{eq} = equivalent continuous sound level

Table 4: Meteorological Conditions During Short-Term Monitoring

Site Number	Maximum Wind Speed (mph)	Average Wind Speed (mph)	Temperature (ºF)	Relative Humidity (%)
1	8.1	3.5	95.7	12.7
2	4.8	0.8	96.4	12.7
3	4.6	0.8	94.6	14.2
4	7.1	1.7	96.4	11.5
5	6.8	1.3	98.6	9.3
6	6.9	1.1	94.6	12.5
7	6.8	2.4	93.2	14.5
8	4.9	2.2	87.3	18.9
9	8.7	3.6	88.3	15.2
10	3.6	1.5	86.9	18.4
11	8.8	1.7	88.4	12.5
12	6.0	1.7	91.9	12.1
13	1.5	0.9	81.6	16.5
14	1.3	0.8	77.1	19.5
15	4.4	2.7	84.7	12.0
16	2.3	1.8	85.2	10.9
17	5.4	2.6	95.6	8.2
18	4.7	2.2	91.2	18.8
19	5.1	3.8	80.1	10.0
20	2.5	1.1	91.3	23.4
21	6.7	4.1	91.1	17.2
22	13.3	10.5	85.9	23.0
23	4.4	3.6	90.5	8.5
24	2.4	1.2	92.3	13.5
25	2.7	1.7	93.7	14.2
26	3.6	2.2	79.7	19.2
27	8.5	4.4	96.7	14.3
28	3.6	2.7	89.9	12.1
29	4.6	3.1	90.2	24.1

Source: LSA Associates, Inc., March 2011.
ºF = degrees Fahrenheit
mph = miles per hour

Table 5: Base Year Condition (2007) Traffic Noise Levels

Roadway Segment	ADT	Centerline to 70 L_{dn} (ft)	Centerline to 65 L_{dn} (ft)	Centerline to 60 L_{dn} (ft)	L_{dn} (dBA) 50 ft from Centerline of Outermost Lane
38th Avenue between Del Webb Boulevard and western city limits of Indio	10,600	< 50	57	121	65.1
42nd Avenue between Washington Street and Yucca Lane	15,700	< 50	85	180	66.6
54th Avenue between Monroe Street and Jackson Street	10,000	< 50	87	187	67.9
62nd Avenue between eastern city limits of La Quinta and Jackson Street	10,400	< 50	78	167	67.2
Agua Mansa Road between Market Street and Wilson Street	13,300	< 50	95	204	67.9
Airport Boulevard between Van Buren Street and Fredrick Street	6,200	< 50	51	110	64.4
Archibald Avenue between Limonite Avenue and northern county limits of Riverside	18,000	69	149	320	71.4
Archibald Avenue between River Road and Chandler Street	9,300	< 50	94	203	68.4
Armstrong Avenue between Sierra Avenue and SH-60	20,800	58	124	266	70.2
Bellegrave Avenue between Cantu Galleano Ranch Road and Marlatt Street	14,300	56	119	256	69.9
Bellegrave Avenue between Bain Street and Van Buren Boulevard	10,100	< 50	104	223	69.0
Bellegrave Avenue between Ontario Freeway and Wineville Avenue	12,500	< 50	105	224	68.0
Bob Hope Drive between Ramon Road and Dinah Shore Drive	15,100	< 50	103	220	67.9
Briggs Road between Los Alamos Road and SH-79	7,700	< 50	63	134	65.1
Broadway between southern city limits of Blythe and Seeley Avenue	8,500	< 50	< 50	105	63.0
Cactus Avenue between Elsworth Street and I-215	24,100	57	117	251	68.7
Cajalco Road between Temescal Canyon Road and La Sierra Avenue	13,800	< 50	75	162	67.0
Cajalco Road between El Sobrante Road and Gavilan Road	14,900	52	110	236	68.8
Cajalco Road between Patterson Avenue and Day Street	13,300	< 50	96	205	67.9
Camino Real between Jurupa Road and Limonite Avenue	10,300	< 50	58	124	65.2
Cantu Galleano Ranch Road between Etiwanda Avenue and Van Buren Boulevard	20,500	102	217	466	72.8
Center Street between Iowa Avenue and Mount Vernon Avenue	6,700	< 50	58	120	63.9
Citrus Street between Cleveland Avenue and Summer Avenue	8,700	< 50	59	128	65.4
Clay Street between Limonite Avenue and Van Buren Boulevard	14,000	< 50	85	181	66.6
Clinton Keith Road between western city limits of Murrieta and Los Alamos Road	11,800	< 50	86	184	67.2
Country Village Road between Granite Hill Drive and Philadelphia Street	20,300	68	142	304	70.0
Del Webb Boulevard between Washington Street and 38th Avenue	12,800	< 50	80	169	66.1
Desert Moon Drive between Ramon Road and Varner Road	10,300	< 50	69	141	64.4
Dillon Road between Long Canyon Road and Bennett Road	9,100	< 50	88	188	67.9
Domenigoni Parkway between Warren Road and Patterson Avenue	28,400	139	295	634	74.4
Domenigoni Road between SH-79 and Patterson Avenue	27,200	136	289	621	74.2
E Streetetson Avenue between eastern city limits of Hemet and Girard Street	12,500	< 50	95	205	68.5
El Sobrante Road between Cajalco Road and Mockingbird Canyon Road	11,600	< 50	77	165	67.1
Ellis Avenue between Theda Street and Marshall Road	9,000	< 50	82	175	66.9
Etiwanda Avenue between SH-60 and Philadelphia Street	33,400	108	227	487	72.6
Etiwanda Avenue between Limonite Avenue and Holmes Avenue	8,400	< 50	57	118	63.7
Felspar Road between Mission Boulevard and Galena Street	11,500	< 50	92	198	68.3
Gavilan Road between Cajalco Road and Multiview Drive	11,200	< 50	67	145	66.2
Gilman Springs Road between ramps on SH-79 and State Street	17,900	94	202	435	73.4

Table 5: Base Year Condition (2007) Traffic Noise Levels

Roadway Segment	ADT	Centerline to 70 L_{dn} (ft)	Centerline to 65 L_{dn} (ft)	Centerline to 60 L_{dn} (ft)	L_{dn} (dBA) 50 ft from Centerline of Outermost Lane
Gilman Springs Road between Jack Rabbit Trail and Bridge Street	16,300	84	179	386	72.0
Graeber Street between Cactus Avenue and Meyer Street	8,600	< 50	< 50	66	60.4
Grand Avenue between Corydon Road and Ortega Highway	13,600	< 50	96	206	68.5
Hamner Avenue between Limonite Avenue and 65th Street	15,000	63	123	258	68.1
Hamner Avenue between northern city limits of Norco and 68th Street	8,800	< 50	85	180	66.5
Harrison Street between 62nd Avenue and 54th Avenue	12,300	87	187	403	72.9
Horsethief Canyon Road between Temecula Valley Freeway and Mountain Road	10,600	< 50	57	123	65.2
I-10 between Apache Trail and Fields Road	132,800	823	1,770	3,811	84.7
I-10 between SH-111 and Tipton Road	106,600	774	1,665	3,585	84.6
I-10 between Ramon Road and Date Palm Drive	112,800	730	1,570	3,379	84.0
I-10 between SH-62 and Tipton Road	106,800	774	1,666	3,588	84.6
I-10 between Ramon Road and Monterey Avenue	118,200	736	1,582	3,408	84.3
I-10 between SH-86 and Dillon Road	25,800	418	899	1,936	82.1
I-10 between Dillon Road and Box Canyon Road	25,500	429	922	1,986	81.8
I-10 between Red Cloud Mine Road and Eagle Mountain Road	25,500	431	926	1,995	81.8
I-10 between Hayfield Road and Red Cloud Mine Road	15,500	417	898	1,933	81.6
I-10 between Box Canyon Road and Summit Road	25,500	431	926	1,995	81.8
I-10 between Chuckwalla Valley Road and Willey Well Road	24,900	433	932	2,008	81.9
I-10 between Willey Well Road and Mesa Drive	25,900	434	935	2,013	81.9
I-15 between Mission Boulevard and Philadelphia Street	191,000	617	1,325	2,853	82.9
I-15 between SH-79 and Rainbow Valley Boulevard West	146,700	527	1,130	2,433	81.8
I-215 between Van Buren Boulevard and Oleander Avenue	139,700	458	984	2,118	81.5
Indian Avenue between Dillon Road and 18th Avenue	17,600	69	146	314	70.7
Iowa Avenue between Center Street and northern city limits of Riverside	23,300	80	167	357	70.6
Jurupa Road between Valley Way and Camino Real	9,000	< 50	58	117	63.2
Knabe Road between Temecula Valley Freeway and Hunt Road	15,700	< 50	107	226	67.6
Cleveland Avenue between southern city limits of Riverside and Dufferin Avenue	15,700	< 50	99	212	68.1
Limonite Avenue between Archibald Avenue and Harrison Avenue	7,700	< 50	65	140	66.0
Limonite Avenue between Hamner Avenue and I-15	22,900	73	152	323	70.0
Limonite Avenue between Pedley Road and Clay Street	16,600	58	121	258	68.9
Limonite Avenue between Pedley Road and Van Buren Boulevard	17,100	77	162	348	70.9
Limonite Avenue between Etiwanda Avenue and Marlatt Street	19,300	61	130	280	70.5
Limonite Avenue between Van Buren Boulevard and Felspar Road	25,700	97	203	435	71.9
Limonite Avenue between Peralta Place and Camino Real	16,800	57	114	242	68.1
Los Alamos Road between Briggs Road and Whitewood Road	11,200	< 50	70	150	65.9
Los Alamos Road between eastern city limits of Murrieta and Briggs Road	11,300	< 50	70	150	66.5
Market Street between Aguamansa Road and Rubidoux Boulevard	17,300	57	121	259	69.4
Markham Street between Mocking Bird Canyon Boulevard and Washington Street	8,100	< 50	68	142	65.0

Table 5: Base Year Condition (2007) Traffic Noise Levels

Roadway Segment	ADT	Centerline to 70 L_{dn} (ft)	Centerline to 65 L_{dn} (ft)	Centerline to 60 L_{dn} (ft)	L_{dn} (dBA) 50 ft from Centerline of Outermost Lane
Markham Street between Seaton Avenue and Day Street	9,500	< 50	69	149	66.4
Menifee Road between Nuevo Road and Central Avenue	6,600	< 50	81	175	67.5
Mission Boulevard between Wineville Avenue and I-15	10,100	63	132	283	69.5
Mission Boulevard between Pedley Road and Agate Street	19,000	70	148	317	70.3
Mocking Bird Canyon Boulevard between Van Buren Boulevard and Markham Street	19,900	79	164	350	70.5
Mocking Bird Canyon Boulevard between Markham Street and Van Buren Boulevard	15,500	69	141	301	69.5
Monroe Street between 54th Avenue and 52nd Avenue	20,600	< 50	108	228	67.7
Mountain View Road between 20th Avenue and Varner Road	11,500	< 50	76	164	67.1
Murrieta Hot Spring Road between Sky Canyon Drive and Winchester Road	11,600	< 50	65	137	64.7
Nuevo Road between Menifee Road and Lakeview Avenue	8,200	< 50	65	141	66.0
Old Elsinore Road between San Jacinto Avenue and Orange Avenue	7,200	< 50	61	131	65.6
Ontario Freeway between Limonite Avenue and 68th Street	184,000	631	1,358	2,925	83.9
Palm Drive between northern city limits of Cathedral City and 20th Avenue	29,100	81	171	366	71.2
Pedley Road between Mission Boulevard and SH-60	7,700	< 50	70	151	66.5
Pedley Road between Limonite Avenue and Jurupa Road	7,100	< 50	61	131	65.6
Perris Boulevard between Reche Vista Drive and Sunnymead Ranch Parkway	6,200	< 50	68	145	65.6
Pinacate Road between eastern city limits of Menifee and Juniper Flats Road	27,000	106	226	485	73.0
Ramon Road between Varner Road and I-10	15,200	53	109	233	68.2
Pourroy Road between Thompson Road and Winchester Road	9,400	< 50	58	125	65.3
Ramon Road between Sierra Del Sol and La Canada Way	9,800	< 50	77	160	65.3
Ramon Road between Bob Hope Drive and I-10	36,600	87	174	369	70.1
Ramon Road between I-10 and Varner Road	36,600	85	173	368	70.4
Ramon Road between Sierra Del Sol and Desert Moon Drive	11,000	< 50	106	228	68.6
Ramona Expressway between eastern city limits of Perris and Davis Road	13,500	71	153	329	71.6
Ramona Expressway between Davis Road and Lakeview Avenue	13,500	71	153	329	71.6
Reche Vista Drive between Perris Boulevard and Reche Canyon Boulevard	12,300	< 50	61	132	65.6
Redlands Boulevard between San Timoteo Canyon Road and Locust Avenue	18,900	71	150	323	70.9
Rubiduox Boulevard between Market Street and 24th Street	11,100	54	111	236	68.3
Schleisman Road between Archibald Avenue and River Road	12,500	< 50	82	175	67.5
Sierra Avenue between Armstrong Avenue and Northern County Limits of Riverside	13,000	61	124	263	68.6
Monterey Avenue between Ramon Road and I-10	9,200	< 50	61	131	65.6
SR-111 between Tram Way Road and I-10	21,000	111	234	502	72.8
SR-195 between Lincoln Street and Grapefruit Boulevard	13,100	59	118	250	68.3
SR-371 between SH-74 and Mitchell Road	7,800	< 50	104	225	69.1
SR-60 between Wineville Avenue and Mission Boulevard	163,600	589	1,267	2,729	83.2
SR-60 between SH-60 and Jack Rabbit Trail	63,600	428	920	1,981	81.8
SR-62 between I-10 and Dillon Road	18,100	119	253	542	73.3
SR-74 between northern city limits of Lake Elsinore and I-15	28,300	105	225	483	73.0
SR-74 between Theda Street and Ethanac Road	27,100	102	217	465	72.8
SR-74 between SH-371 and Palm Canyon Drive	8,300	53	110	233	68.3
SR-78 between Hobson Way and 18th Avenue	10,600	< 50	96	205	67.9
SR-79 between eastern city limits of Murrieta and Pourroy Road	19,100	110	237	510	73.9
SR-79 between Auld Road and Hunter Road	32,200	128	274	588	74.3

Table 5: Base Year Condition (2007) Traffic Noise Levels

Roadway Segment	ADT	Centerline to 70 L_{dn} (ft)	Centerline to 65 L_{dn} (ft)	Centerline to 60 L_{dn} (ft)	L_{dn} (dBA) 50 ft from Centerline of Outermost Lane
SR-79 between Scott Road and Wickered Road	20,700	100	216	465	73.8
SR-79 between eastern city limits of Temecula and Anza Road	13,800	71	152	327	71.5
SR-79 between SH-371 and Sage Road	8,800	52	111	239	69.5
SR-79 between Domenigoni Road and Patton Avenue	19,100	99	212	456	73.7
SR-79 between Gilman Springs Road and southern city limits of Beaumont	47,100	152	324	697	75.0
SR-86 between Pierce Street and 81St Avenue	8,200	78	167	360	72.2
SR-86 between 74th Avenue and Pierce Street	7,700	77	165	354	71.5
SR-86 between southern city limits of Coachella and 66th Avenue	37,900	247	531	1,144	78.6
SR-86 between 54th Avenue and Airport Boulevard	12,800	88	190	409	73.0
SR-86 between I-10 and Dillon Road	62,200	362	779	1,678	81.1
SR-86 between Grapefruit Boulevard and southern city limits of Coachella	37,900	247	531	1,143	78.2
Seaton Avenue between Harvill Avenue and Markham Street	10,100	< 50	65	131	64.0
I-15 between Temescal Canyon Road and Indian Truck Trail	150,900	594	1,277	2,750	83.2
I-15 between Weirick Road and Temescal Canyon Road	154,100	596	1,283	2,762	83.2
Temescal Canyon Road between Cajalco Road and I-15	10,600	< 50	79	169	66.6
Temescal Canyon Road between I-15 and Lawson Road	9,300	< 50	54	115	64.1
Temescula Valley Freeway between Temescal Canyon Road and Weirick Road	154,100	596	1,283	2,762	83.2
US-95 between I-10 and northern county limits of Riverside	7,200	< 50	105	225	68.5
Van Buren Boulevard between Bellegrave Avenue and Etiwanda Avenue	44,400	192	411	885	76.5
Van Buren Boulevard between Mocking Bird Canyon Boulevard and Firethorn Avenue	48,000	136	290	624	74.2
Van Buren Boulevard between Washington Street and Krameria Avenue	35,800	116	246	529	73.2
Van Buren Boulevard between Limonite Avenue and Jurupa Road	44,600	191	409	880	76.5
Van Buren Boulevard between Limonite Avenue and Clay Street	56,700	210	450	968	77.1
Van Buren Boulevard between I-215 and Harmon Street	27,000	101	213	457	72.2
Warren Road between Domenigoni Parkway and Simpson Road	11,000	62	132	285	70.6
Warren Road between western city limits of Hemet and West Esplanade Avenue	8,600	65	137	294	70.3
Washington Street between Van Buren Boulevard and Golden Street	13,300	< 50	82	176	67.5
Washington Street between Del Webb Boulevard and Wildcat Drive	14,000	< 50	86	182	66.6
West Florida Avenue between Winchester Road and western city limits of Hemet	36,500	141	301	648	74.9
Winchester Road between West Florida Avenue and California Avenue	12,800	80	171	367	71.7

Source: LSA Associates, Inc., March 2011.
Note: ADT values rounded up to the nearest 100. Traffic noise within 50 ft of the roadway centerline should be evaluated with site-specific information.
ADT = average daily traffic
dBA = A-weighted decibels
ft = feet
L_{dn} = Day-Night Average Level

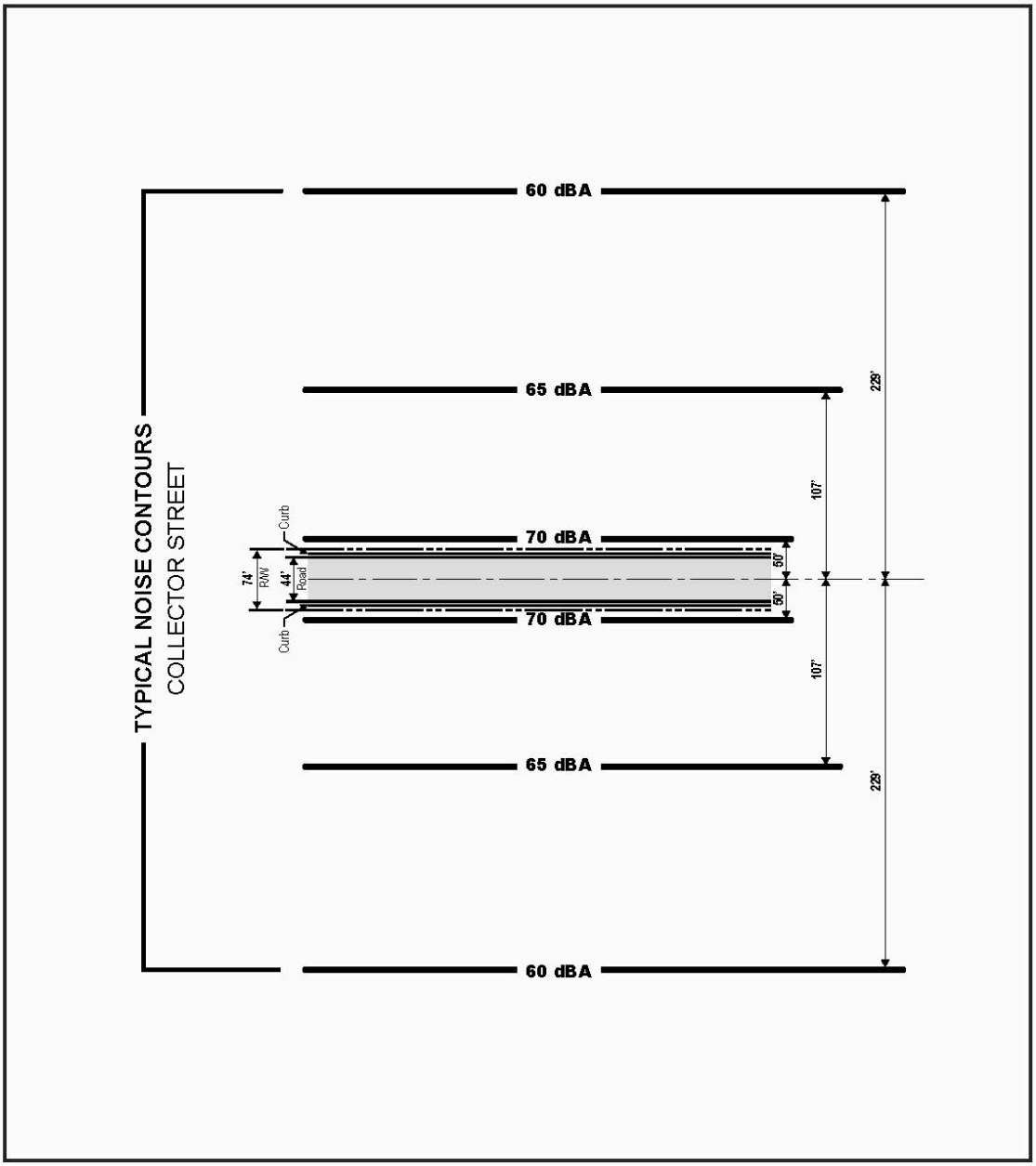

Figure 1

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways: Collector Street (2 Lanes)

I:\CORI 0011\GIS\Noise\Contours\Proj Contour_CollectorStreet_2-Lanes.ai (2/15/11)

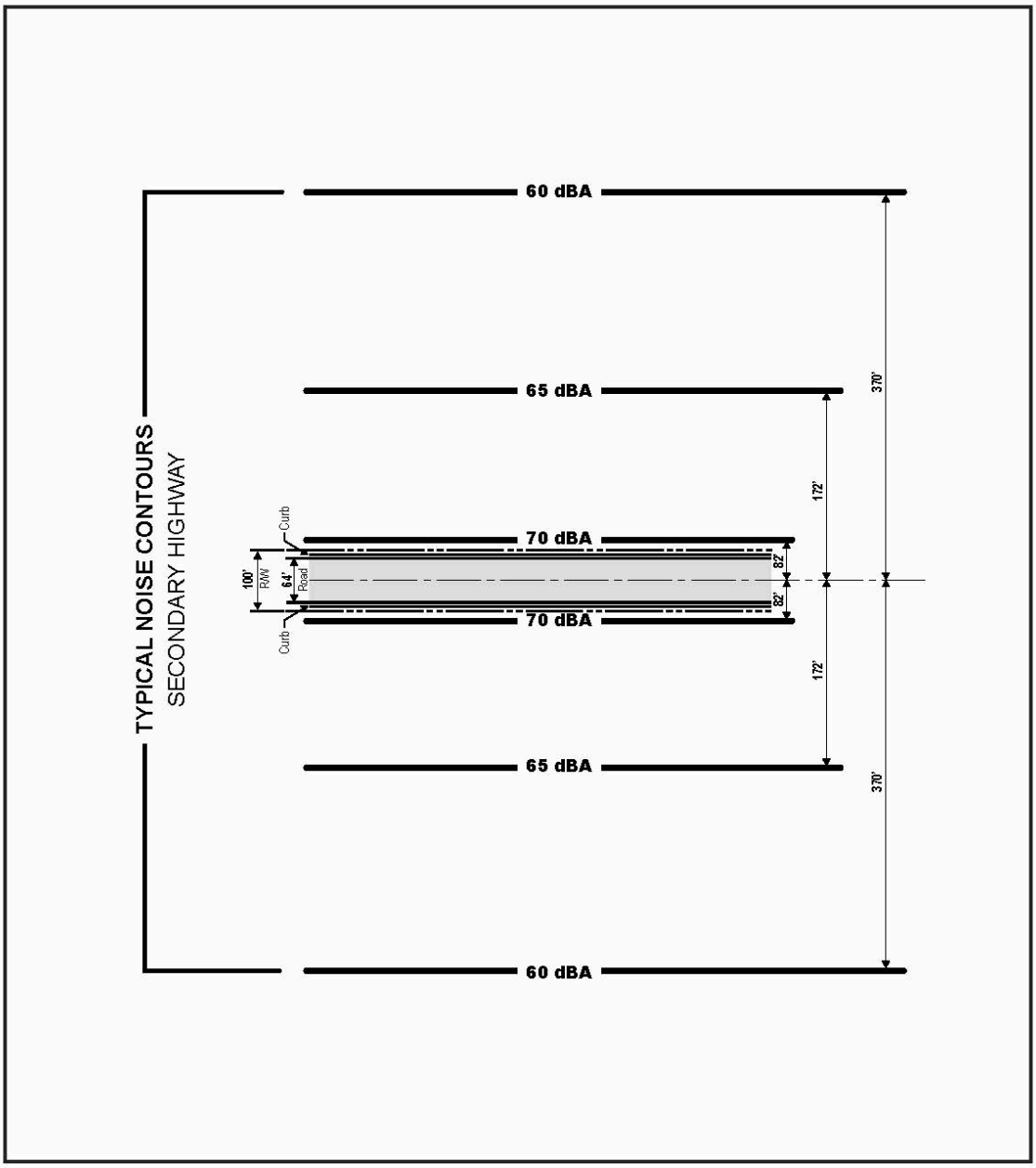

Figure 2

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways: Secondary Highway (4 Lanes)

I:\COR10011\GIS\Noise\Contours\Proj Contour _SecondaryHighway_4-Lanes.ai (2/15/11)

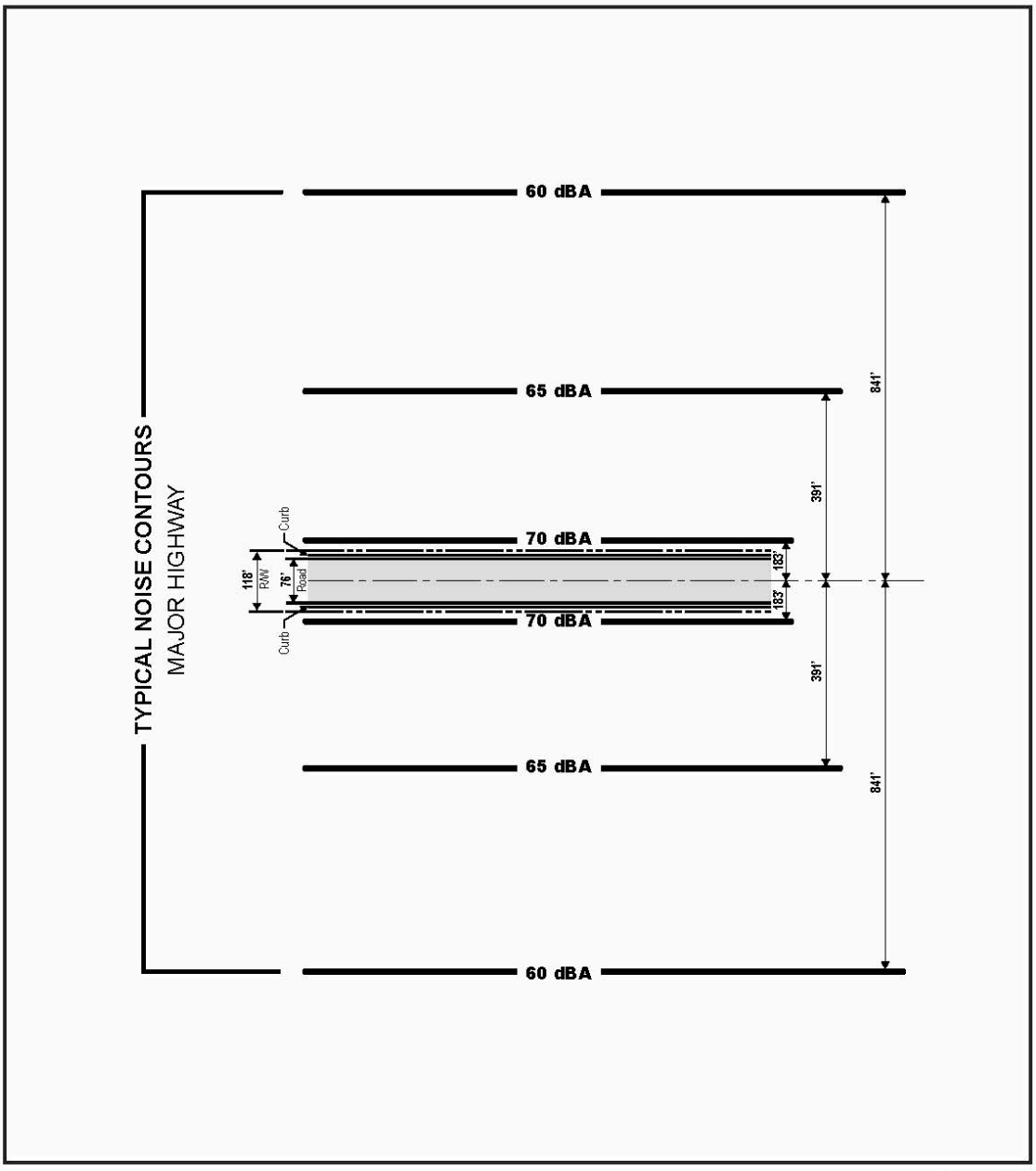

Figure 3

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways:
Major Highway (4 Lanes)

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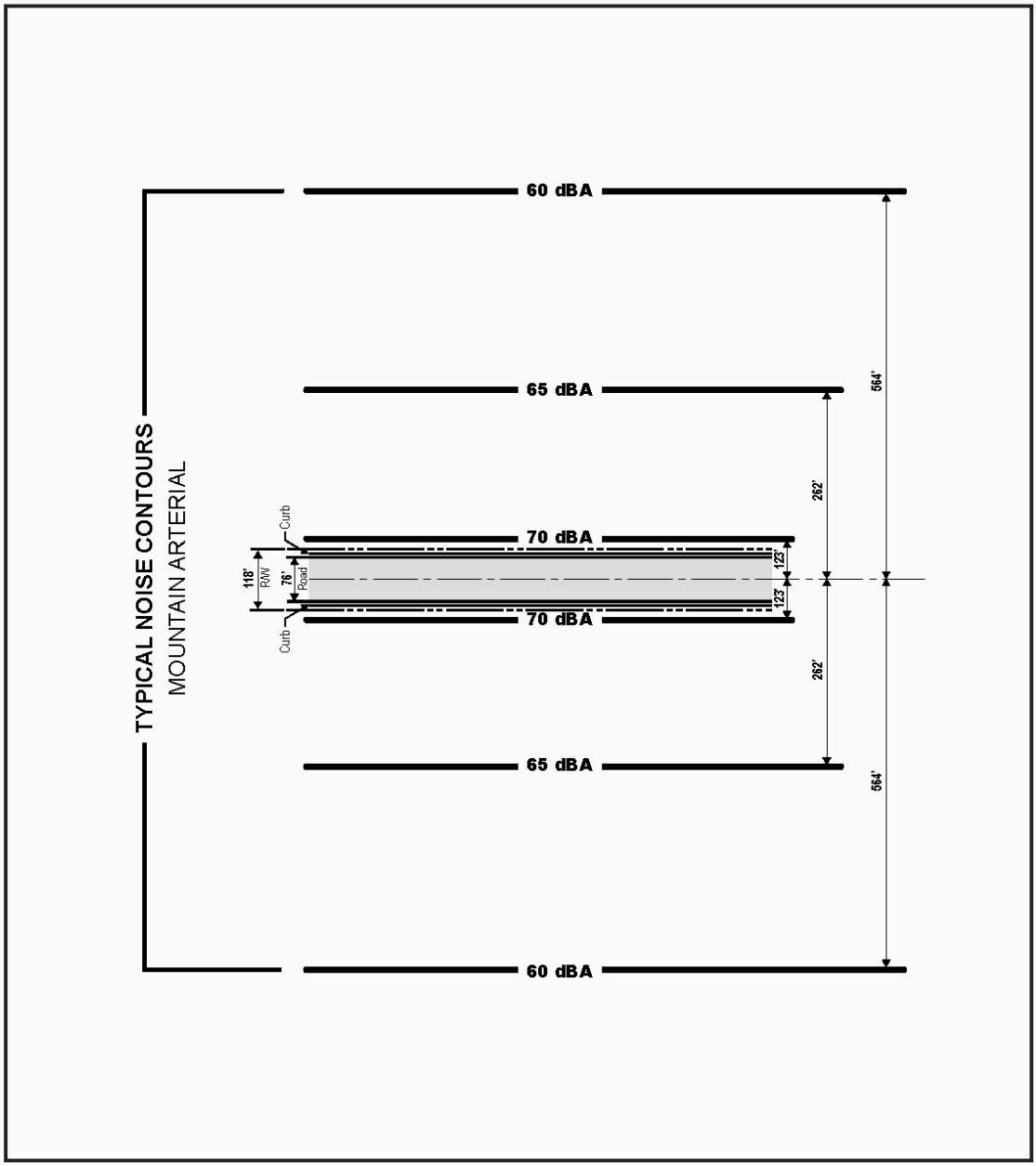

Figure 4

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways: Mountain Arterial (4 Lanes)

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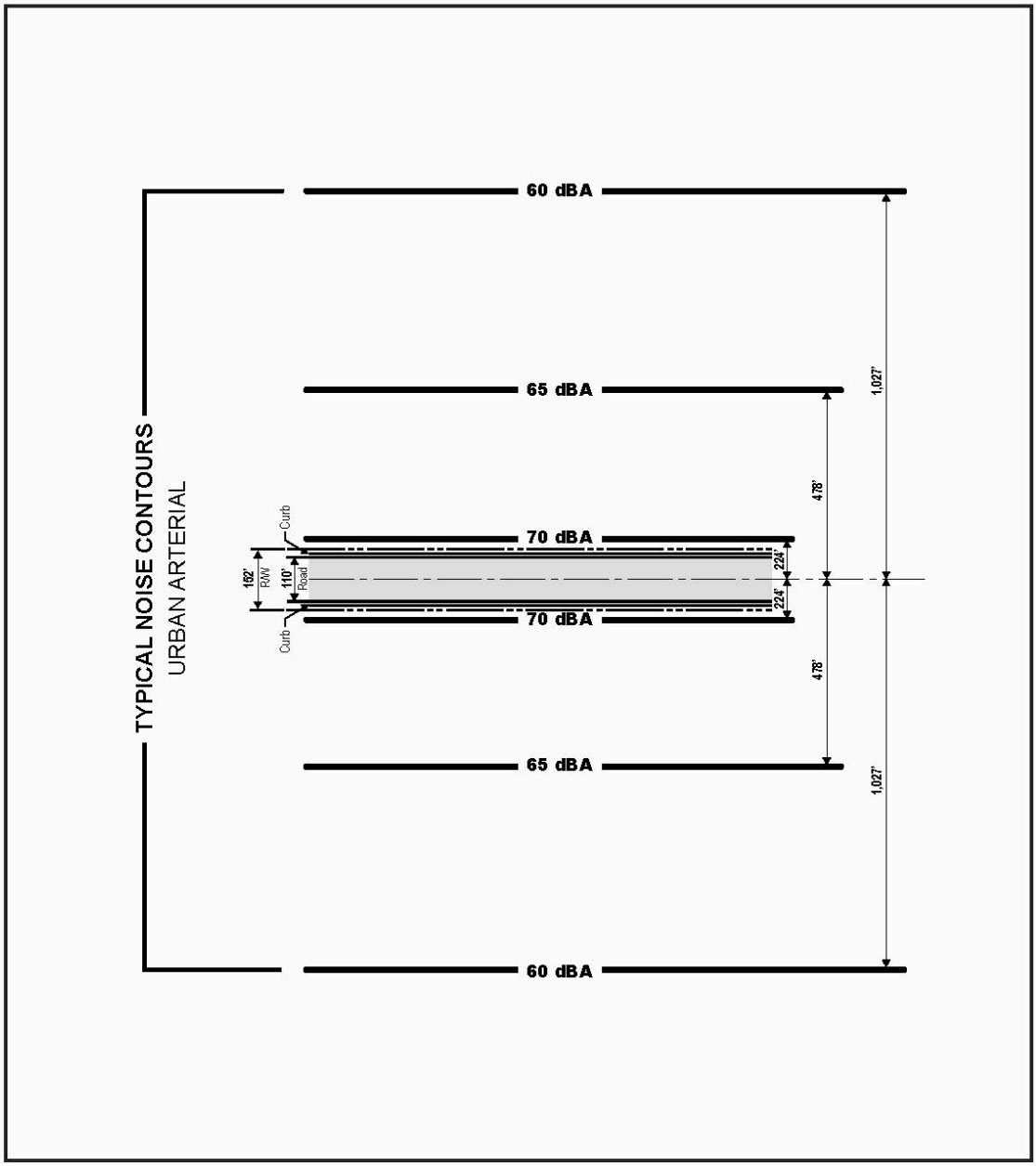

Figure 5

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways: Urban Arterial (6 Lanes)

I:\COR1001\GIS\Noise\Contours\Proj Contour_UrbanArterial_6-Lanes.ai (2/15/11)

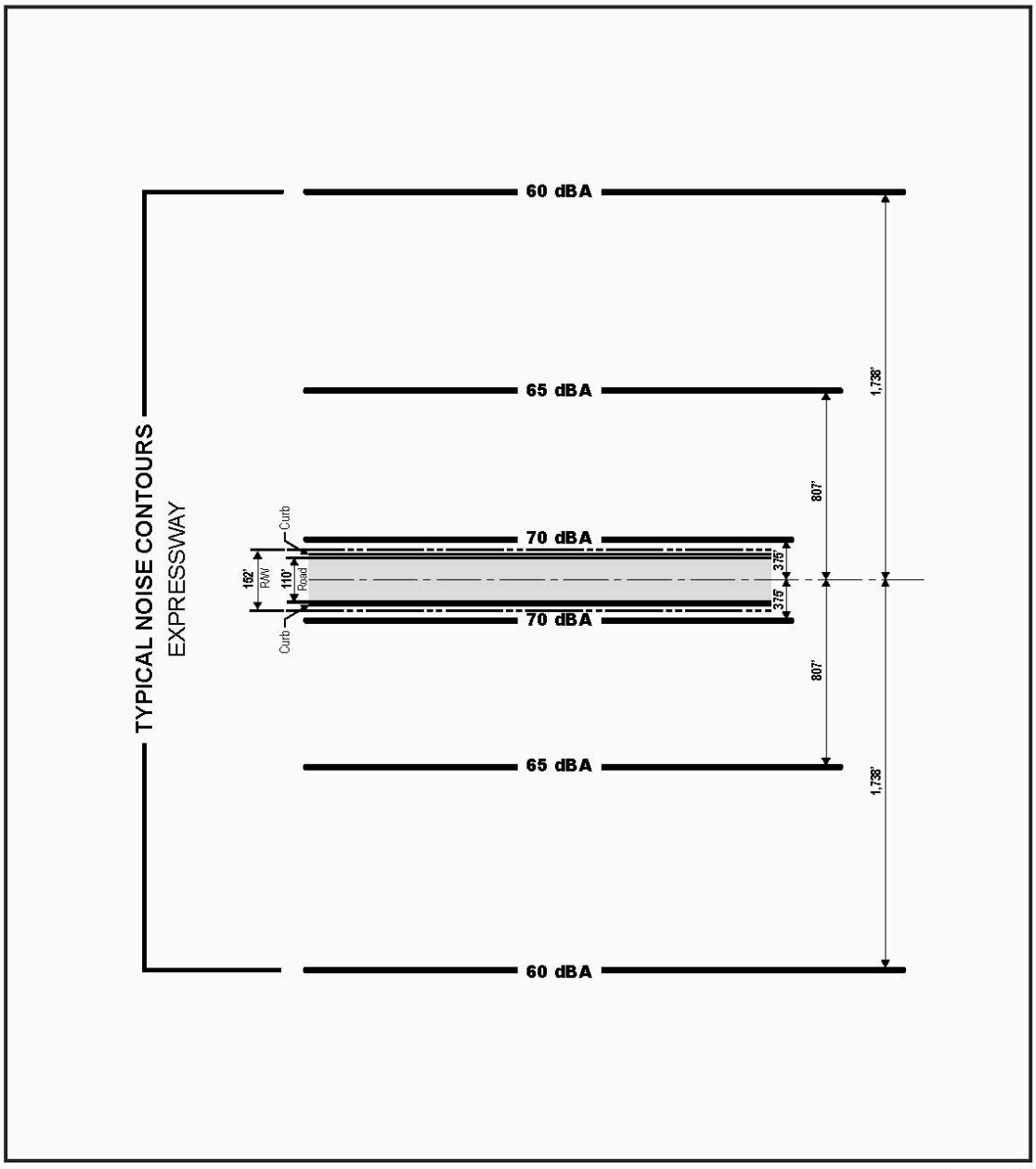

Figure 6

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways: Expressway (6 Lanes)

I:\CORI001\GIS\Noise\Contours\Proj Cont_Expressway_6-Lanes.ai (2/15/11)

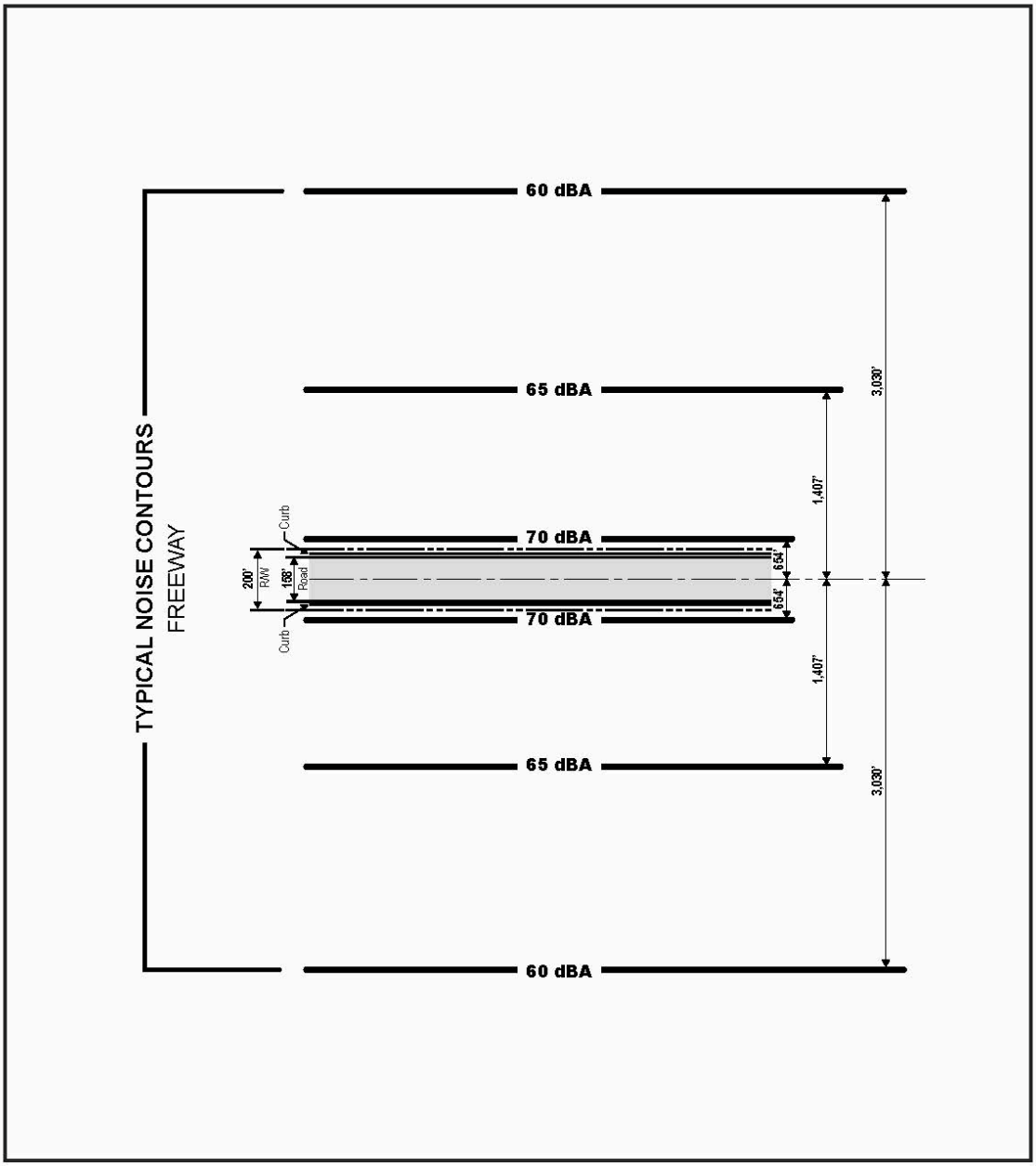

Figure 7

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways: Freeway (6 Lanes)

I:\COR10011G\NoiseContours\Proj Cont_Freeway_6-Lanes.ai (2/15/11)

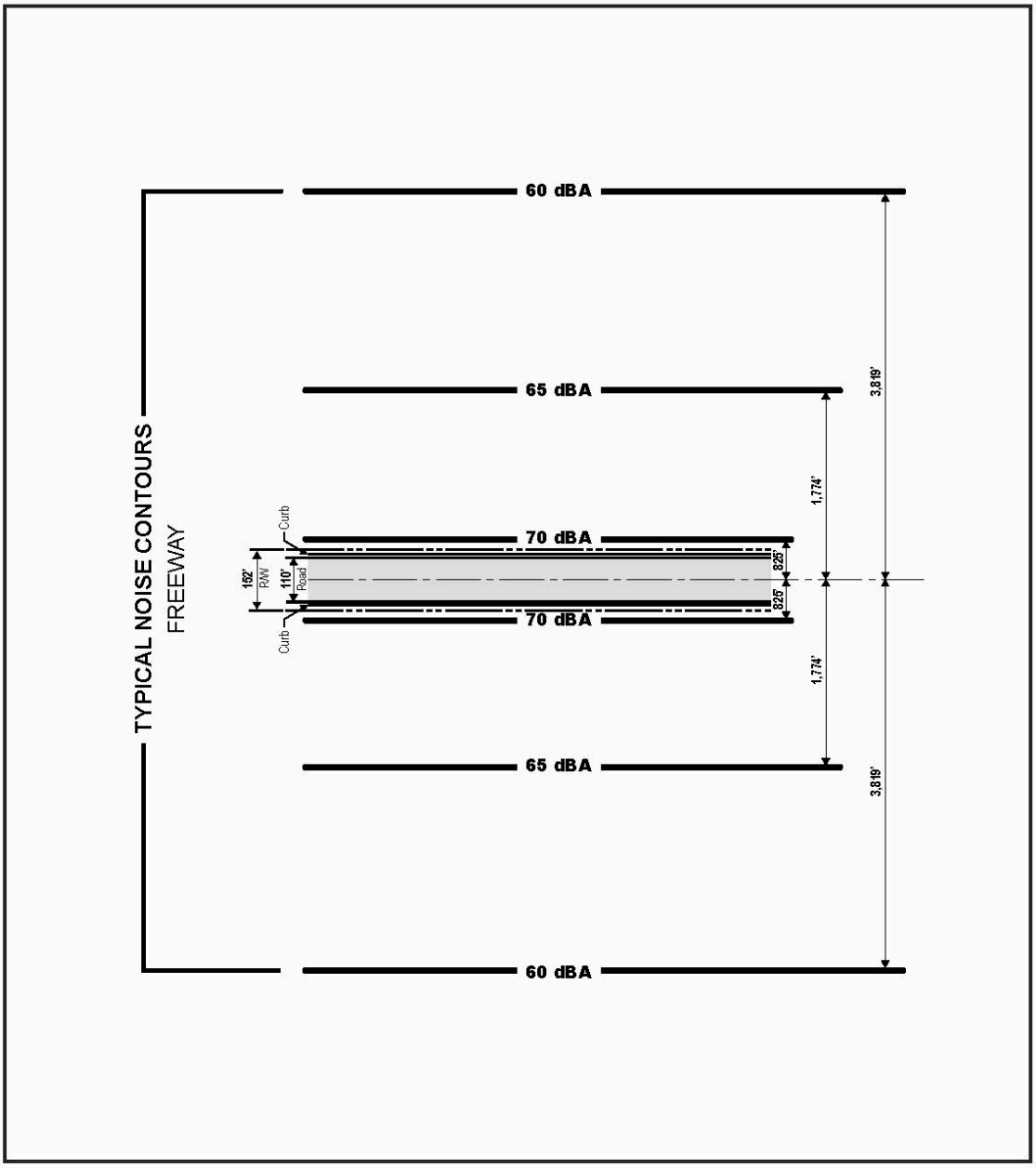

Figure 8

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Projected Noise Contours Along Freeways and Major Highways:
Freeway (10 Lanes)

I:\CORI 0011\GI\Noise\Contours\Proj Cont_Freeway_10-Lanes.ai (2/15/11)

Figure 9

NOT TO SCALE

Projected Noise Contours Along Freeways and Major Highways:
Grand Avenue between Cactus Avenue and Ortega Highway

I:\CORI001\GIS\Noise\Contours Fwys\Exist Contour_GrandAve at Cactus & Ortega.ai (2/15/11)

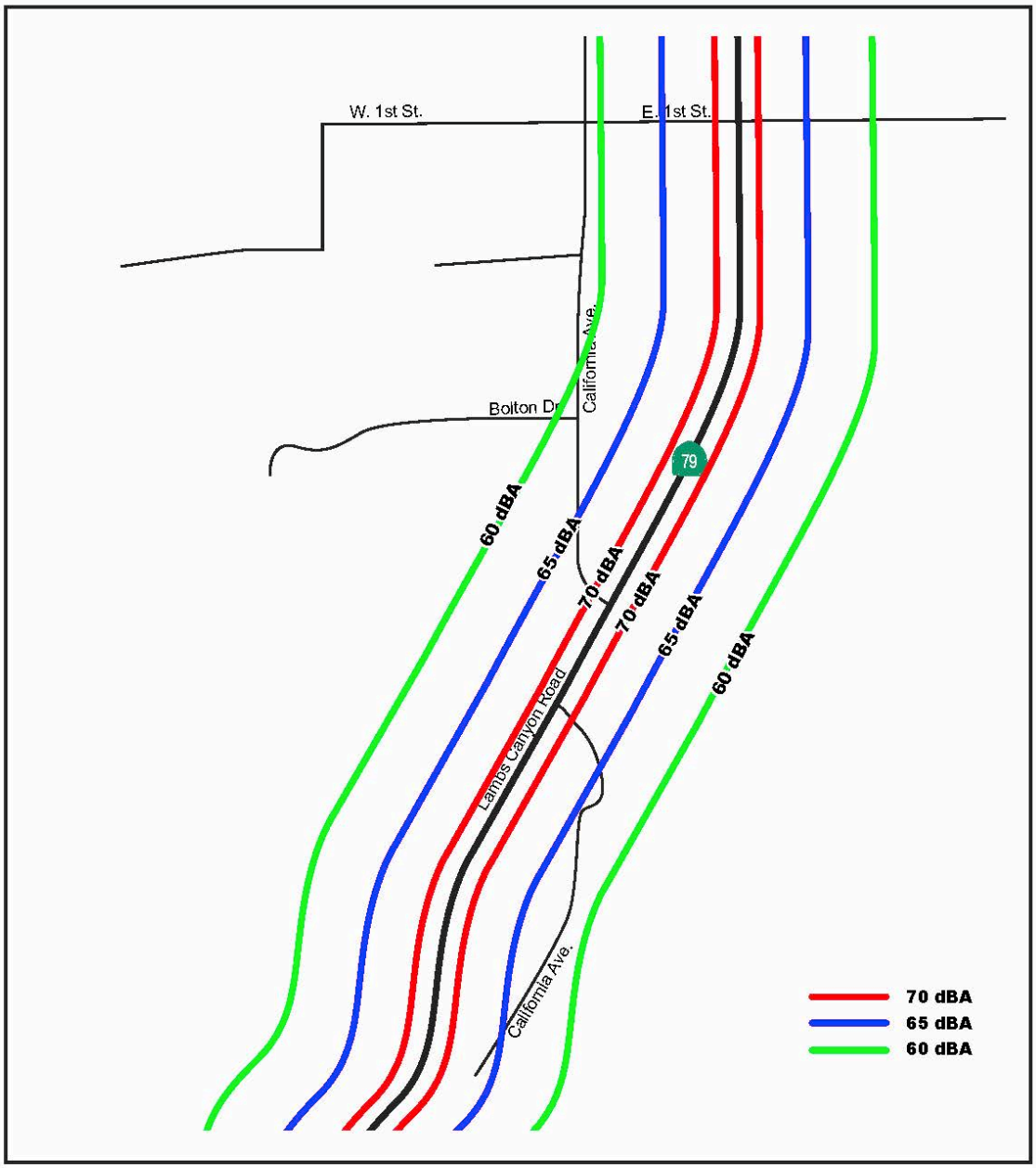

Figure 10

NOT TO SCALE

Projected Noise Contours Along Freeways and Major Highways:
State Route 79 between Gilman Springs Road and Mellow Lane

I:\COR1001\GIS\Noise\Contours Fwys\Exist Contour_SR-79 at Gilman & Mellow.ai (2/15/11)

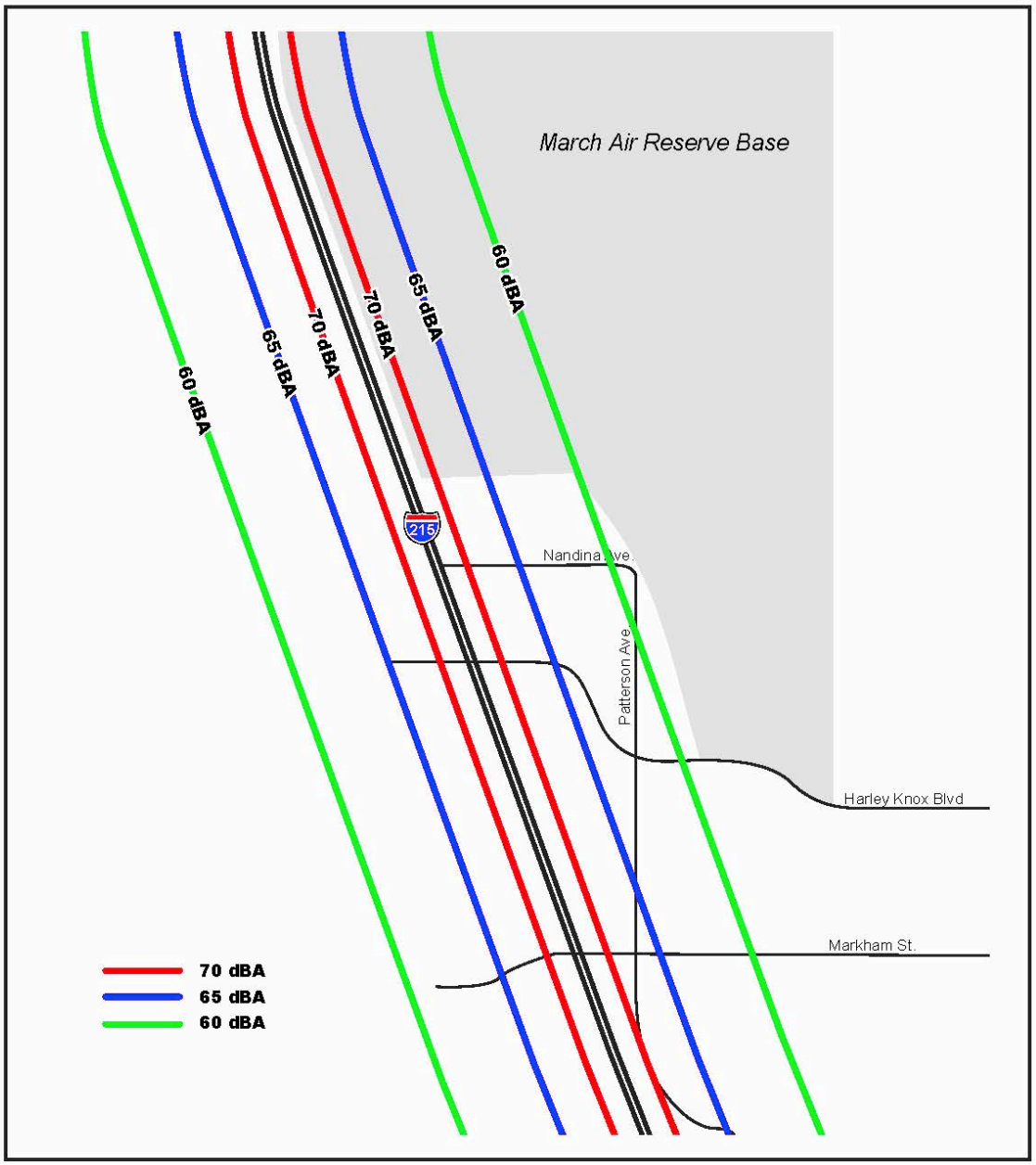

Figure 11

NOT TO SCALE

Projected Noise Contours Along Freeways and Major Highways:
I-215 between Van Buren Blvd and Ramona Expressway

I:\COR1001\GIS\Noise\Contours Fwys\Exist Contour_Hwy215_VanBuren & Ramona.ai (2/15/11)

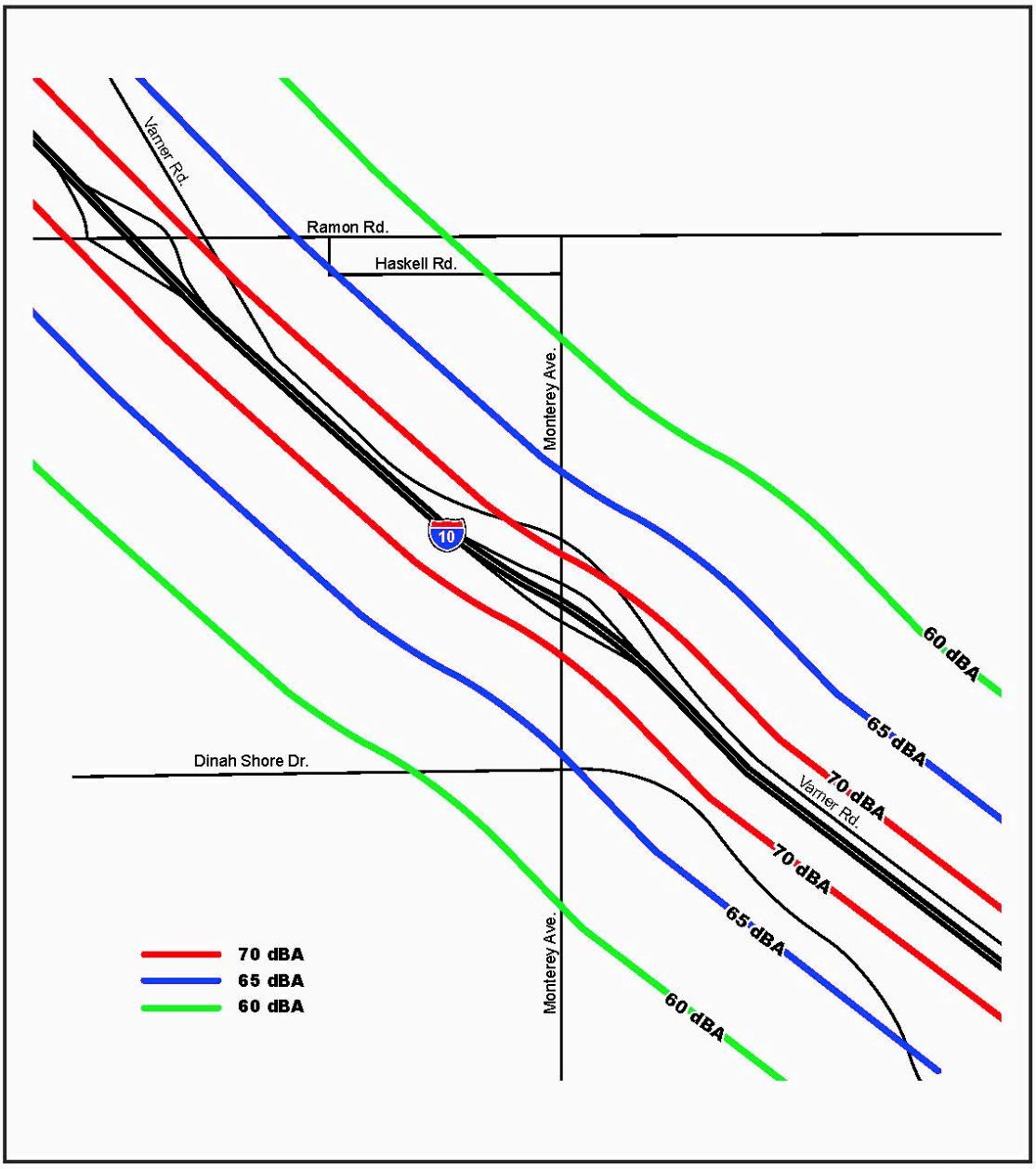

Figure 12

NOT TO SCALE

Projected Noise Contours Along Freeways and Major Highways:
I-10 at Monterey Avenue

I:\COR1001\GIS\Noise\Contours Fwys\Exist Contour_I-10 at MontereyAve.ai (2/15/11)

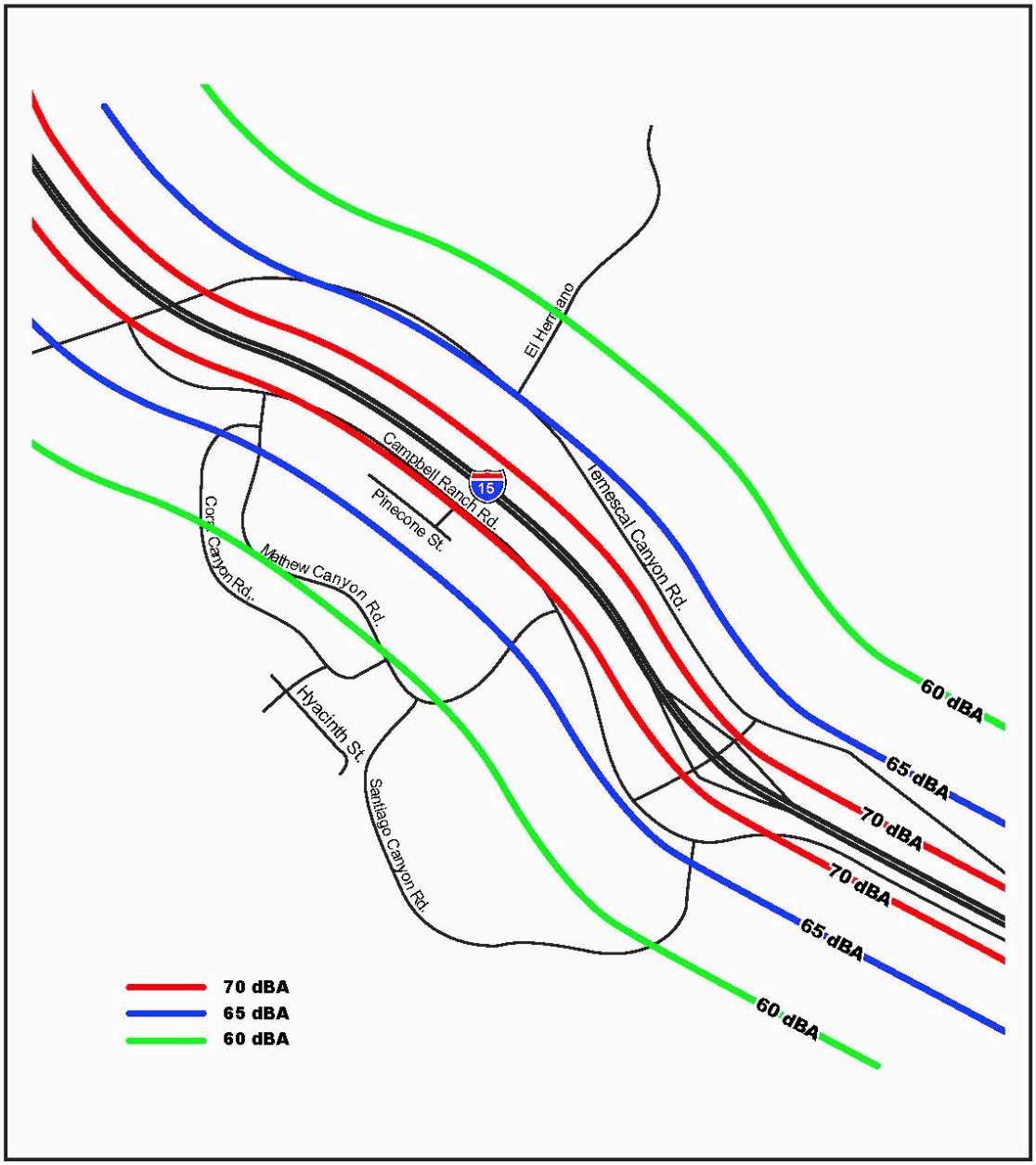

Figure 13

NOT TO SCALE

Projected Noise Contours Along Freeways and Major Highways:
I-15 between Weirick Road and Temescal Canyon Road

I:\COR1001\GIS\Noise\Contours Fwys\Exist Contour_I-15 at Weirick_Temescal.ai (2/15/11)

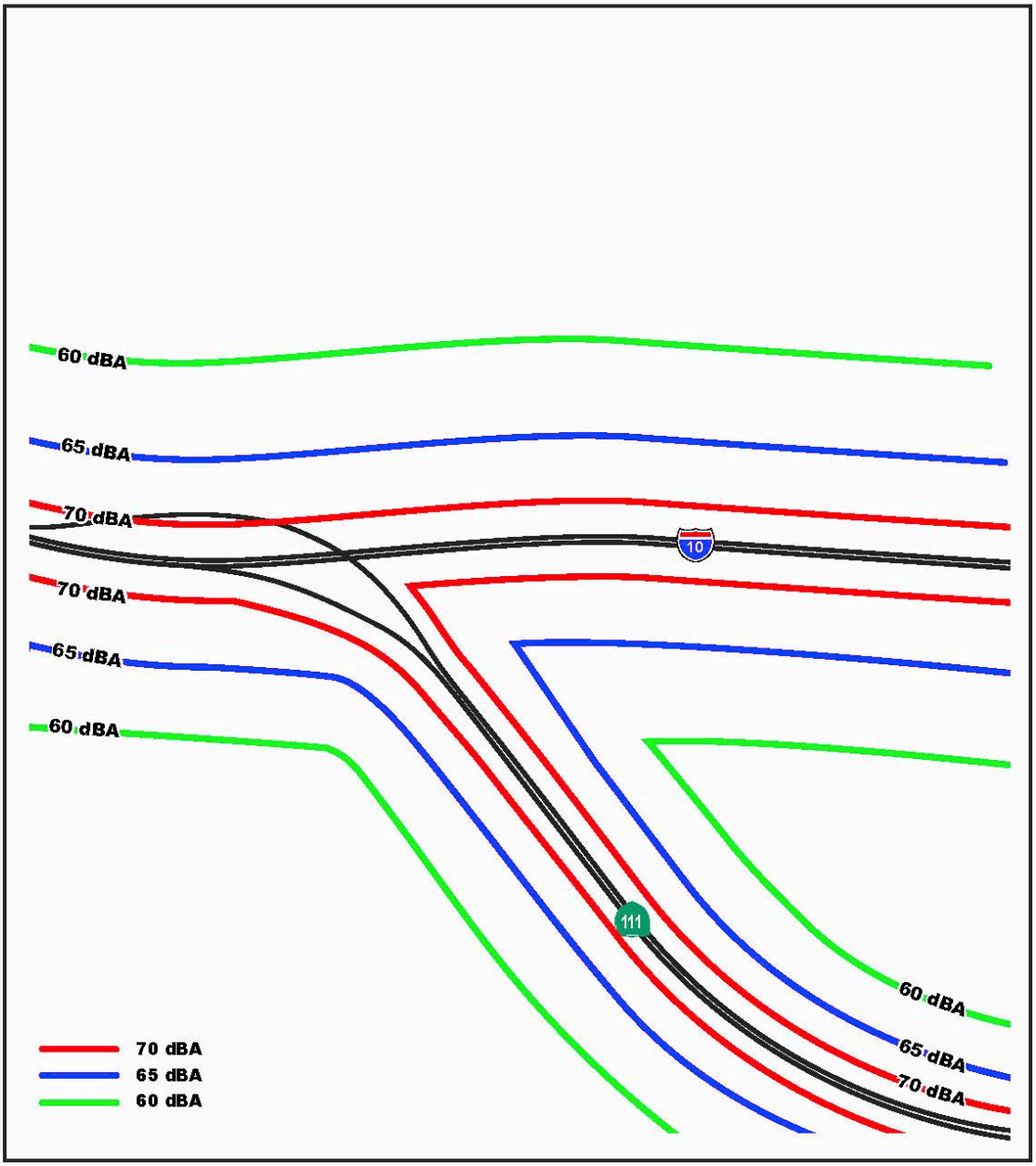

Figure 14

NOT TO SCALE

Projected Noise Contours Along Freeways and Major Highways:
I-10 at State Highway 111

I:\COR1001\GIS\Noise\Contours Fwys\Exist Contour_I-10 at SH-111.ai (2/15/11)

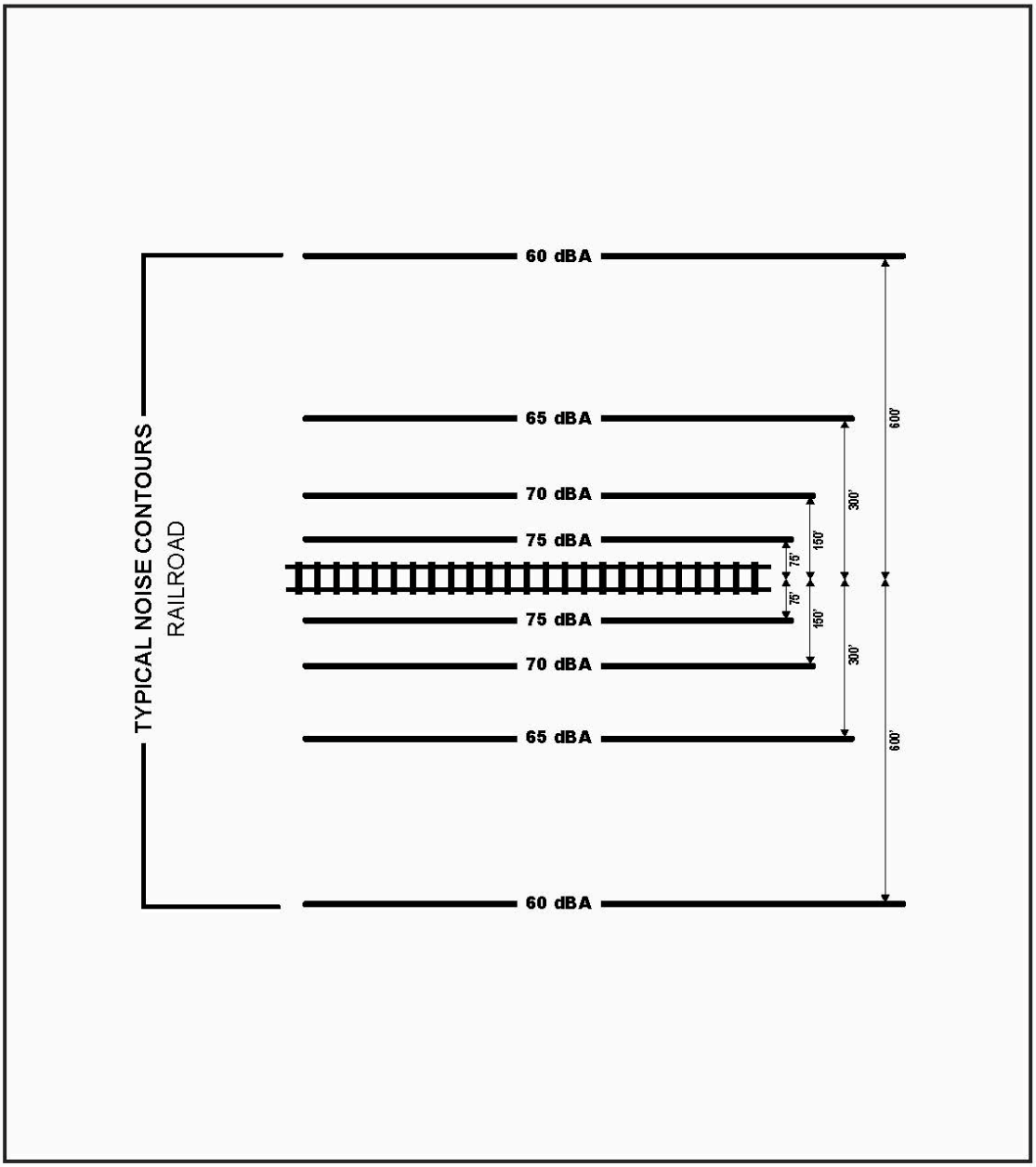

Figure 15

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Typical Railroad Noise Contours:
1 Locomotive and 5 Cars with Horns (a Commuter Train)

I:\CORI0011\GIS\Noise\Contours Railroad\Proj Contour_Railroad_1Loco & 5 Cars.ai (2/16/11)

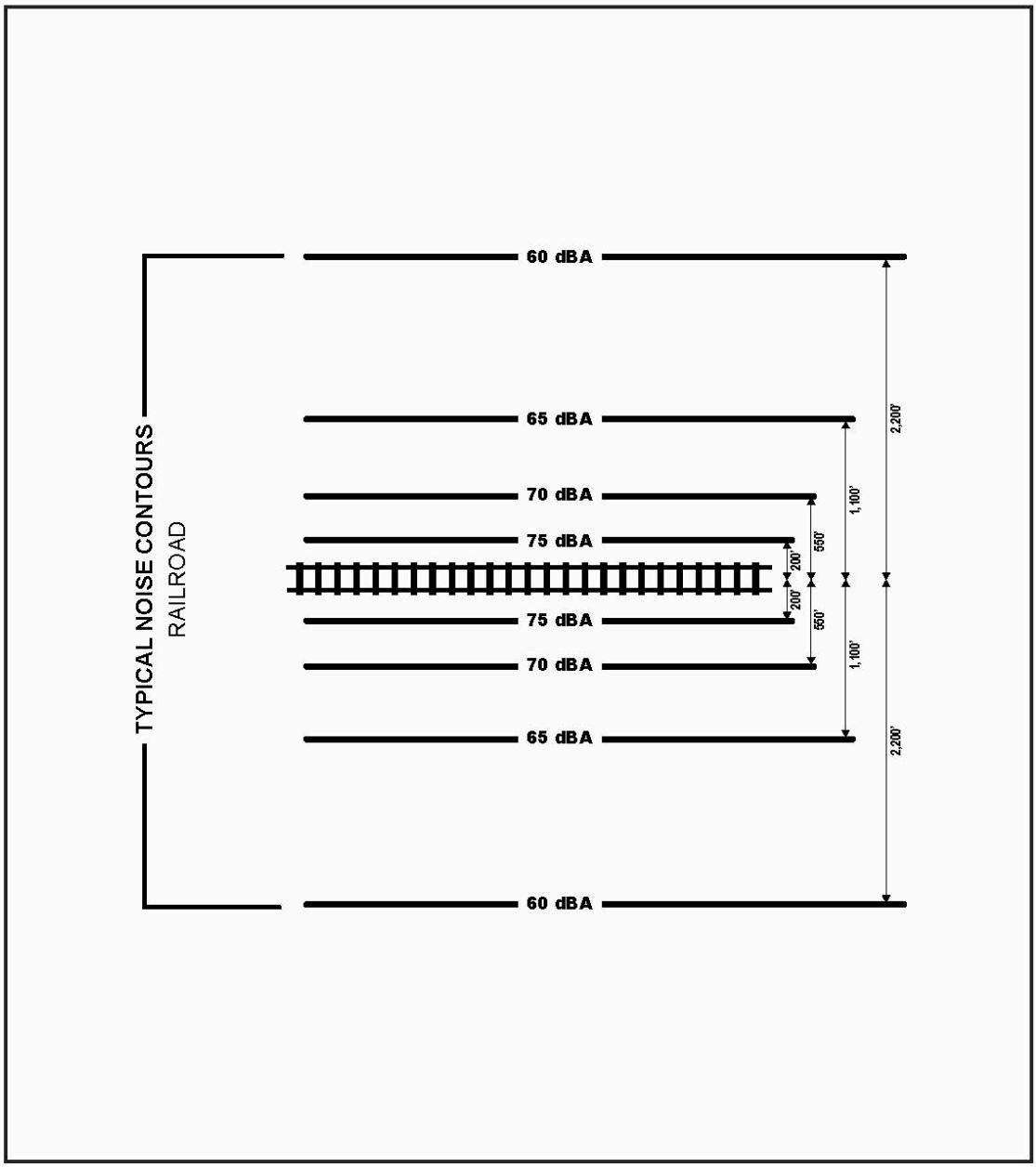

Figure 16

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Typical Railroad Noise Contours:
2 Locomotives and 50 Cars with Horns (a Freight Train)

I:\COR1001\GIS\Noise\Contours Railroad\Proj Contour_Railroad_2 Locos & 50 Cars.ai (2/16/11)

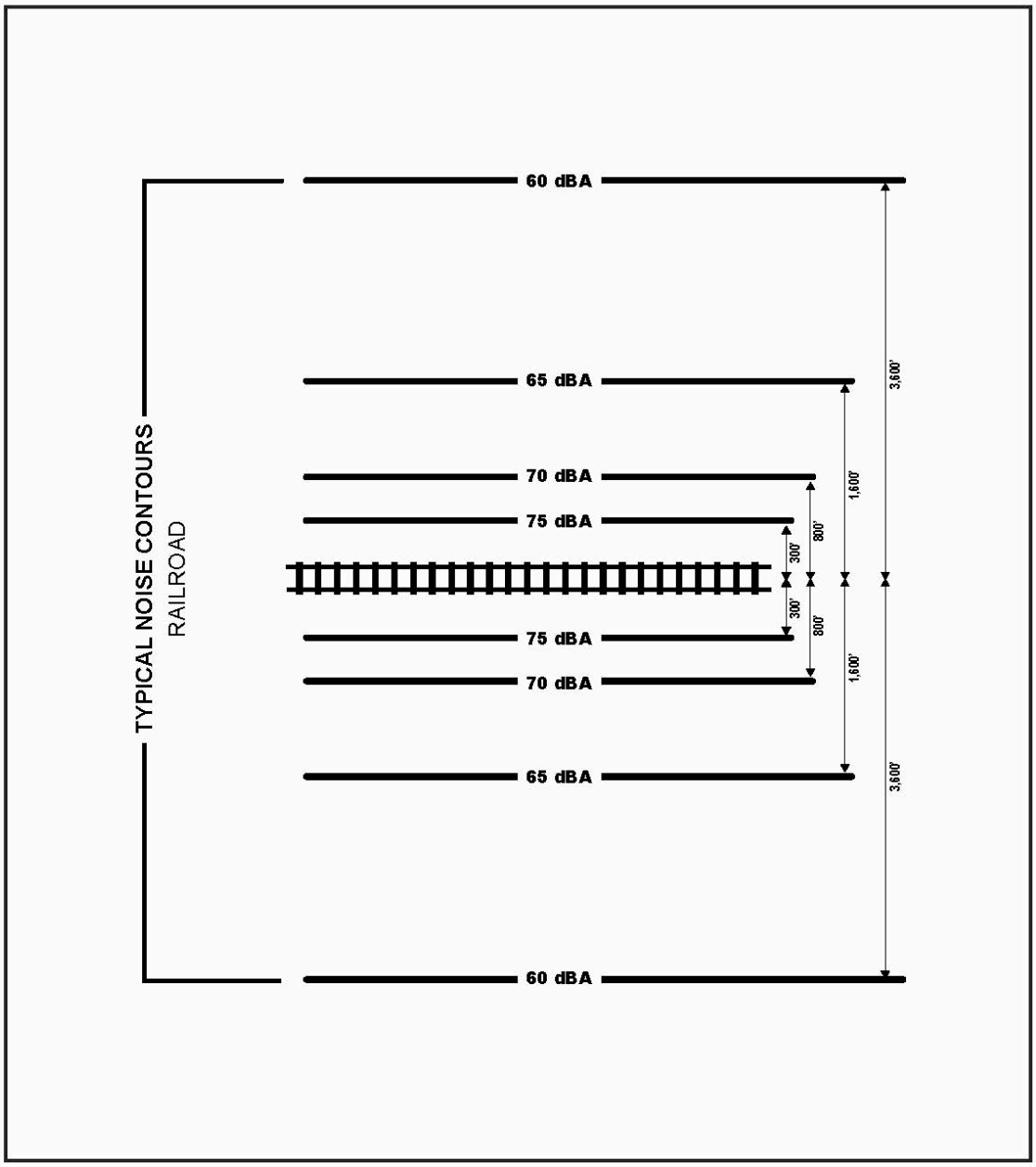

Figure 17

SOURCE: COUNTY OF RIVERSIDE GENERAL PLAN - NOISE ELEMENT DATA

Typical Railroad Noise Contours:
3 Locomotives and 100 Cars with Horns (a Freight Train)

I:\CORI0011\GI\Noise\Contours Railroad\Proj Contour_Railroad_3 Locos & 100 Cars.ai (2/16/11)

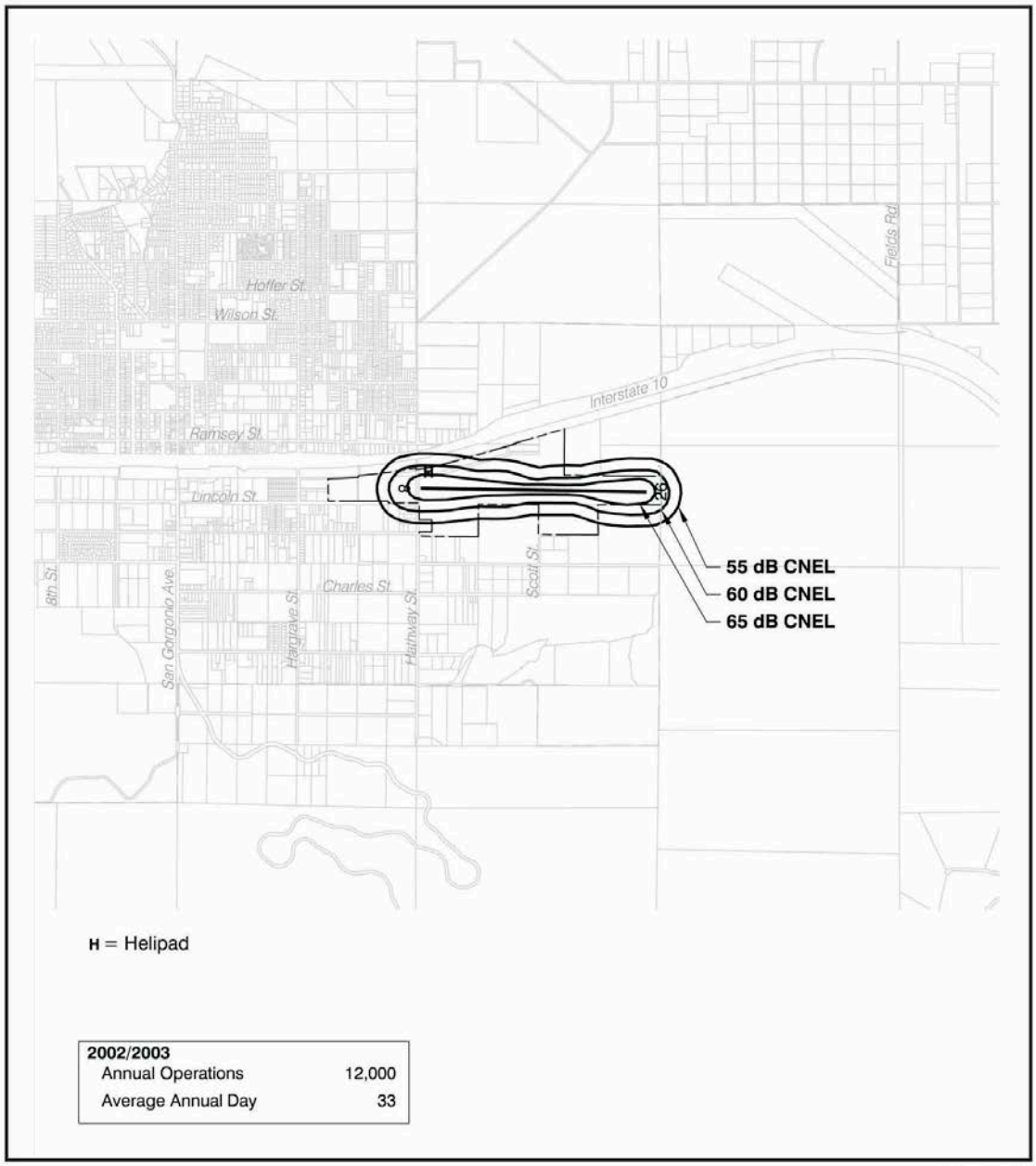

Figure 18

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,500 3,000 FEET

Banning Municipal Airport
Existing Noise Contours

I:\COR1001\GIS\Noise\Banning Municipal - Existing.cdr (2/15/11)

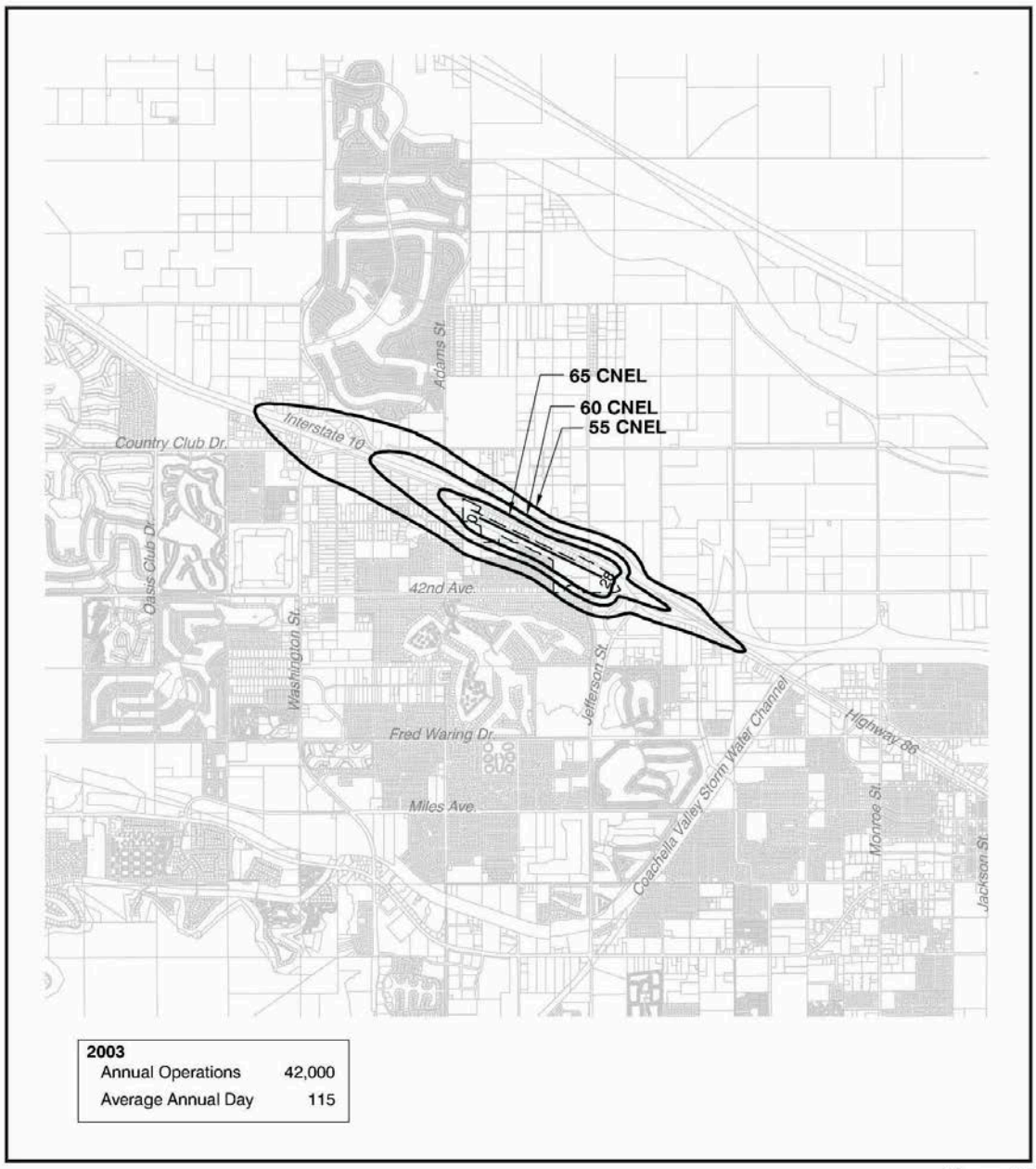

Figure 19

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 2,500 5,000 FEET

Bermuda Dunes Airport Existing Noise Contours: Average Annual Day

I:\COR1001\GIS\Noise\Bermuda Dunes - Existing_AAD.cdr (2/15/11)

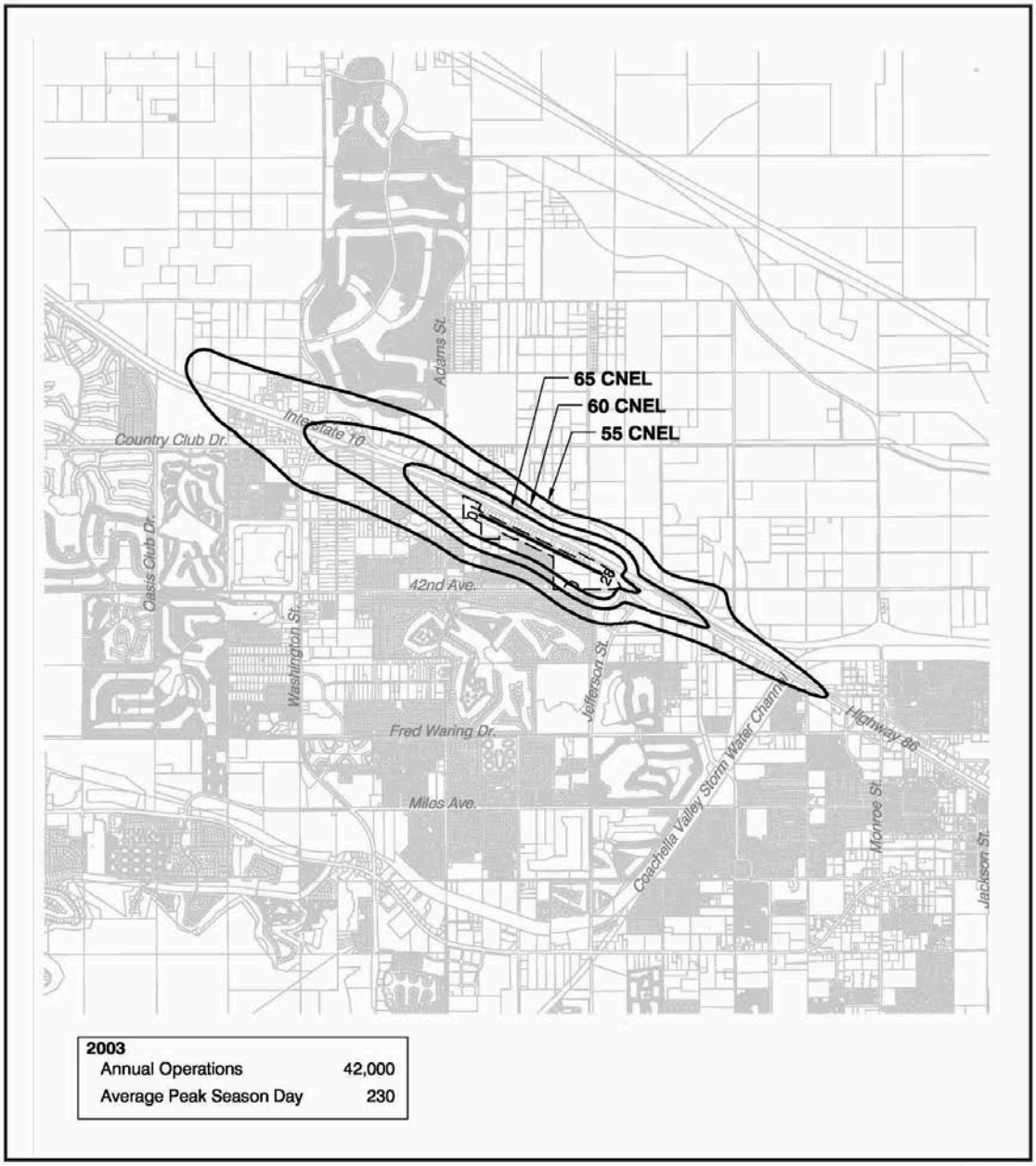

Figure 20

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 2,500 5,000 FEET

Bermuda Dunes Airport Existing Noise Contours: Average Peak Season Day

I:\COR1001\G\Noise\Bermuda Dunes - Existing_APSD.cdr (2/15/11)

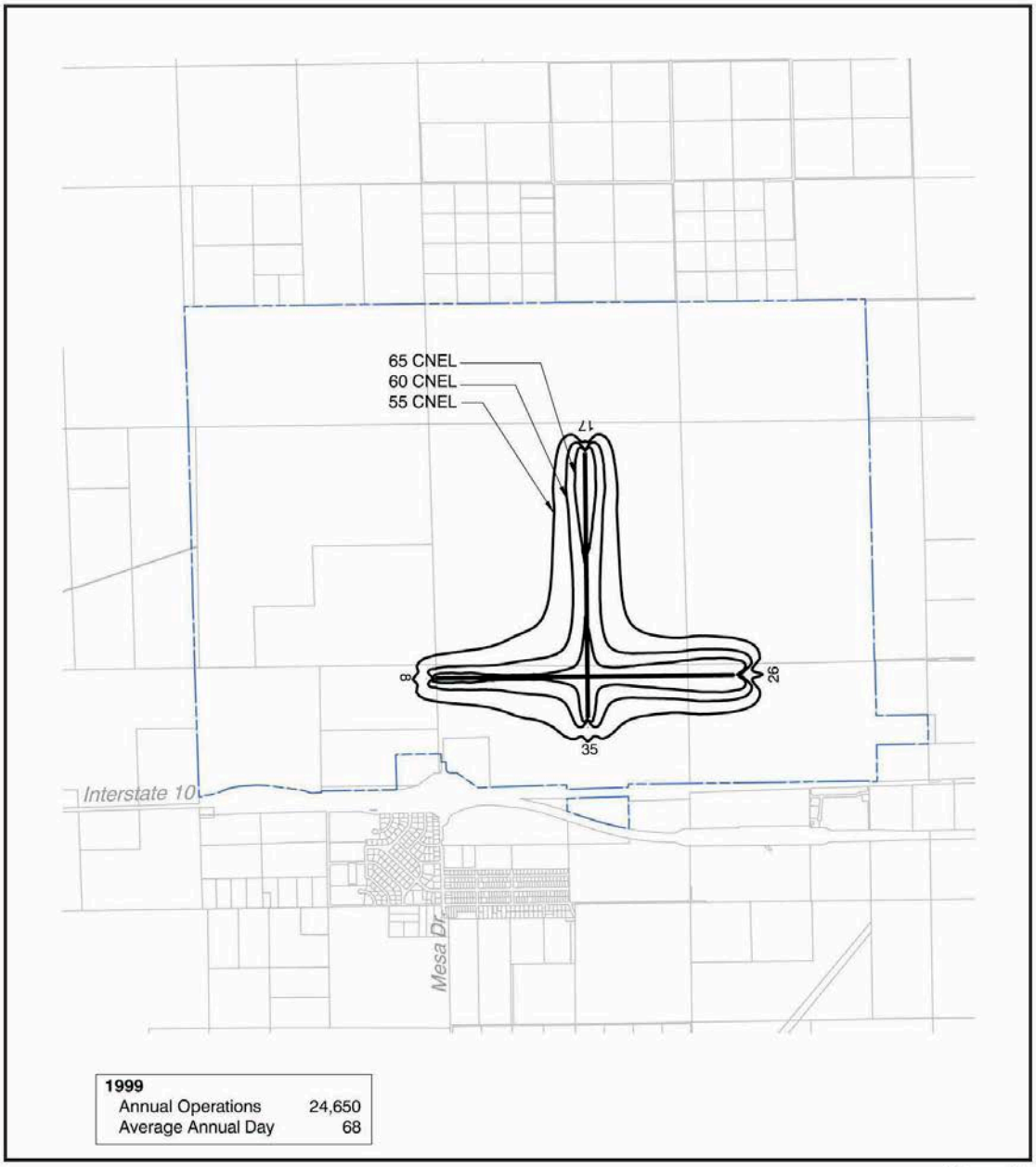

Figure 21

SOURCE: RIVERSIDE COUNTY ALUCP -
EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,500 3,000 FEET

Blythe Municipal Airport
Existing Noise Contours

I:\COR1001\G\Noise\Blythe Municipal - Existing cdr (2/15/11)

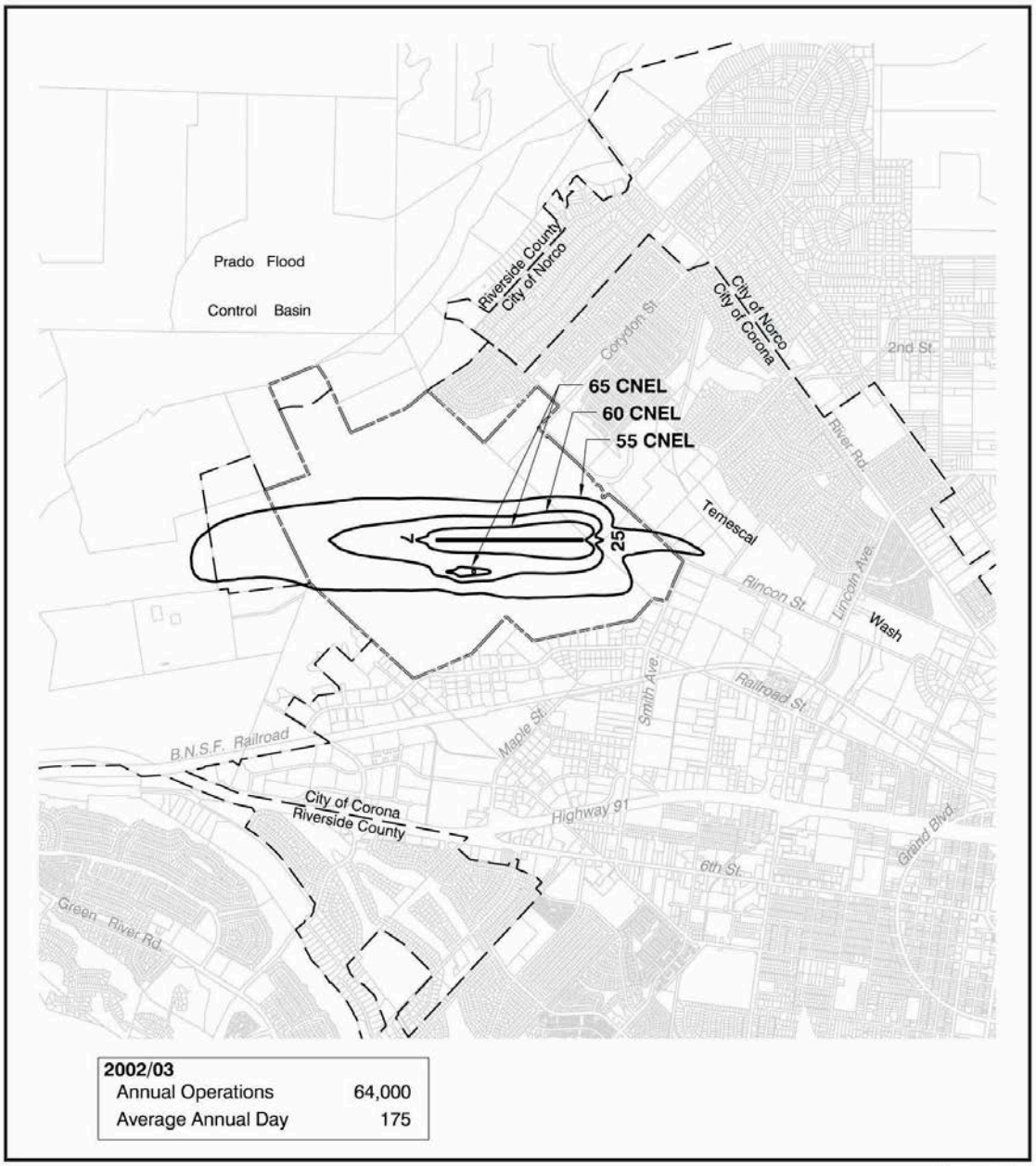

Figure 22

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,500 3,000 FEET

Corona Municipal Airport
Existing Noise Contours

I:\COR1001\G\Noise\Corona Municipal - Existing cdr (2/15/11)

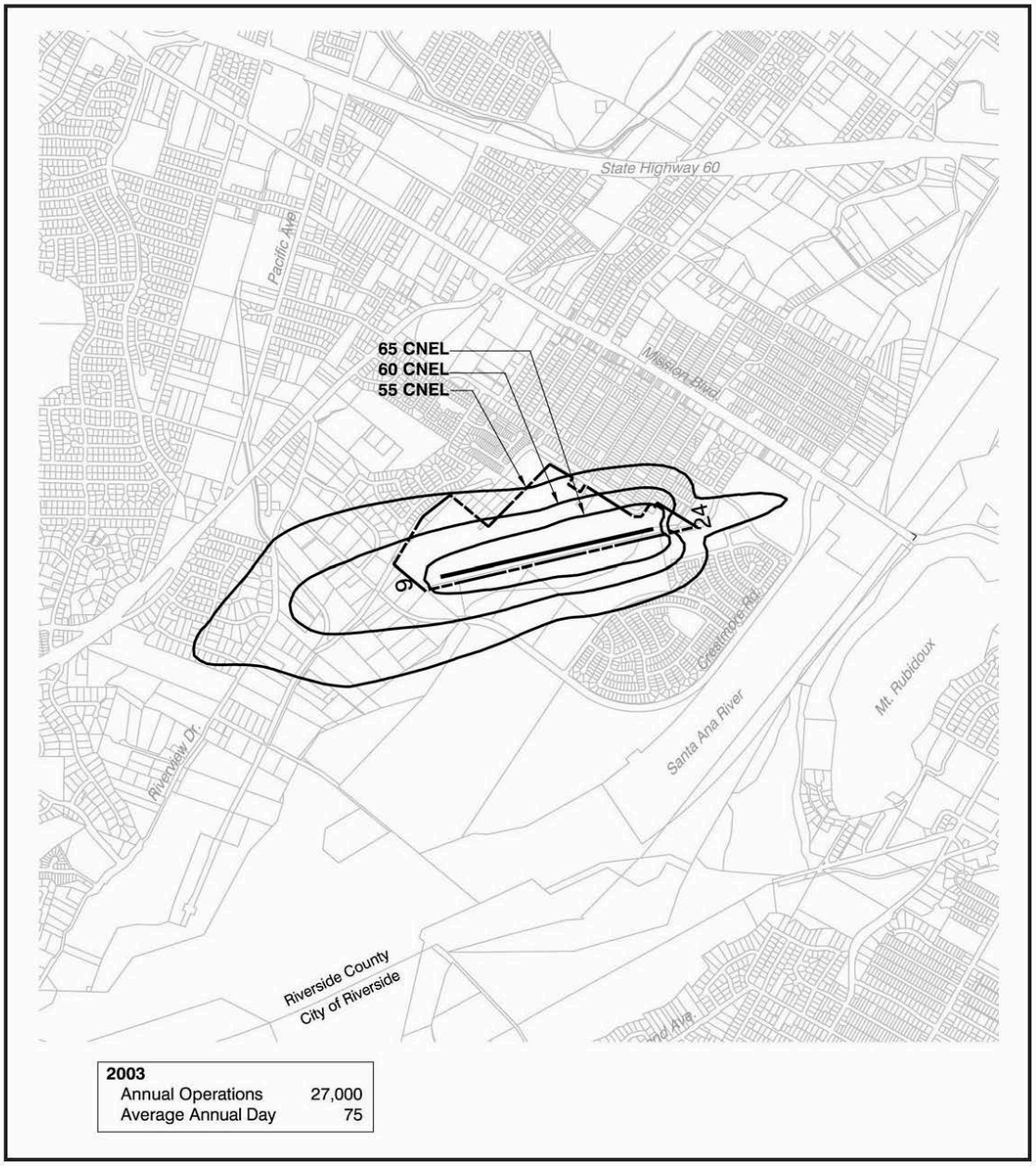

Figure 23

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 1,000 2,000 FEET

Flabob Airport
Existing Noise Contours

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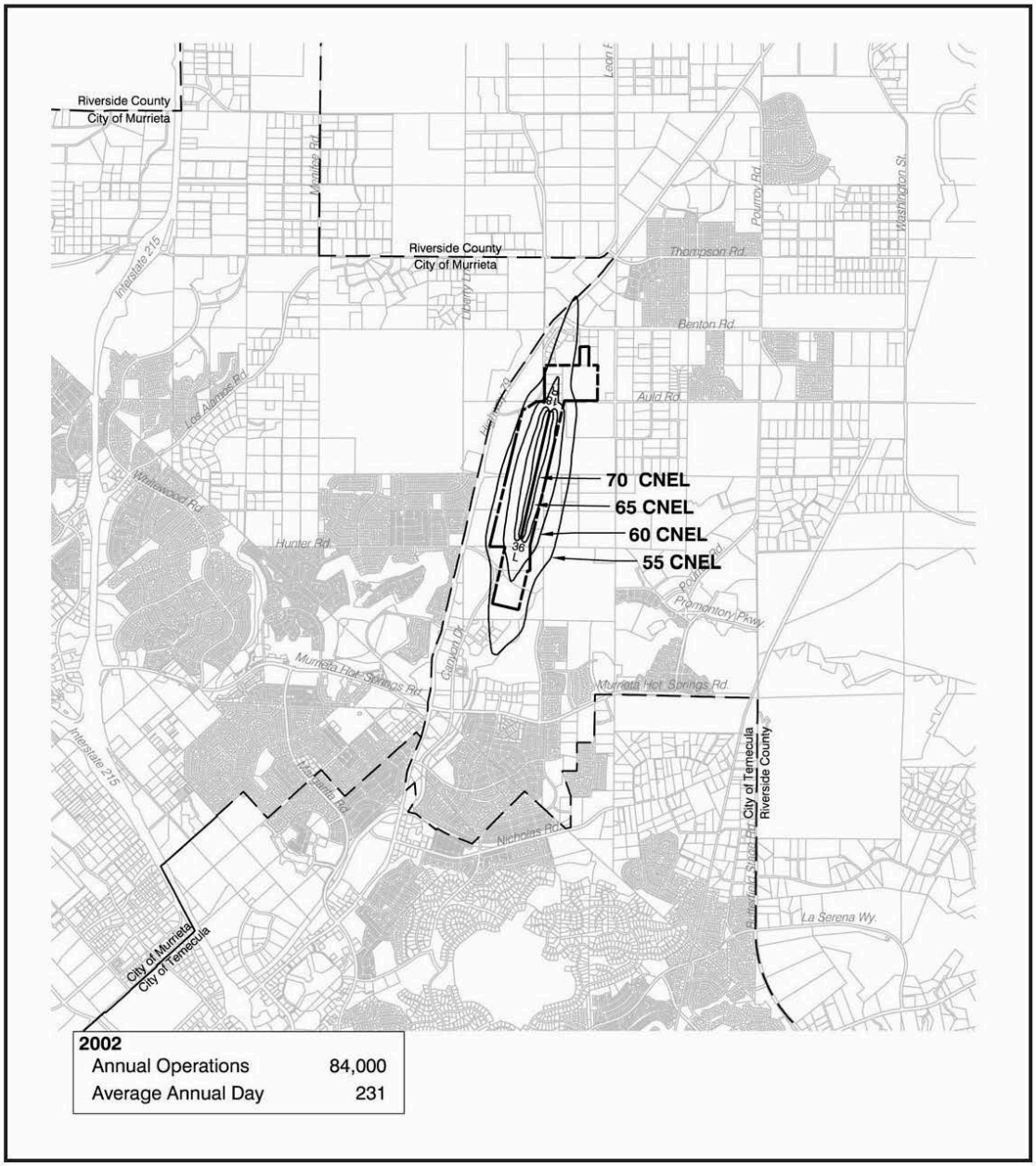

Figure 24

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 2,500 5,000 FEET

I:\COR1001\G\Noise\French Valley-Existing.cdr (2/15/11)

French Valley Airport
Existing Noise Contours

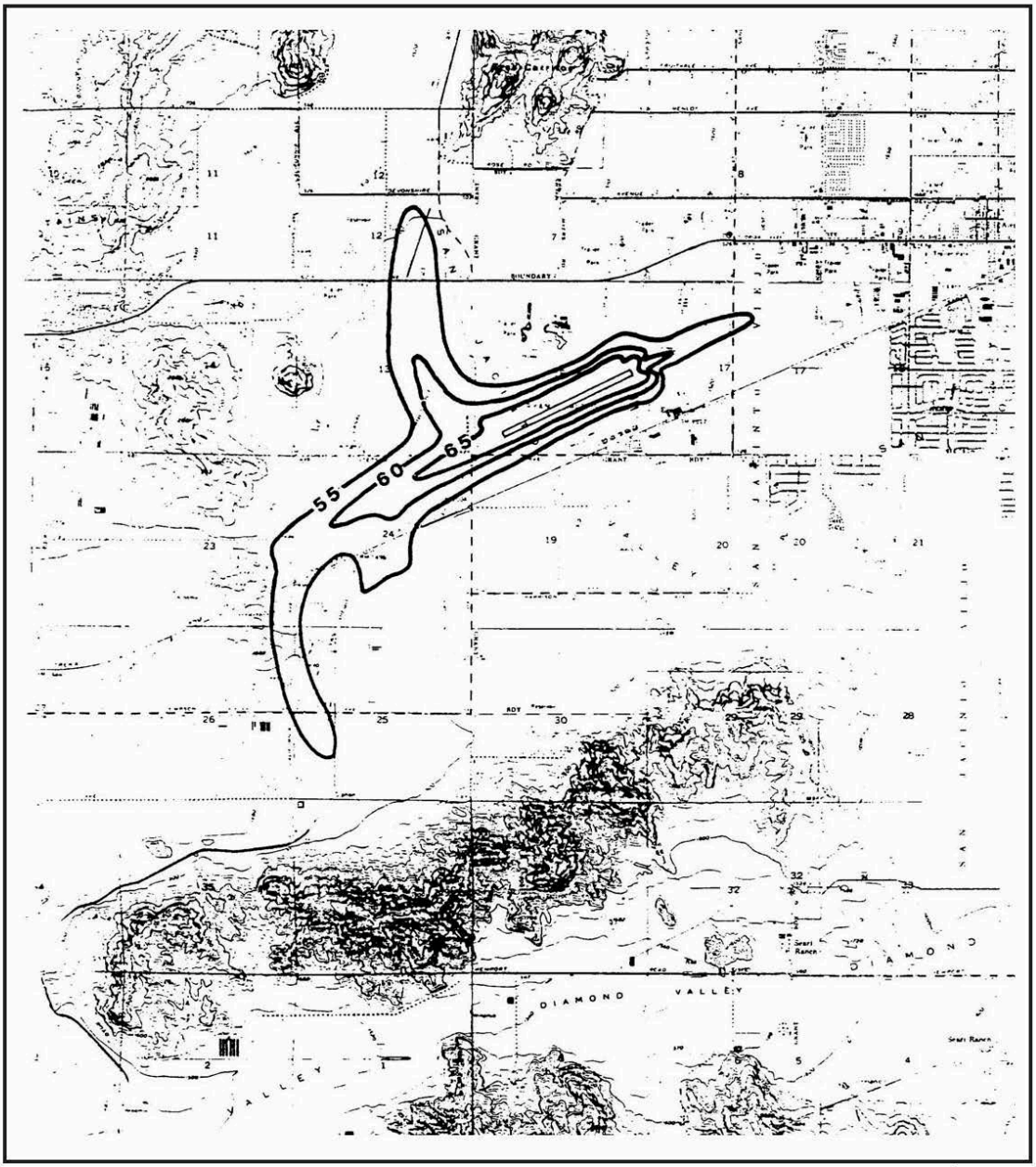

Figure 25

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

Hemet Ryan Airport
Existing (1990) Noise Contours

I:\COR1001\G\Noise\Hemet Ryan-Existing-1990.cdr (2/15/11)

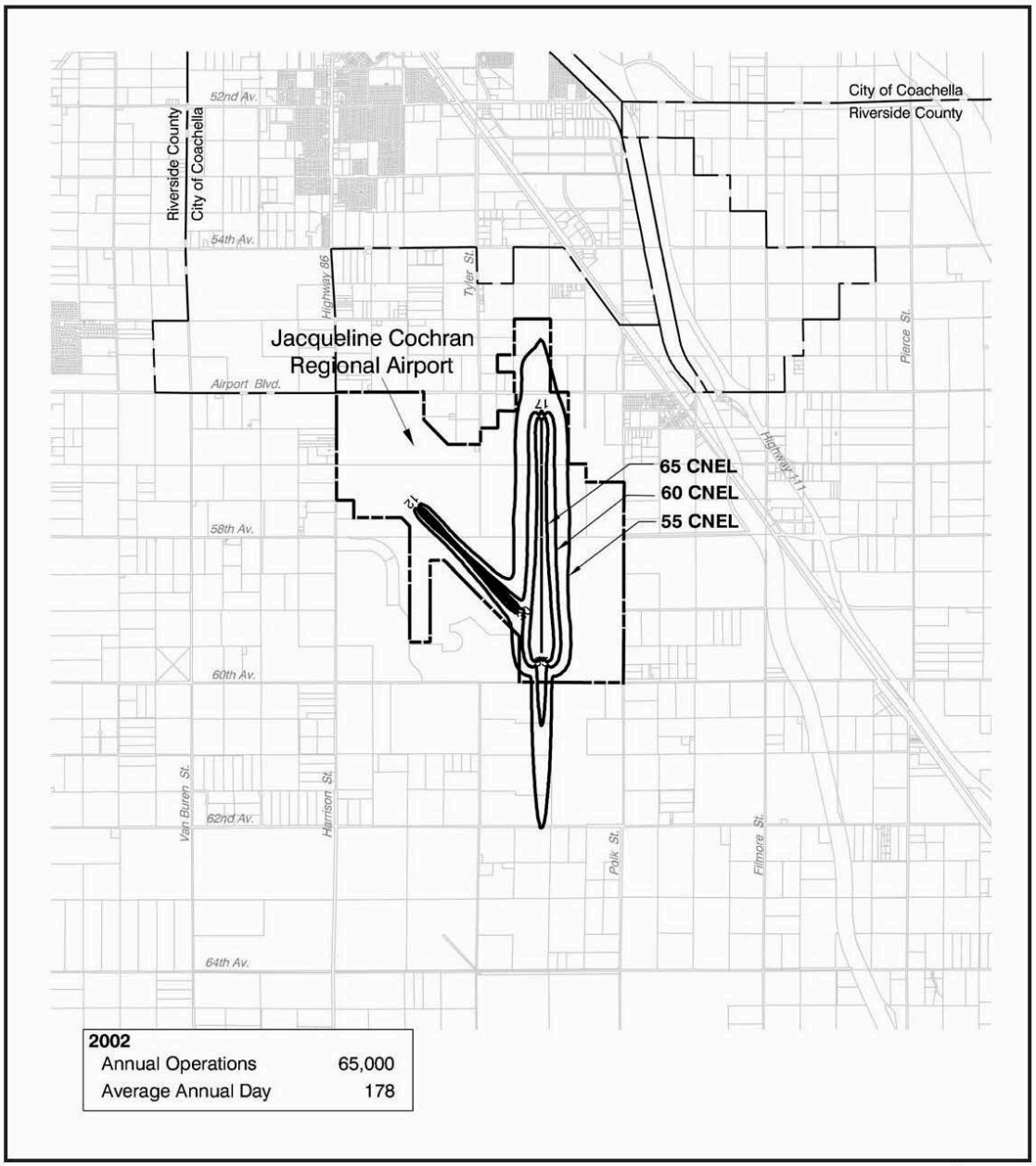

Figure 26

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 2,500 5,000 FEET

Jacqueline Cochran Regional Airport
Existing Noise Contours

I:\COR1001\G\Noise\Jacqueline Cochran Regional-Existing.cdr (2/15/11)

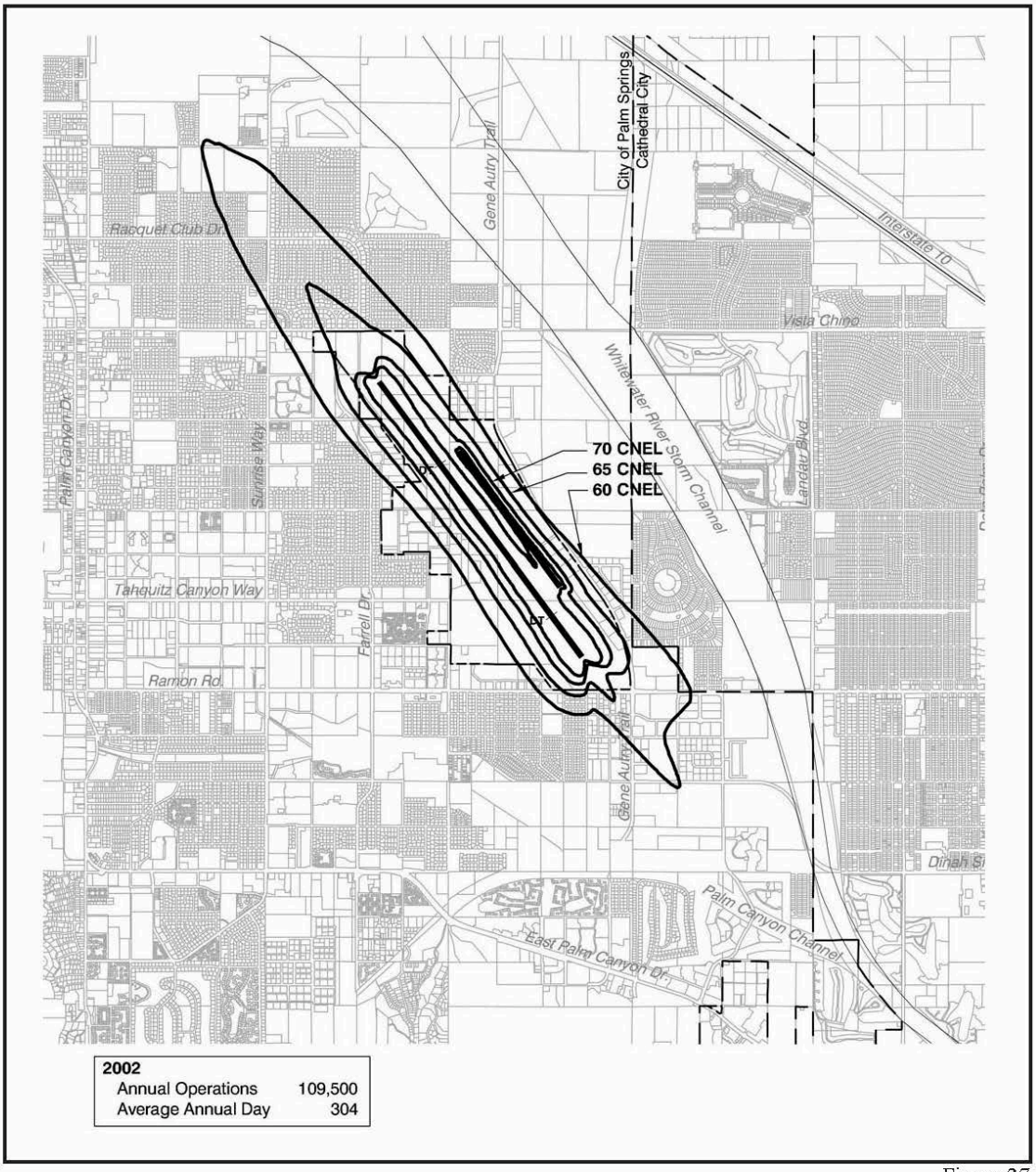

Figure 27

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 2,000 4,000 FEET

I:\COR1001\G\Noise\Palm Springs International-Existing.cdr (2/15/11)

Palm Springs International Airport
Existing Noise Contours

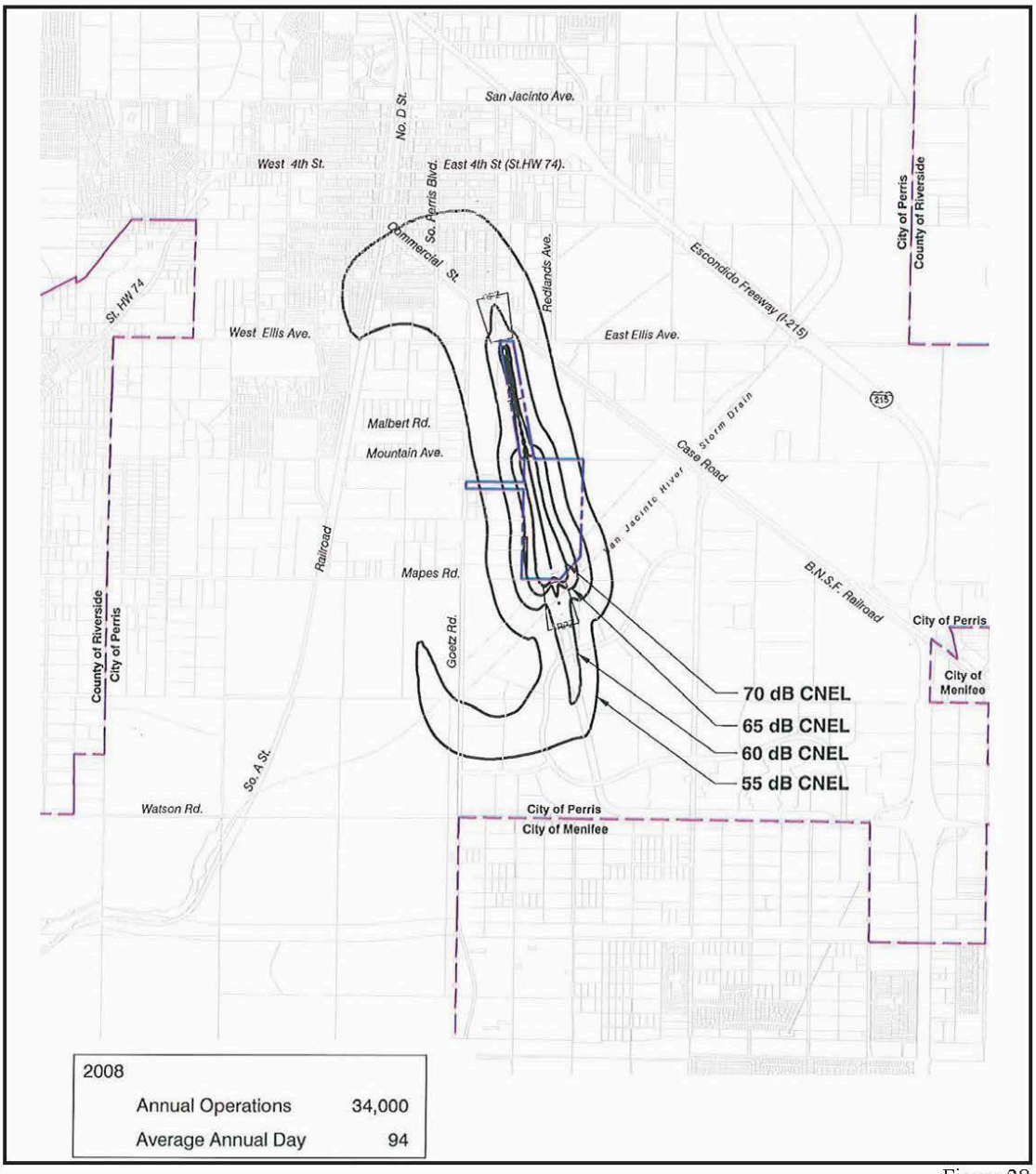

Figure 28

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 1,500 3,000 FEET

Perris Valley Airport
Existing Noise Contours

I:\COR1001\G\Noise\Perris Valley-Existing.cdr (2/15/11)

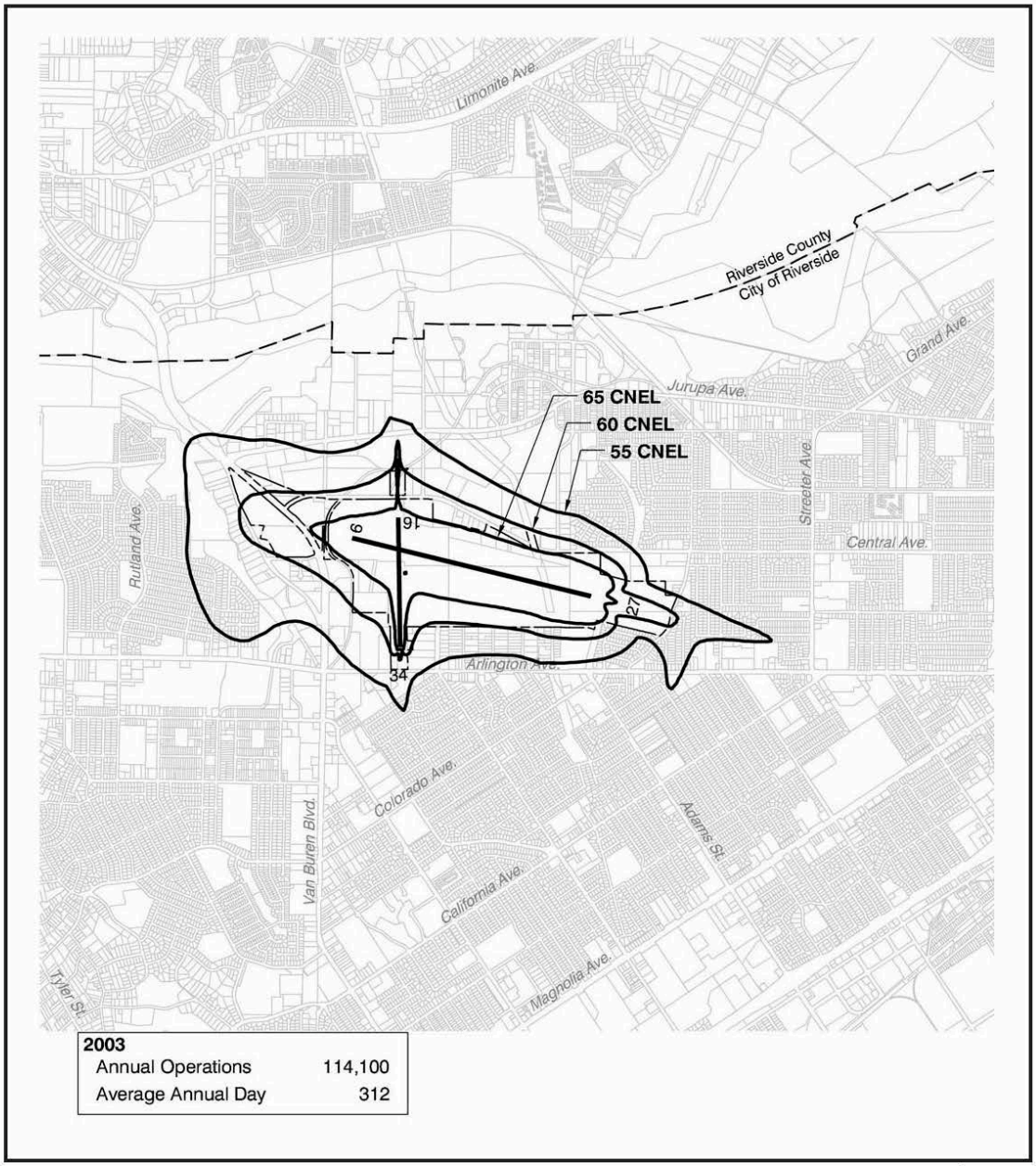

Figure 29

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 1,500 3,000 FEET

Riverside Municipal Airport
Existing Noise Contours

I:\COR1001\G\Noise\Riverside Municipal-Existing.cdr (2/15/11)

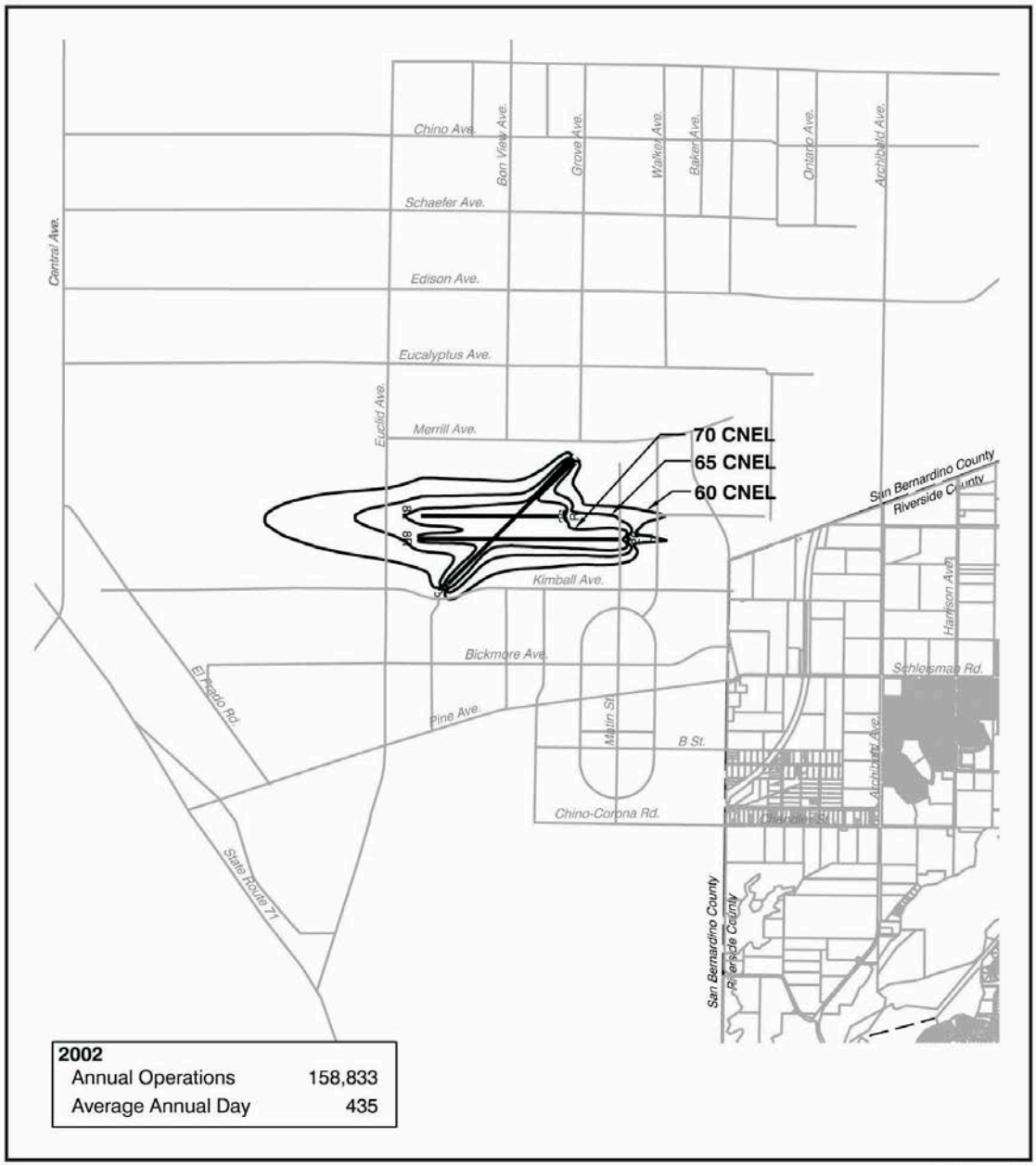

Figure 30

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 2,500 5,000 FEET

Chino Airport
Existing Noise Contours

I:\COR1001\G\Noise\Chino - Existing.cdr (2/15/11)

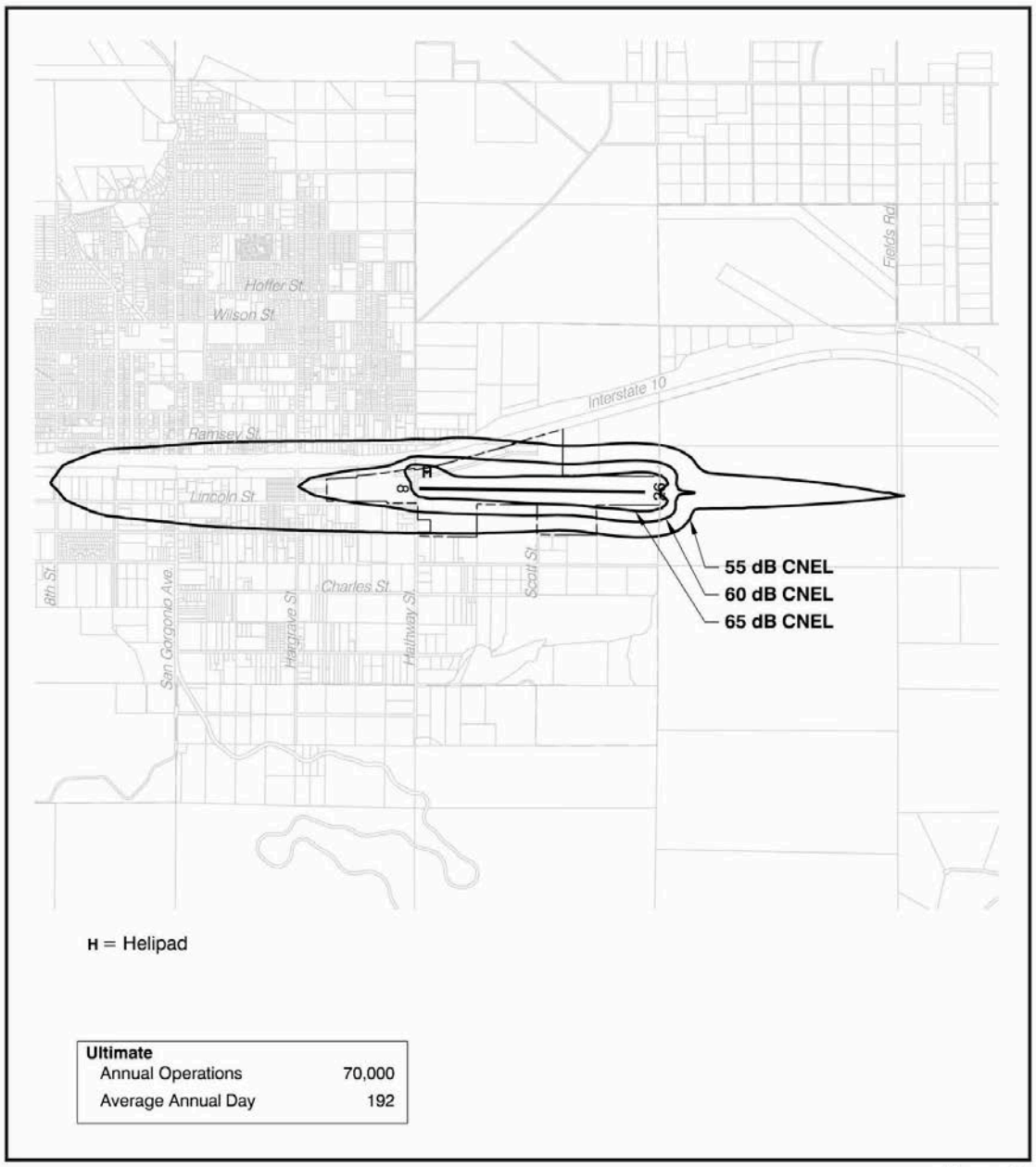

Figure 31

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,500 3,000 FEET

Banning Municipal Airport
Future Noise Contours

I:\COR1001\G\Noise\Banning Municipal - Future.cdr (2/15/11)

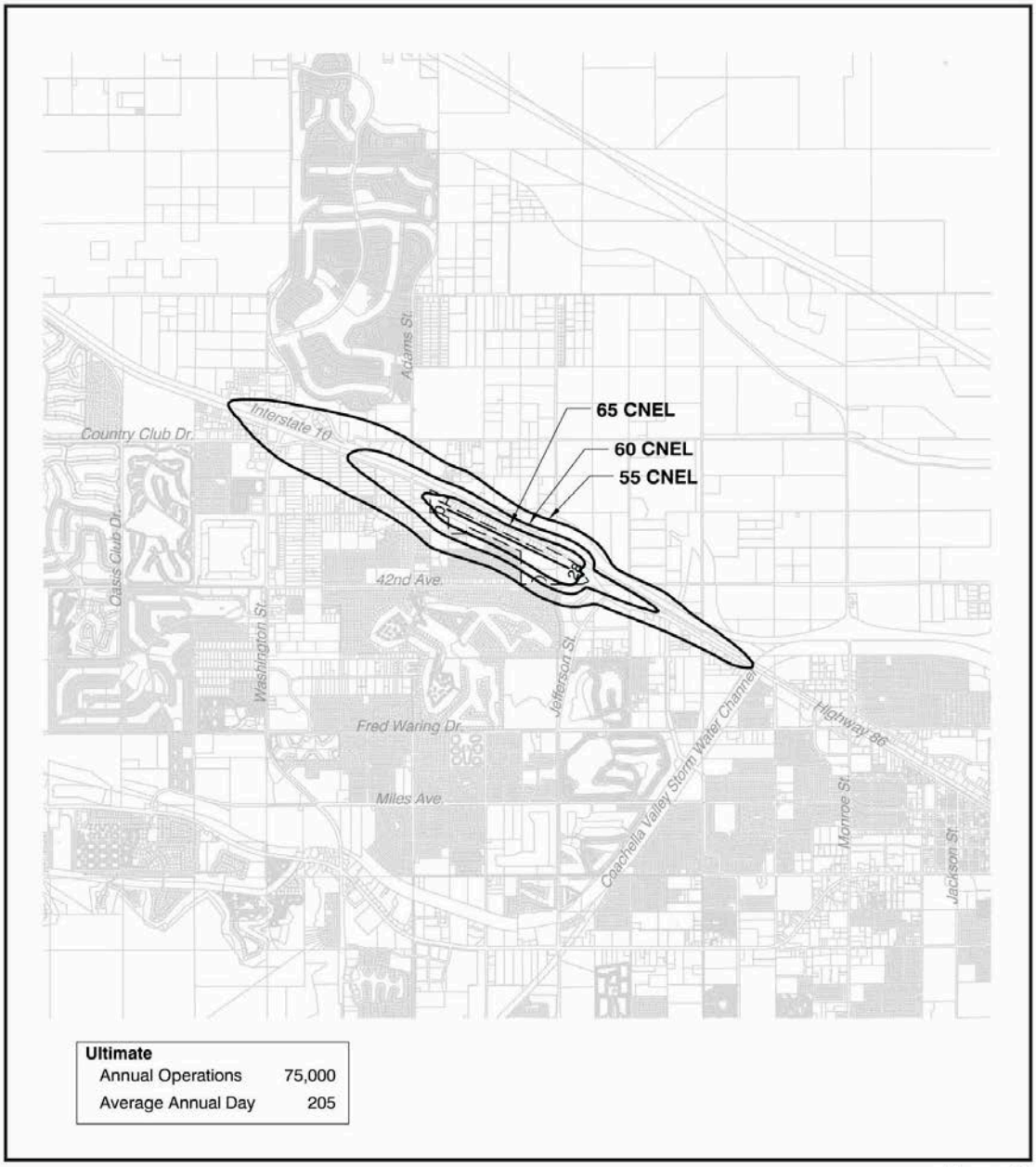

Figure 32

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 2,500 5,000 FEET

Bermuda Dunes Airport Future Noise Contours: Average Annual Day

I:\COR100\GIS\Noise\Bermuda Dunes - Future_AAD.cdr (2/15/11)

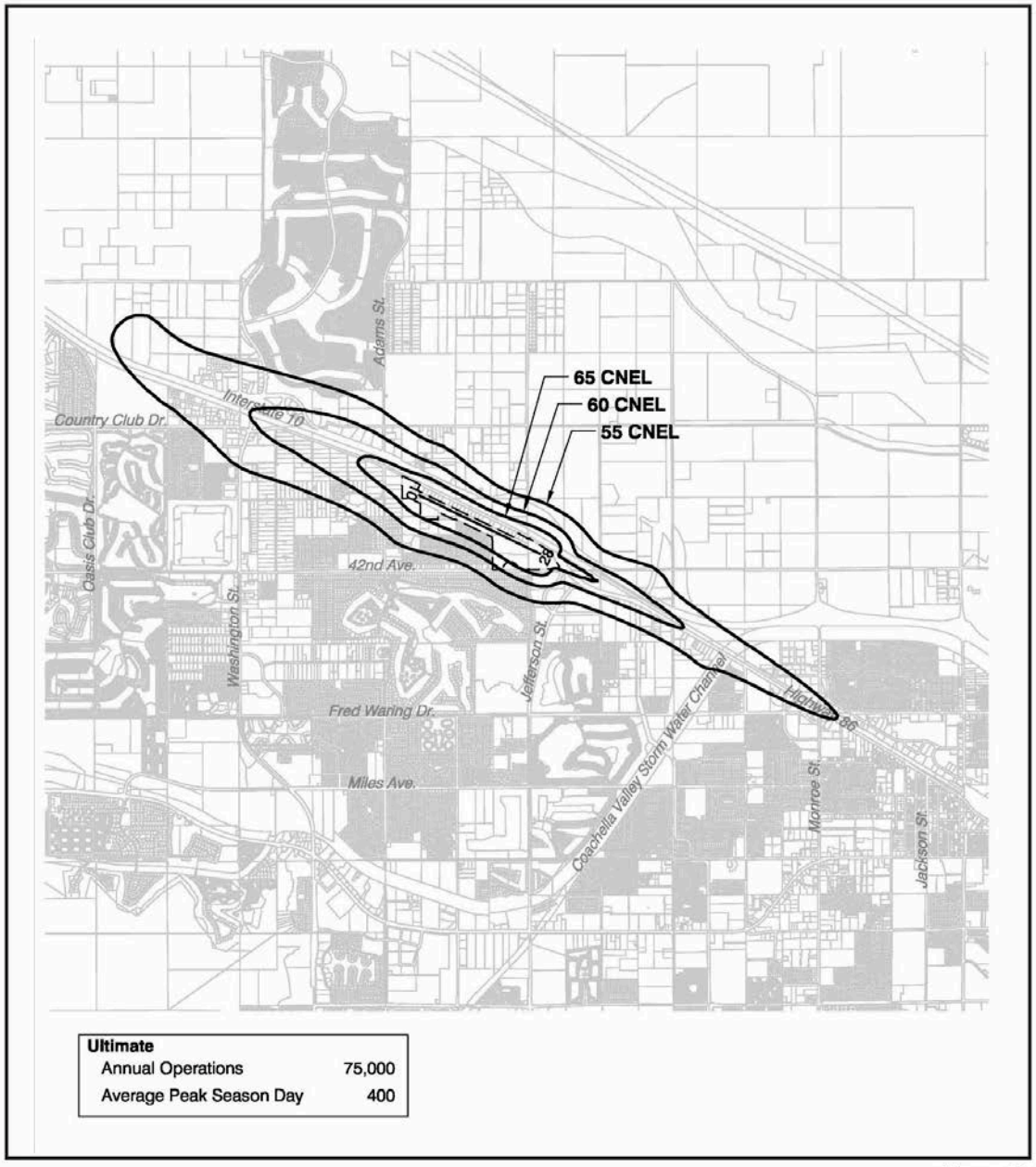

Figure 33

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 2,500 5,000 FEET

Bermuda Dunes Airport Future Noise Contours: Average Peak Season Day

I:\COR100\1\G\Noise\Bermuda Dunes - Future_APSD.cdr (2/15/11)

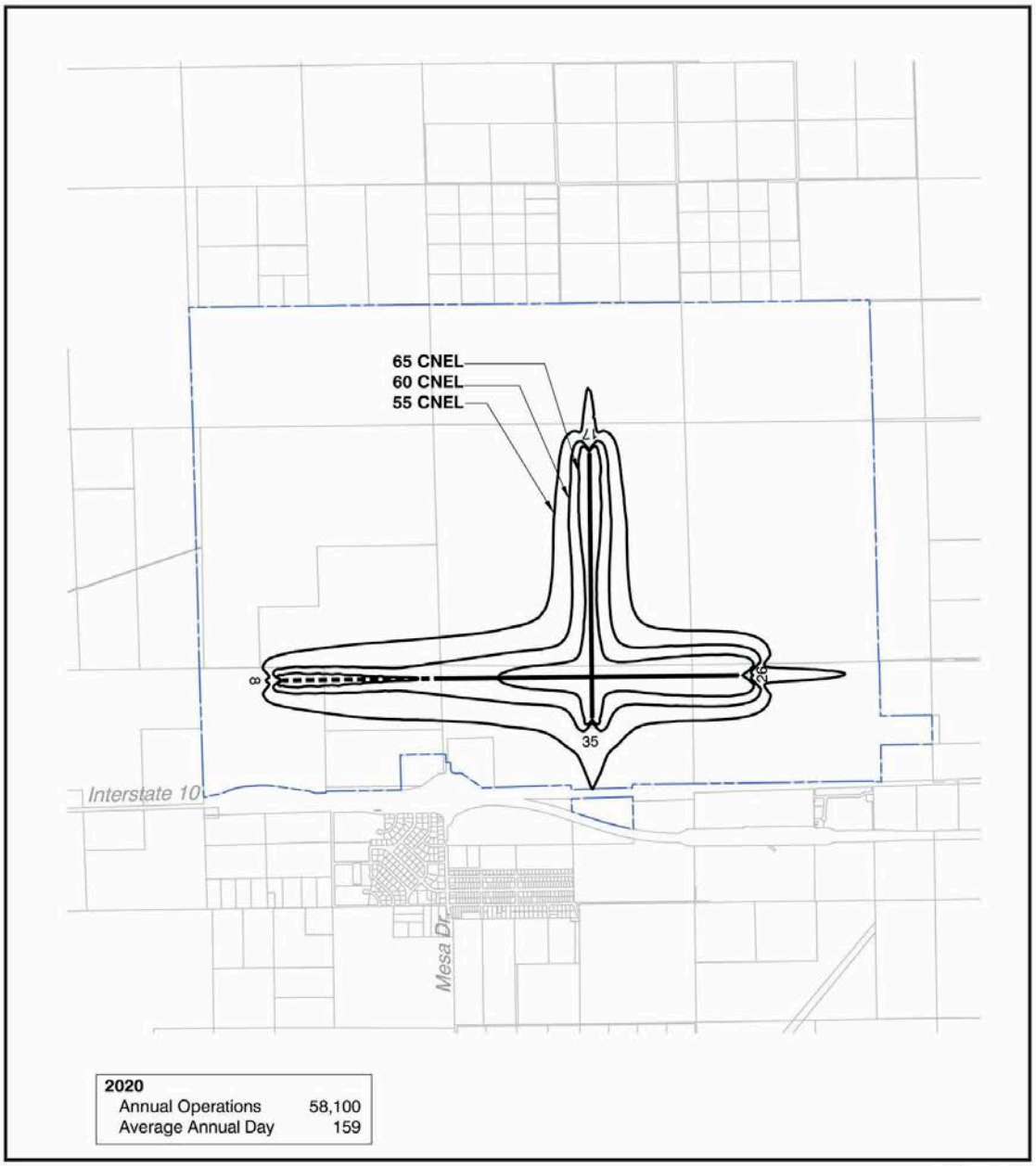

Figure 34

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,500 3,000 FEET

Blythe Municipal Airport
Future Noise Contours

I:\COR1001\G\Noise\Blythe Municipal - Future.cdr (2/8/11)

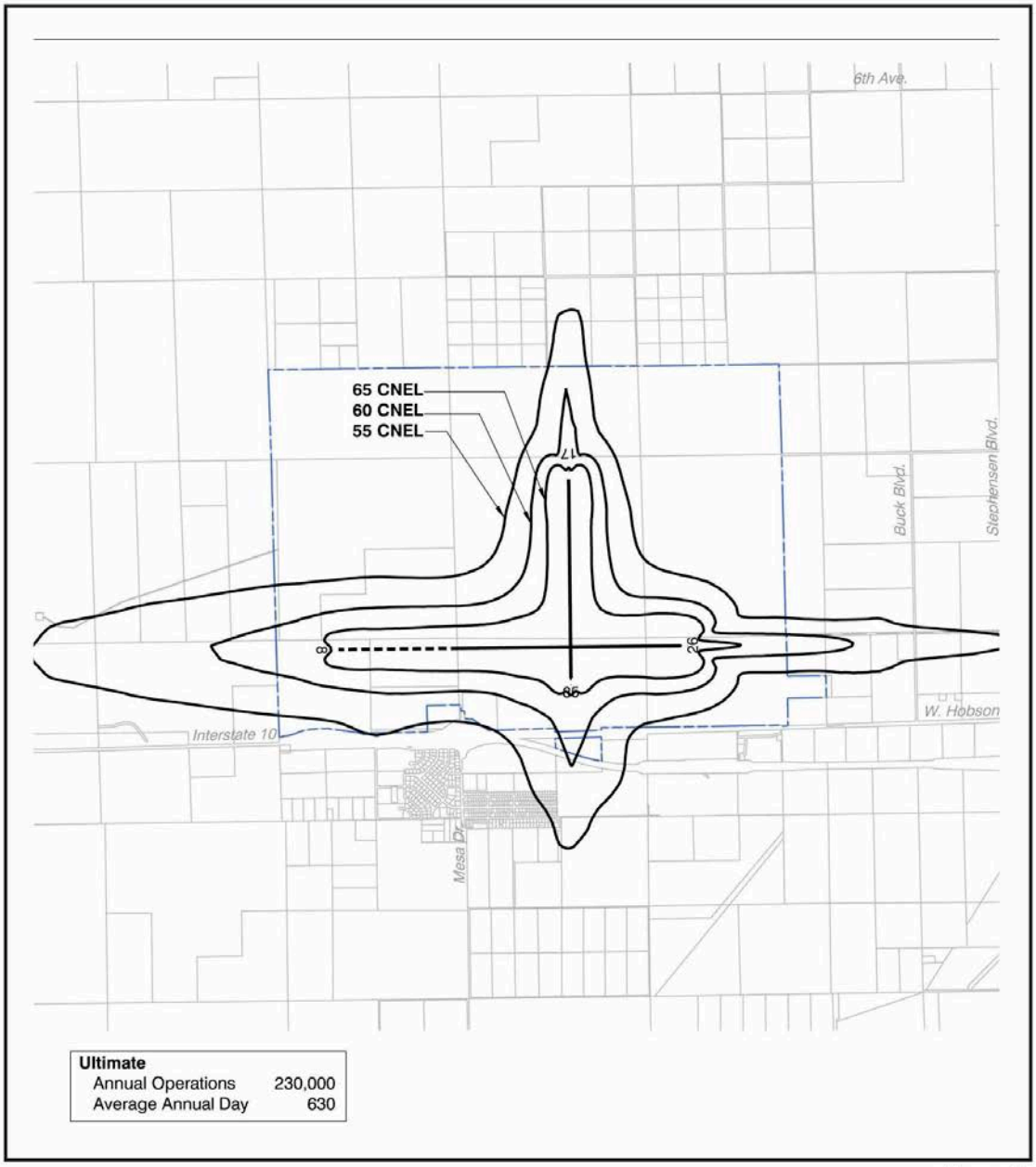

Figure 35

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 2,000 4,000 FEET

Blythe Municipal Airport
Ultimate Noise Contours

I:\COR100\G\Noise\Blythe Municipal - Ultimate.cdr (2/15/11)

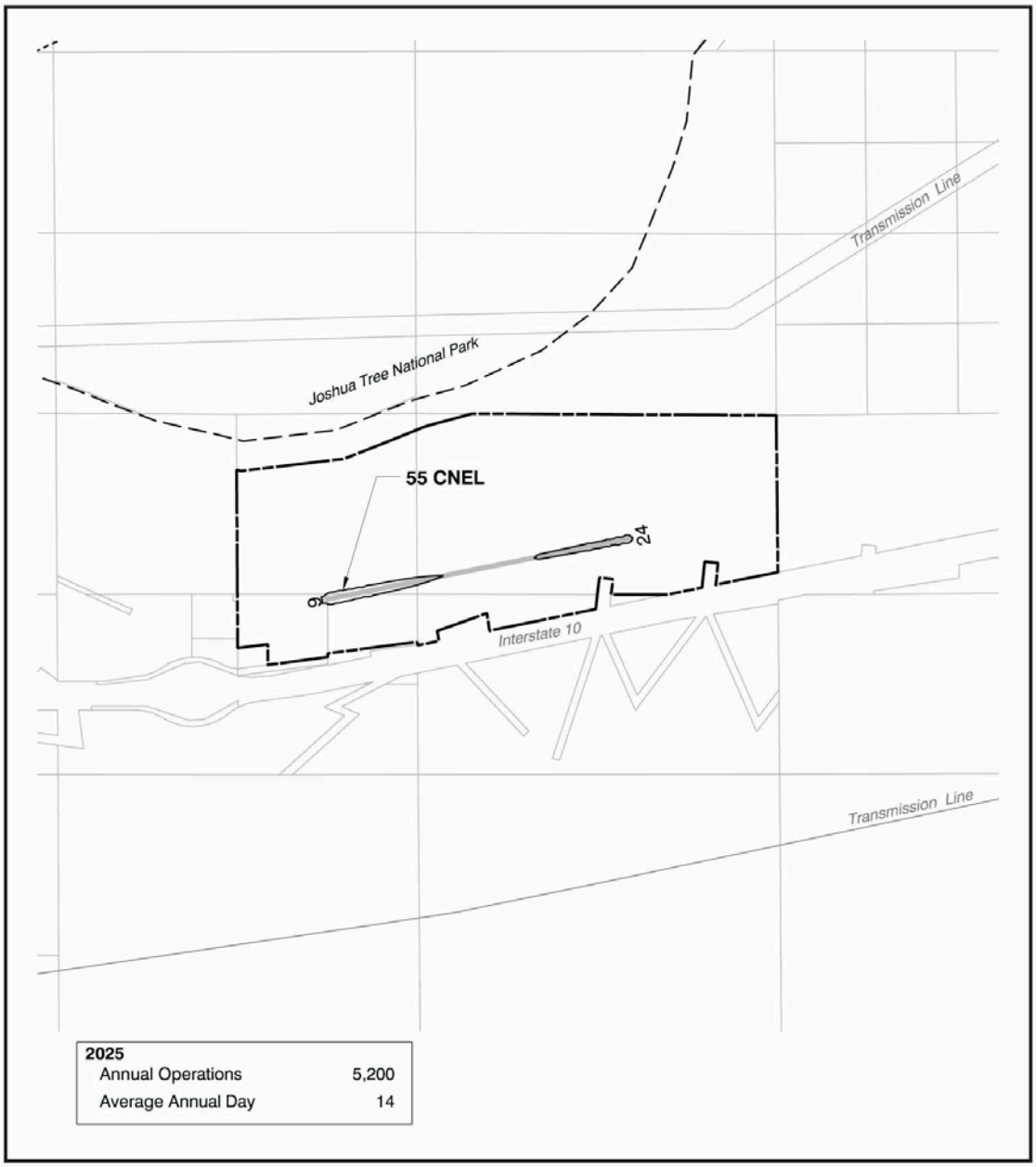

Figure 36

SOURCE: RIVERSIDE COUNTY ALUCP -
EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,500 2,000 FEET

Chiriaco Summit Airport
Future Noise Contours

I:\COR1001\GIS\Noise\Chiriaco Summit - Future.cdr (2/15/11)

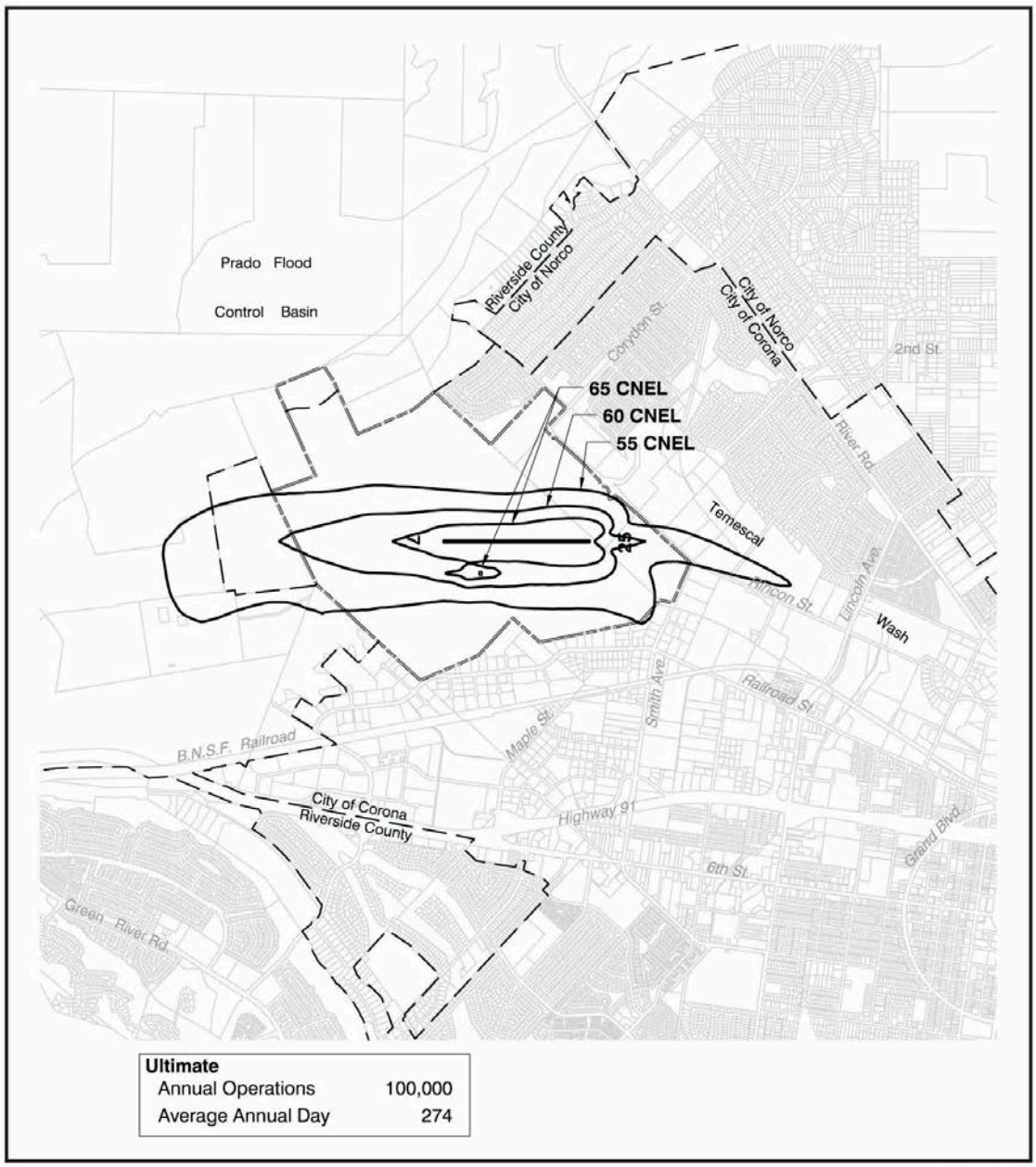

Figure 37

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,500 3,000 FEET

Corona Municipal Airport
Future Noise Contours

I:\COR1001\G\Noise\Corona Municipal - Future.cdr (2/15/11)

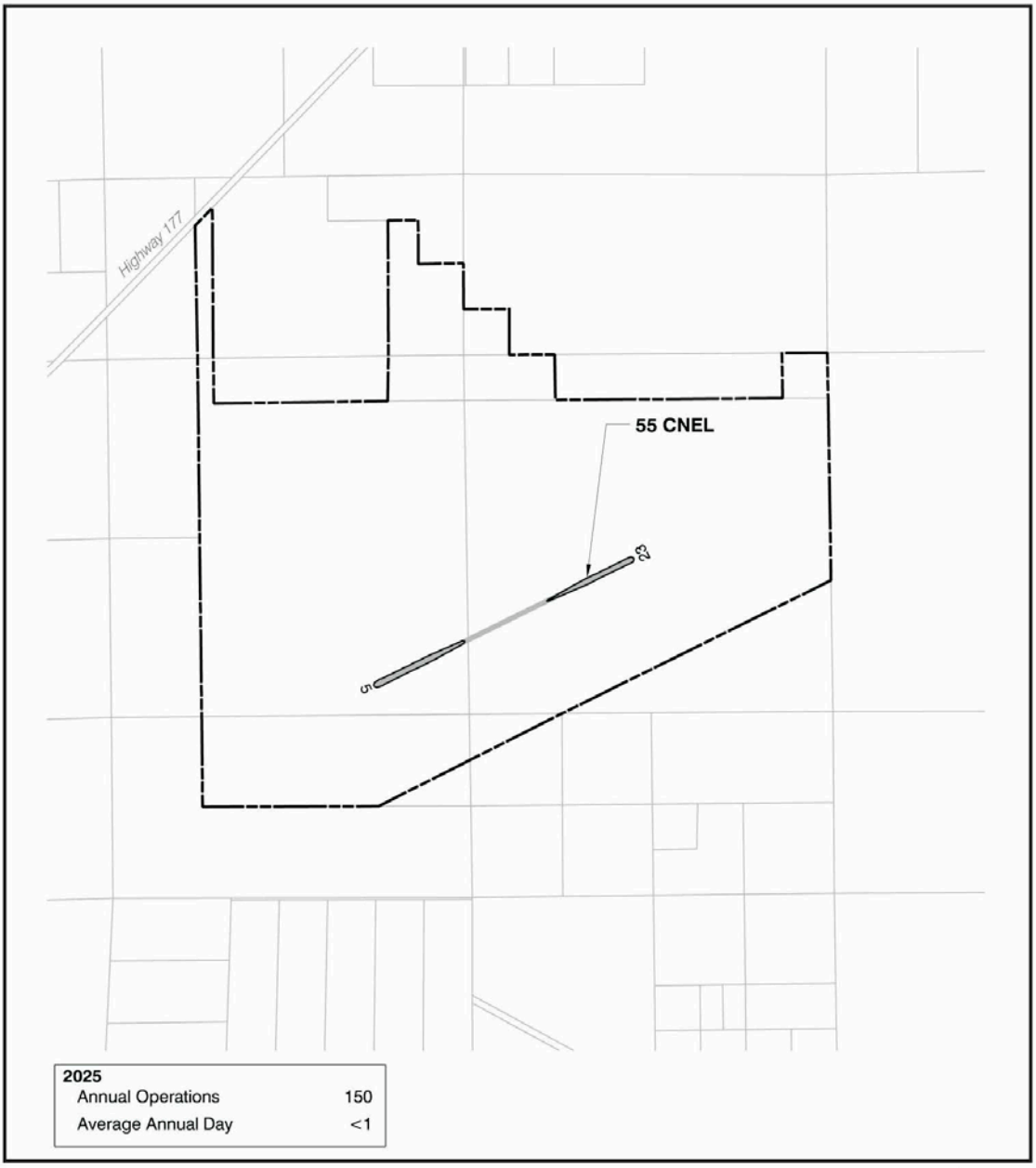

Figure 38

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 1,000 2,000 FEET

Desert Center Airport
Future Noise Contours

I:\COR1001\GIS\Noise\Desert Center - Future.cdr (2/15/11)

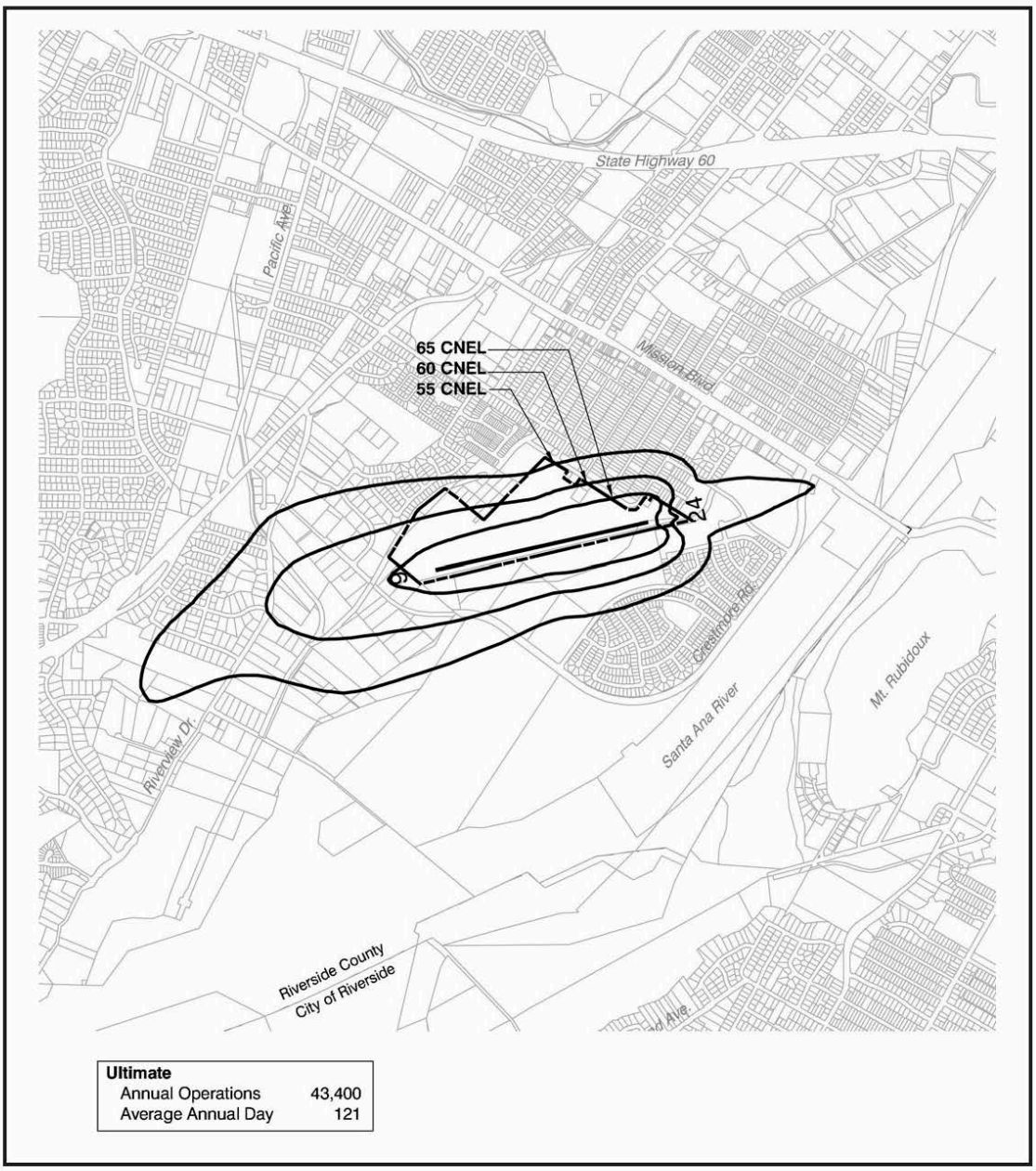

Figure 39

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 1,000 2,000 FEET

Flabob Airport
Future Noise Contours

I:\COR1001\G\Noise\Flabob-Future.cdr (2/15/11)

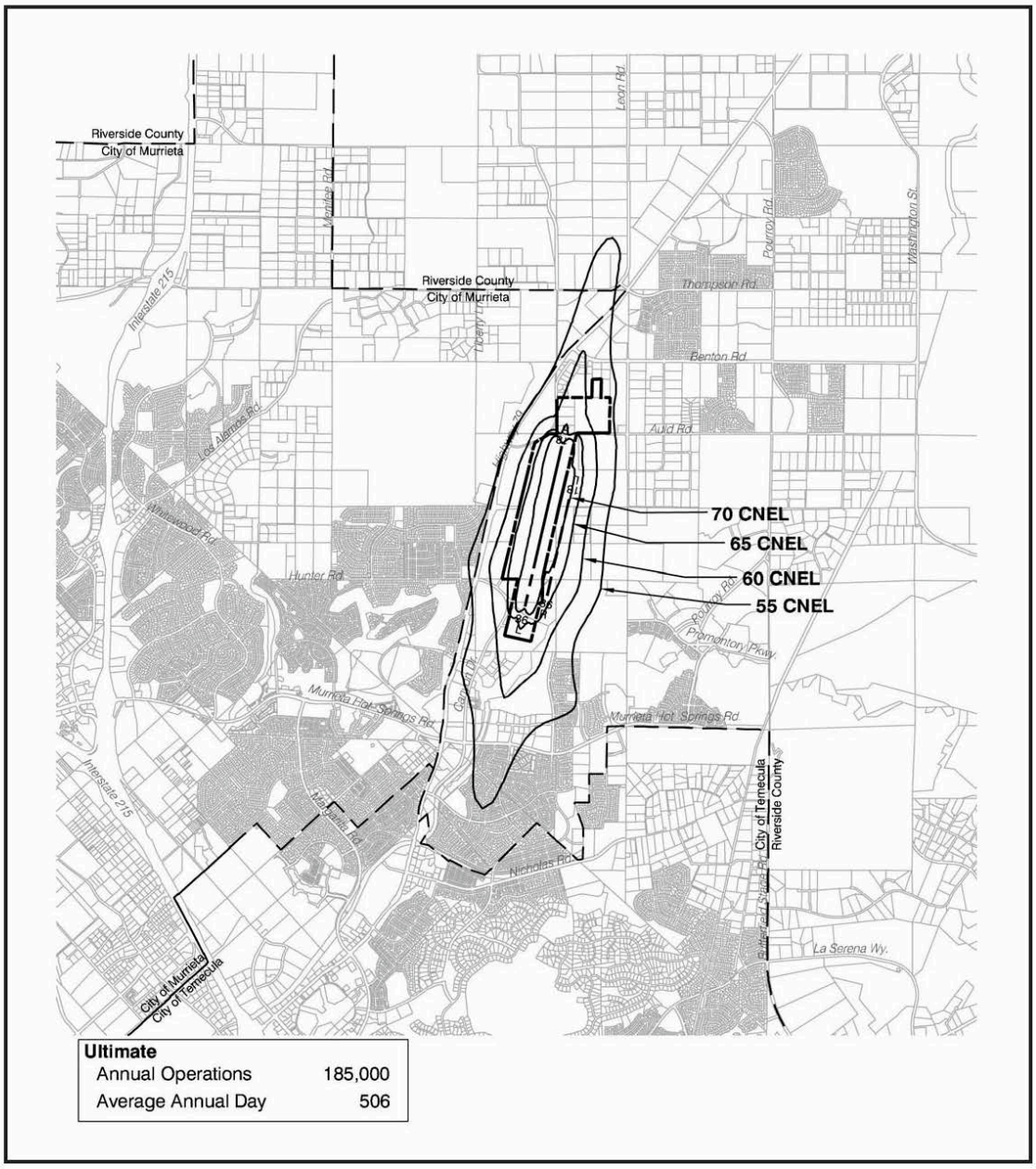

Figure 40

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 2,500 5,000 FEET

French Valley Airport
Future Noise Contours

I:\COR1001\G\Noise\French Valley-Future.cdr (2/15/11)

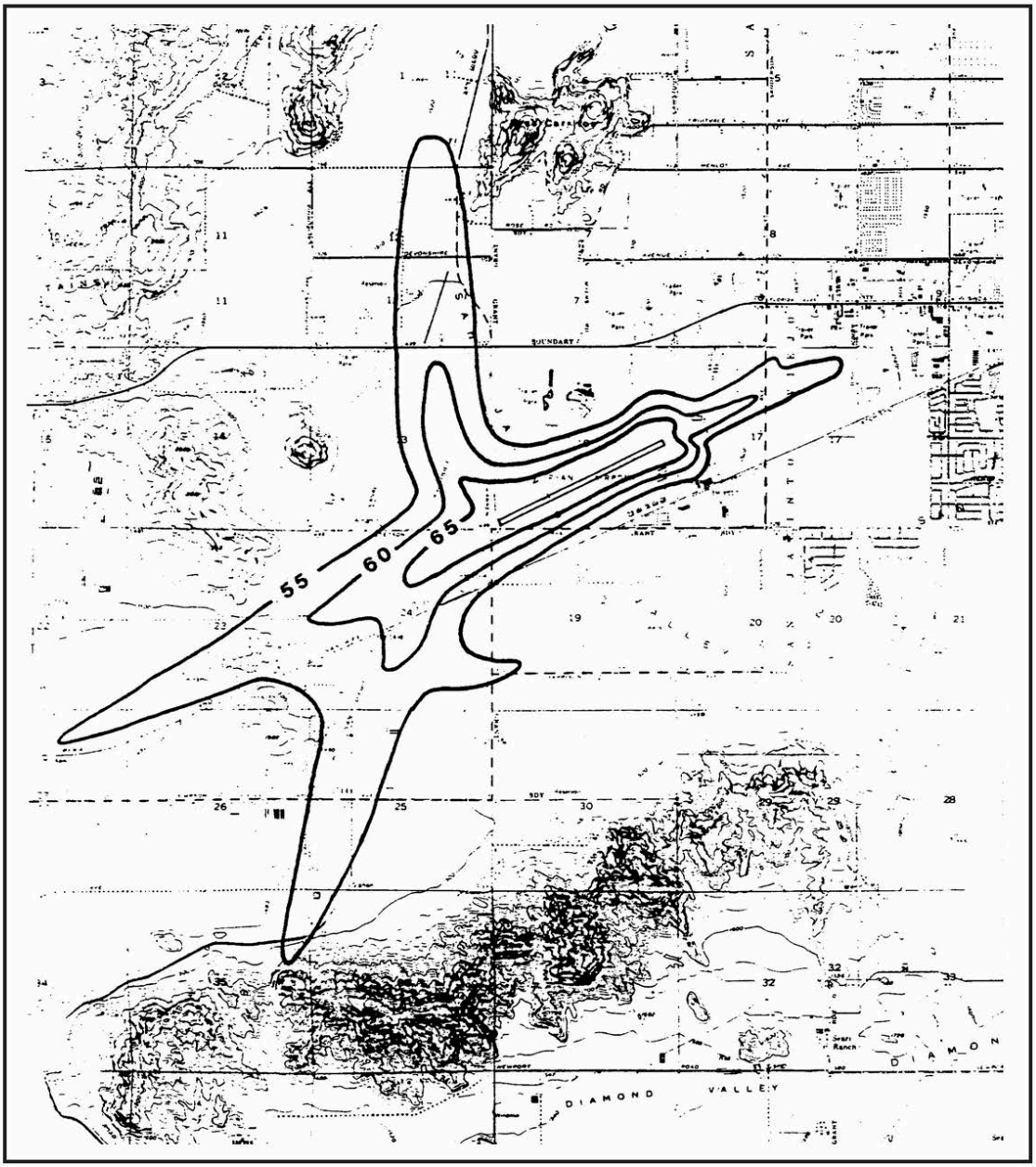

Figure 41

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

Hemet Ryan Airport
Future (2005) Noise Contours

I:\COR1001\G\Noise\Hemet Ryan-Future-2005.cdr (2/15/11)

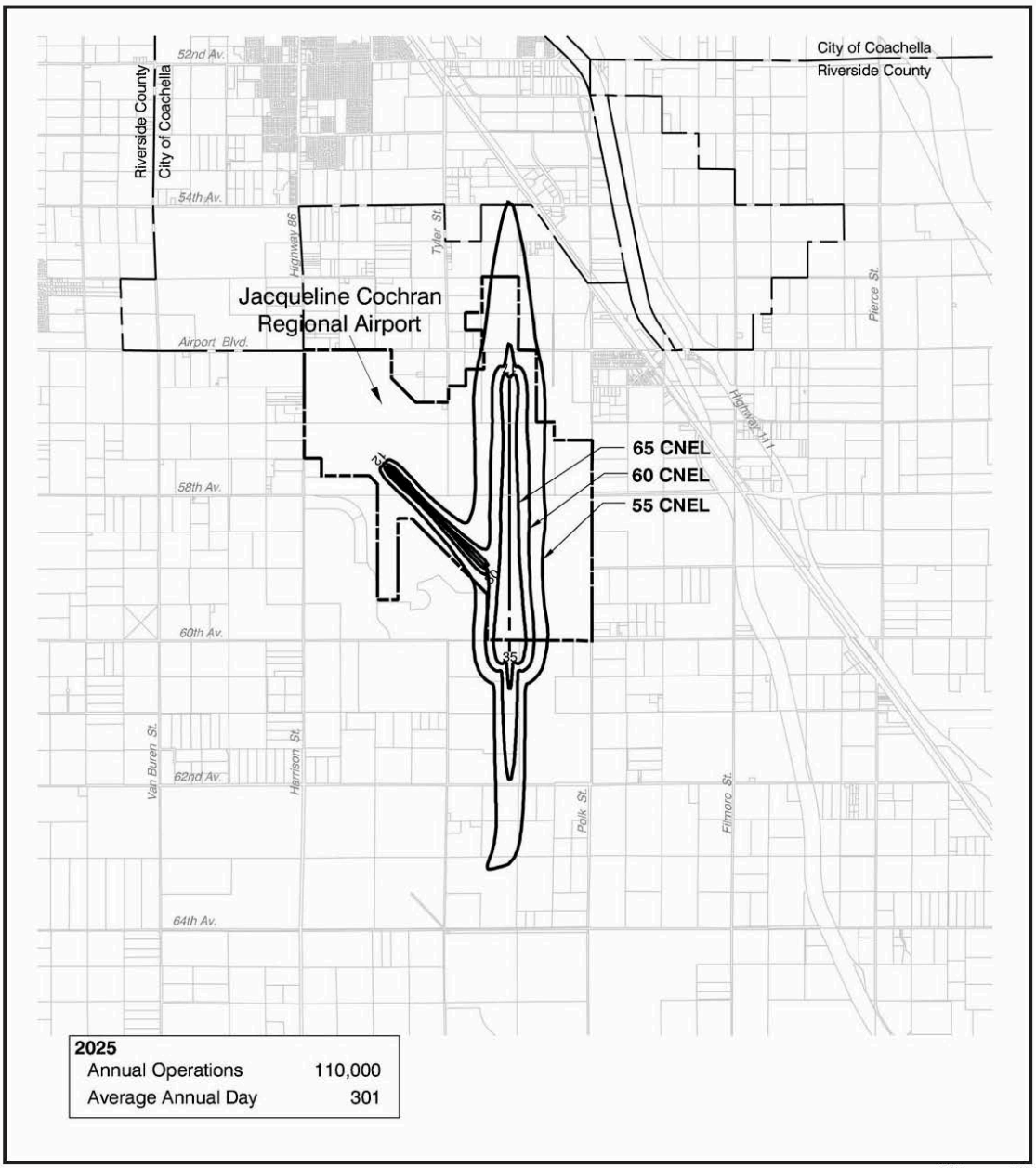

Figure 42

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 2,500 5,000 FEET

Jacqueline Cochran Regional Airport
Future Noise Contours

I:\COR1001\G\Noise\Jacqueline Cochran Regional-Future.cdr (2/15/11)

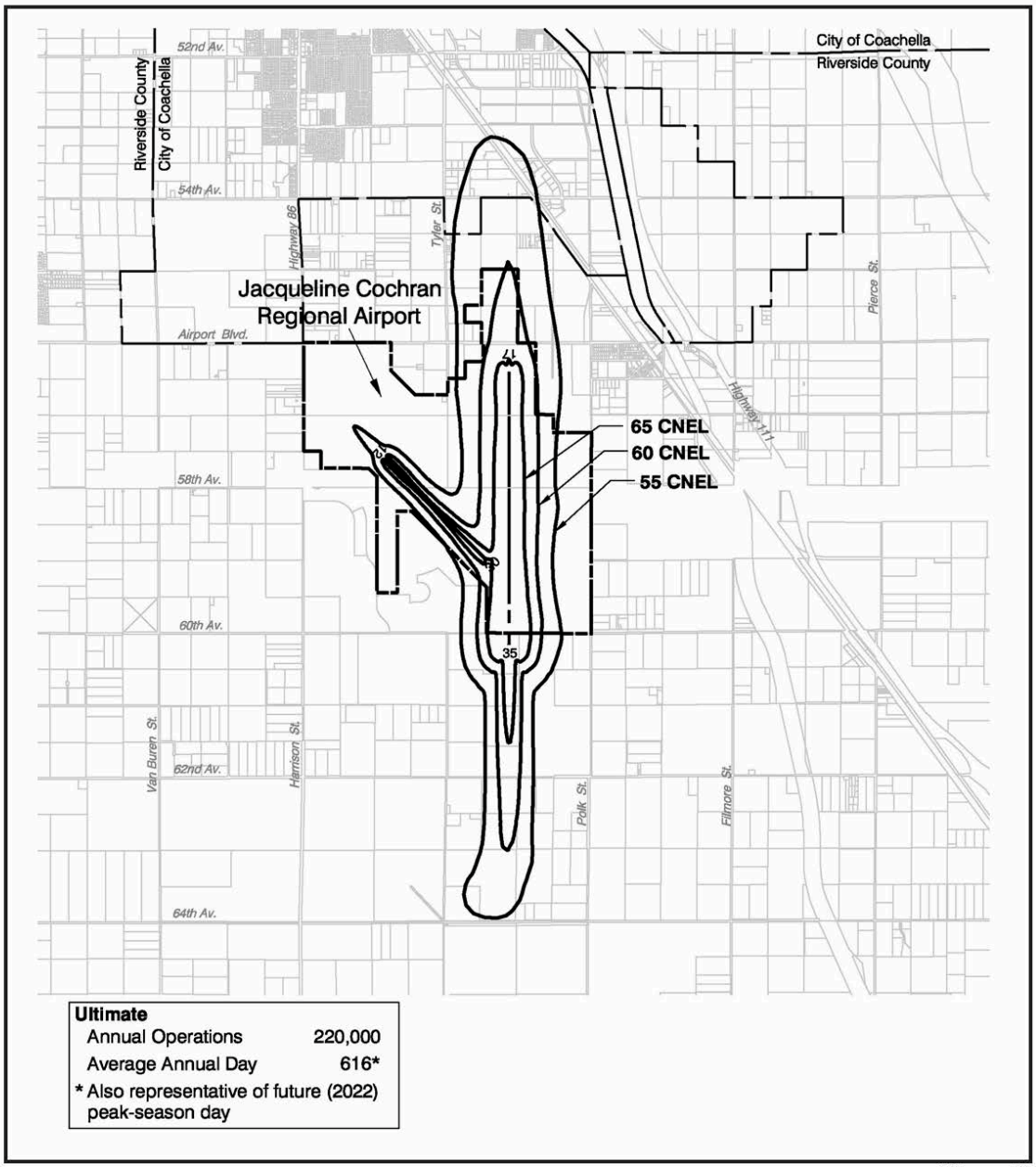

Figure 43

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 2,500 5,000 FEET

Jacqueline Cochran Regional Airport
Ultimate Noise Contours

I:\COR1001\G\Noise\Jacqueline Cochran Regional-Ultimate.cdr (2/15/11)

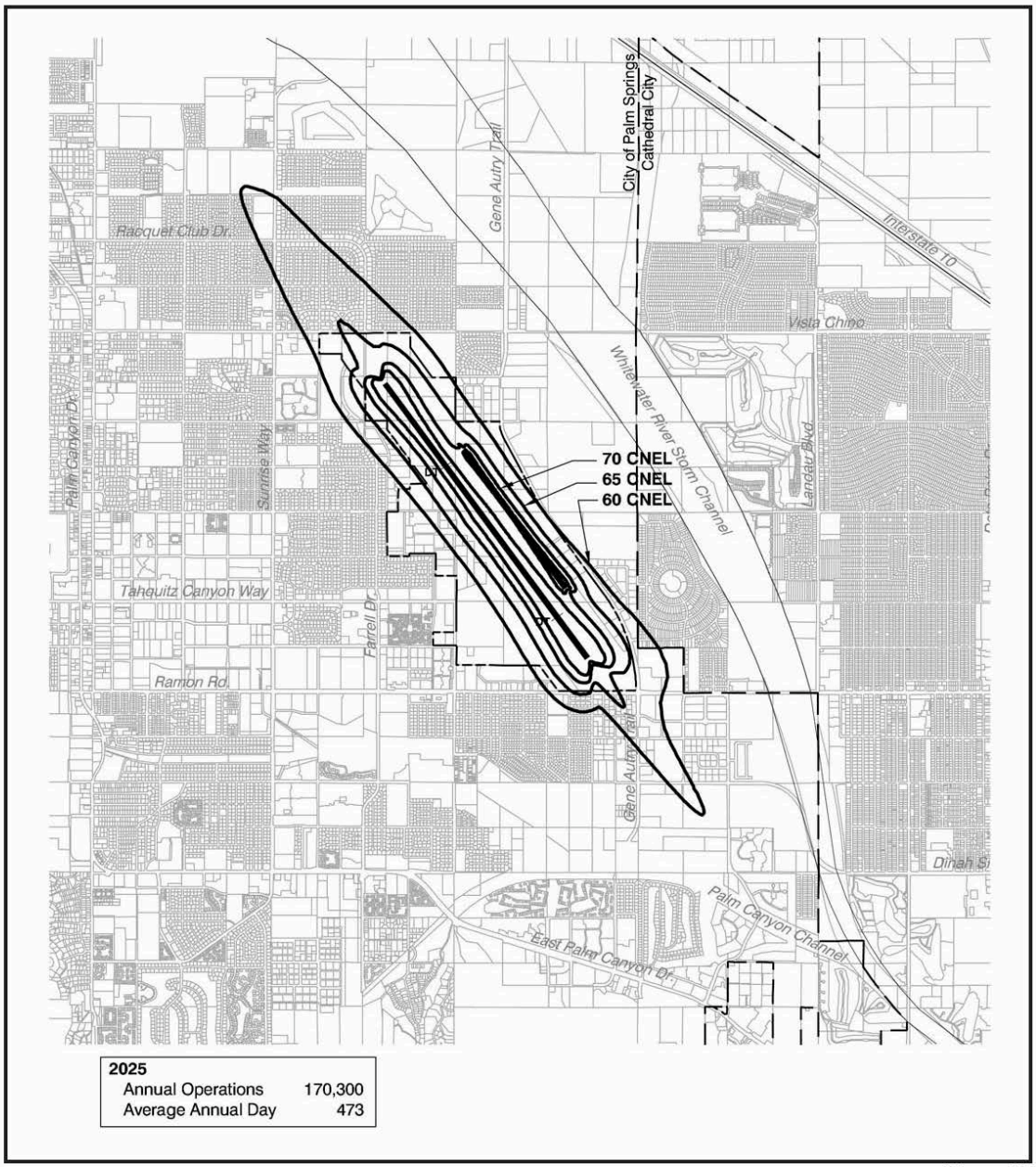

Figure 44

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 2,000 4,000 FEET

Palm Springs International Airport
Future Noise Contours

I:\CORI001\GNoise\Palm Springs International-Future.cdr (2/15/11)

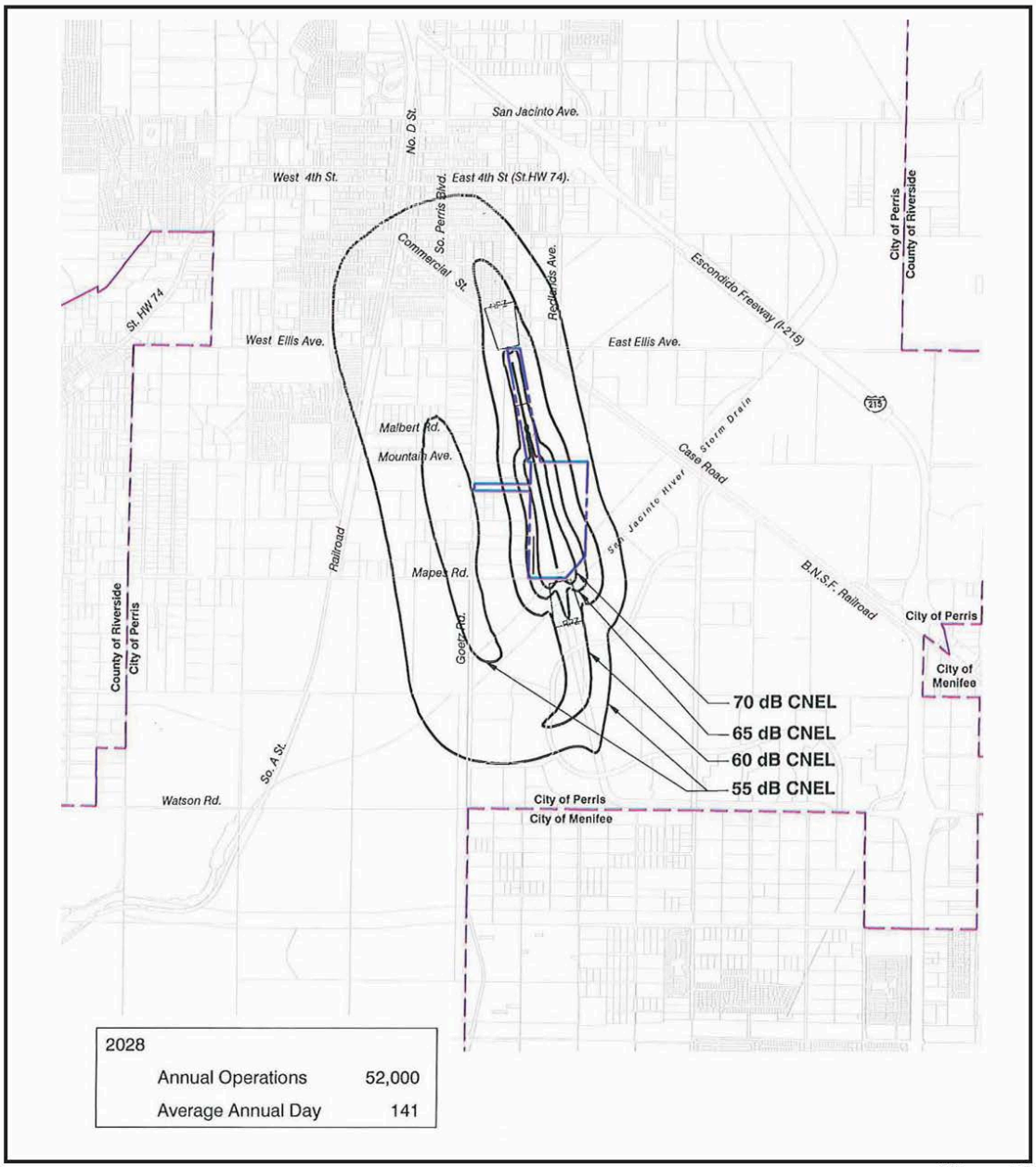

Figure 45

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 1,500 3,000 FEET

Perris Valley Airport
Ultimate Noise Contours

I:\COR1001\G\Noise\Perris Valley-Ultimate.cdr (2/15/11)

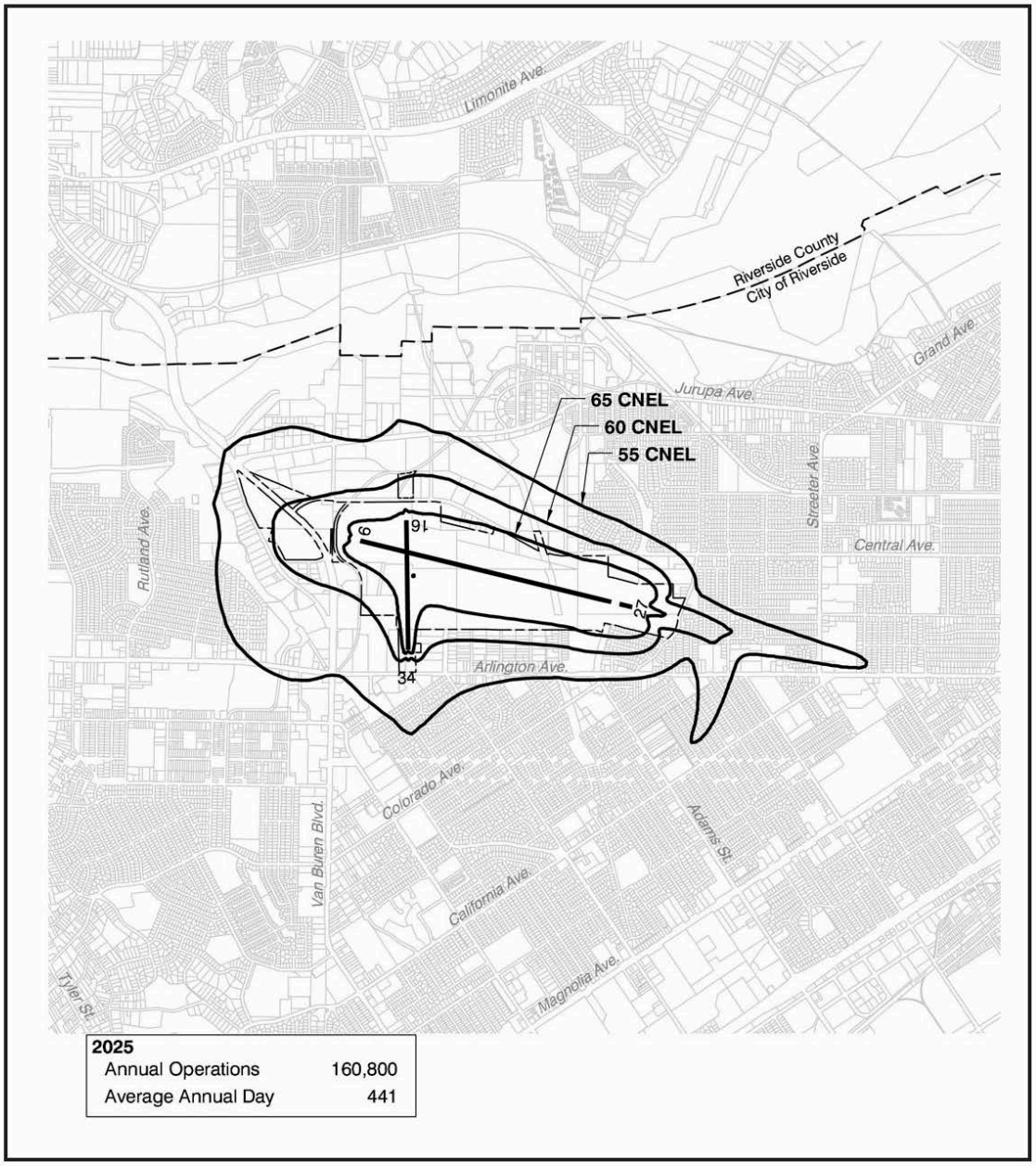

Figure 46

SOURCE: RIVERSIDE COUNTY ALUCP
WEST COUNTY AIRPORTS BACKGROUND DATA (DECEMBER 2004)

0 1,500 3,000 FEET

Riverside Municipal Airport
Future Noise Contours

I:\COR1001\G\Noise\Riverside Municipal-Future.cdr (2/15/11)

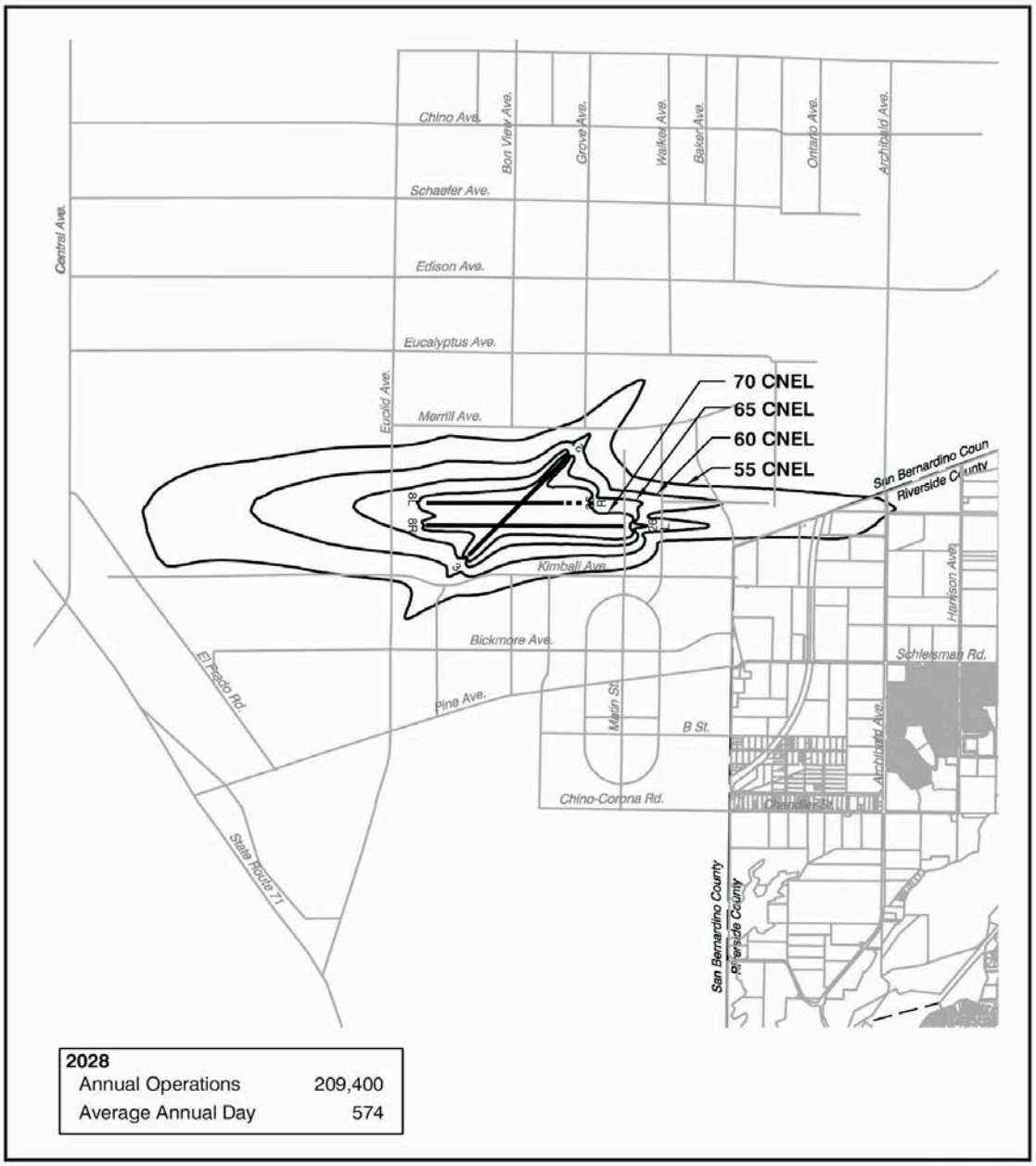

Figure 47

SOURCE: RIVERSIDE COUNTY ALUCP - EAST COUNTY AIRPORTS BACKGROUND DATA (OCT 2004)

0 2,500 5,000 FEET

Chino Airport
Future Noise Contours

I:\COR1001\GIS\Noise\Chino - Future.cdr (2/15/11)

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Department of Public Health
Riverside County Community Health Agency

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MEMO: Requirements for Determining and Mitigating Non-transportation Noise Source Impacts to Residential Properties.

APPLICATION:

This document is intended to provide guidelines for the determination of community noise impact due to non-transportation (hereafter known as "stationary") noise sources. Noise sources covered by this standard include, but are not limited to: industrial facilities, mining activities, loading dock activities, loud speakers operation, sporting events, musical performances, well pumps, equipment, vehicles operated off the public roadways, or any noise producing activities associated with a permanent fixed base of operation (hereafter referred to as the "facility"). Temporary construction activities are not covered by the standard.

NOISE STANDARDS FOR STATIONARY NOISE SOURCES:

Facility-related noise, as projected to any portion of any surrounding property containing a "habitable dwelling, hospital, school, library or nursing home", must not exceed the following worst-case noise levels.

A) 45 dB(A) - 10 minute noise equivalent level ("leq"), between the hours of 10:00 p.m. to 7:00 a.m. (nighttime standard).

B) 65 dB(A) - 10 minute leq, between 7:00 a.m. and 10:00 p.m. (daytime standard).

REQUIREMENTS FOR DETERMINATION OF COMMUNITY NOISE IMPACT:

1. Noise originating from operations within the facility grounds shall be treated as "stationary" noise sources for which this standard will apply.

2. Noise Modeling Methodology: Noise predictions are to be made by an engineer, acoustical consultant, or other similar professional with experience in predicting community noise exposure using standard methods and practices of the noise consulting industry.

3. Required Modeling Parameters for Stationary Sources:

i. Stationary sources are to be modeled as "point" sources.

ii. Mobile point sources are to be modeled as emanating from the acoustical centroid of the activity, or at its closest approach to potentially impacted residential property lines, which ever yields the worst-case results.

iii. Noise modeling for each piece of acoustically significant equipment, process or activity must be based on Reference Noise Levels (RNL). RNL may be obtained directly from the manufacturer (in the case of equipment) or generated from field studies. Regardless, the data must be representative of worst-case conditions. Directionality of the noise source must be taken into consideration if applicable.

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iv. Predicted noise levels are to be expressed in germs of worst-case "equivalent continuous sound levels" [or, Leq] averaged over a ten minute period.

v. For modeling purposes, receivers are assumed to be positioned at the property line boundary at an elevation of five feet off the ground.

vi. Terrain conditions for modeling noise propagation: Assumptions regarding ground effects, atmospheric absorption and other forms of noise attenuation must be fully justified.

NOISE REPORT FORMAT AND REQUIRED SUBMITTALS:

The noise Consultant's findings and recommendations must be submitted for review, and receive approval from, the Office of Industrial Hygiene. The resulting report must incorporate the requirements above and, at a minimum, contain the following information:

a) an adequate and accurate characterization of the current ambient noise environment;
b) a clear description of the proposed facility and its activities including a step-by-step flow chart of manufacturing processes if applicable;
c) the identity and characterization of all acoustically significant equipment and/or activities;
d) a discussion of analytical methodology and parameters used for noise modeling;
e) a table containing reference noise data accompanied by a detailed description of how it was obtained;
f) the facilities hours of operation;
g) a discussion of anticipated production volume, how it is expected to change over time and how such change will effect community noise;
h) a discussion of worst-case unmitigated noise impact;
i) a discussion of mitigation (if necessary);
j) a printed copy of computer input/output (if available) or manual calculations clearly illustrating the rationale for the Consultant's conclusions.

In addition, the final noise report must contain a scaled map(s) defining the acoustical contours surrounding the facility. Minimally, this map(s) must show:

a) The facility relative to the residential properties surrounding it. Include both unincorporated and incorporated (any adjoining Cities) area surrounding the project and potentially affected by project-related noise.
b) The 65 dB(A) 10 minute Leq noise contour reflecting the anticipated "worst-case" conditions between the hours of 7AM - 10 PM (daytime hours).
c) The 45 dB(A) 10 minute Leq noise contour reflecting the anticipated "worst-case" conditions between the hours of 10 PM - 7AM (nighttime hours).
d) The location and number of residential structures located within these contours.

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MEMO: Requirements for Determining and Mitigating Traffic Noise Impacts to Residential Structures.

NOISE STANDARDS:

1. The Noise Element of the General Plan indicates that to avoid future noise hazard, the maximum capacity design standard for highways and major roads will be used for determining the maximum future noise level or, in the case of freeways and airports, the estimated conditions 20 years in the future.

2. The interior noise levels in residential dwellings shall not exceed 45 Ldn/CNEL.

3. The exterior noise level shall not exceed 65 Ldn/CNEL.

4. Required Noise Prediction Model – Traffic Noise: FHWA RD 77-108 Highway Traffic Prediction Model, Sound 32 or the equivalent.

REQUIRED TRAFFIC NOISE MODELING PARAMETERS:

1. Roadway Classification: All roadways must be classified into one of the following categories as defined in the General Plan: Secondary, Major, Arterial, Urban Arterial, Expressway, Freeway, and Specific Plan Road.

2. Roadway Traffic Volume: All roadways must be modeled using Average Daily Trip (ADT) Level of Service "C" design capacities. For roadways classified by the General Plan as variable, future build-out traffic volumes must be obtained from the County's Transportation Department
3. or in the case of freeways, from Caltrans.

4. Required vehicle mix.

- Freeways: Vehicle mix information must be obtained from Caltrans.

- Roadways designated as major, arterial highways, or expressways:

VEHICLE	OVERALL %	DAY (7AM-7PM) %	EVENING (7PM-10PM) %	NIGHT (10PM-7AM) %
Auto	92	69.5	12.9	9.6
Medium Truck	3	1.44	0.06	1.5
Heavy Truck	5	2.4	0.1	2.5

- Roadways designated as secondary, collectors, or smaller:

VEHICLE	OVERALL %	DAY (7AM-7PM) %	EVENING (7PM-10PM) %	NIGHT (10PM-7AM) %
Auto	97.4	73.6	13.6	10.22
Medium Truck	1.84	0.9	0.04	0.9
Heavy Truck	0.74	0.35	0.04	0.35

5. Traffic Speed: For County roads assume an average traffic speed of 40 MPH. For freeways, contact CALTRANS and use what speed they recommend.

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Riverside County Community Health Agency

6. Terrain conditions for modeling noise propagation: Assume "hard site" conditions in determining noise propagation (no more than 3 dB of attenuation per doubling of distance between source and receiver).

7. Noise attenuation attributed to standard residential architecture: It is assumed that standard residential design (with windows closed) will provide no more than 20 dB (A) of attenuation. Additional mitigation must be demonstrated via modeling.

8. Receiver placement for modeling exterior noise levels (unmitigated): Noise levels must be estimated at the exterior face of the nearest residence at an elevation of five feet above the finished pad.

   - Receiver placement for noise barrier design: *Set back*: Barrier calculations shall be based on a hypothetical outdoor receiver located ten (10) feet behind the intervening noise barrier.

   - Receiver height: Initial calculations shall be based on a receiver height of five (5) feet above the ground. If these calculations result in a barrier less than or equal to six (6) feet in height, no further barrier calculations are necessary and this shall be selected as the required wall height.

9. However, if the resulting barrier height is calculated to be greater than six feet, it shall be re-calculated using a receiver height of three (3) feet. The resulting re-calculated wall height shall be then selected as the required wall height.

10. Receiver placement for architectural-based (indoor) noise mitigation – first floor: First floor interior noise level predictions are to be calculated assuming a hypothetical receiver is located in the center of the room nearest the noise source and elevated 5 feet above the pad (finished floor).

NOISE REPORT FORMAT AND REQUIRED SUBMITTALS:

The noise Consultants findings and recommendations must be submitted for review, and receive approval from, the Office of Industrial Hygiene. The resulting report must incorporate the requirements above and, at a minimum, contain the following information: a) a clear description of the proposed project; b) the identity and characterization of all acoustically significant roadways; c) a discussion of analytical methodology and parameters used for noise modeling; d) information obtained from applying requirements 6-10 (above); e) a discussion of mitigation (if necessary) including a clear diagram illustrating noise barrier placement; f) a printed copy of computer input/output (if available).

In addition to the report, Industrial Hygiene must be provided with the following depending on the design stage of the project. The first item that must be provided is a scaled map (blue-line) of the project. This map must clearly illustrate lot boundaries and the relative location of all acoustically significant roadways. Topographical elevations for lots and roadway centerlines must be included. Second, if architectural-based mitigation is necessary, and if the project has progressed to the point where plans for the homes have been drawn, copies must be provided (floor plans and exterior elevation drawings). Additionally, an updated blue-line showing exact pad location and finished floor elevation must be included.

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MEMO: Potential Studies Requiring Input from Department of Public Health

I. STUDIES

Except for WECS (Wind Energy Conversion Systems) Noise, Department of Public Health input is discretionary as determined by the Planning Department. Regularly, the Planning Department requests Department of Public Health reviews concerning the acoustical issues associated with a project. Less frequently, the Department may be requested to comment on ground vibration from trains (may apply to noise sensitive receptor within 1,000 feet of a rail corridor) and release of silica dust from sand and gravel pit operations. In addition, in response to community and planning commissioners comments, the Planning Department may request Department reviews of projects having the following associated issues: nuisance dust, cement dust, electromagnetic fields from power lines, and asbestos dust.

A. Noise Appraisals

Noise appraisals fall into three groups each with distinct criteria; Transportation noise receptors, e.g. tracts receiving noise from highways and airports; stationary noise sources, e.g. projects emitting significant noise impacting neighboring communities; and Wind Energy Conversion Systems noise (WECS or Windturbine Farms). An applicant should be aware that a given project may fall into more than one group. The following outlines the minimum criteria associated with each group.

1. Transportation noise receptors:
   (a) Interior noise levels in residential dwellings shall not exceed 45 Ldn (or CNEL).
   (b) Exterior noise levels shall not exceed 65 Ldn (or CNEL).
   (c) Acoustical parameters are outlined in the memo of Dec. 21, 1990 (contact the Office of Industrial Hygiene).

2. Stationary noise sources:
   During hours of 7 A.M. to 10 P.M. and 10 P.M. to 7 A.M., the noise levels shall not exceed 65 and 45 dB,A weighted ten minute Leq, respectively, as projected to any portion of a lot with occupied residence.

3. WECS Noise.:
   WECS shall comply with criteria established by Ordinance No. 348.258 and Resolution No. 93-378.

4. Consultants Expertise:
   The acoustical study demonstrating compliance with these categories shall be performed by a noise consultant with at least two years experience in acoustical design and mitigation. The consultant shall be able to utilize FHWA Highway Traffic Noise Prediction Model and Sound 32. Preferably the consultant shall be a member of the Institute of Noise Control Engineering or a Certified Industrial Hygienist.

B. Other Studies

For other studies requiring our input, the applicant shall contact Industrial Hygiene for guidelines in providing a study prior to conducting the assessment or study.

Department of Public Health
Riverside County Community Health Agency

Office of Industrial Hygiene
4065 County Circle Drive, Suite 318,
Riverside, CA 92503 909-358-5050
FAX: 909-358-5443
TDD: 909-358-512

II. FEES

Our current man-hour fee (subject to change by ordinance) is $95 per hour devoted to the project including review and comment, verbally and in writing. Any time consumed by traveling to and attending meetings (including public hearings) on behalf of the project is also included. In addition, incidental expenses such as mileage at .29/mile, meals, lodging, and miscellaneous transportation expenses may be incurred. Note, the incidental expenses other than mileage are rarely utilized.

III. DEPOSITS

For WECS, a $500 deposit is required. Frequently, expenses exceed this deposit and additional deposits are requested prior to completion of reviews and participation at public hearings. For all others, a $1,500 deposit is requested. This is generally sufficient, unless the project is complex and/or controversial, involving many revisions, and/or attendance at meetings.

COUNTY OF RIVERSIDE GENERAL PLAN UPDATE 2008: GENERAL PLAN AMENDMENT NO. 960

DRAFT ENVIRONMENTAL IMPACT REPORT NO. 521

APPENDIX EIR-7 NOISE STUDY (2011) – ADDITIONAL EXHIBITS

RIVERSIDE COUNTY
PLANNING DEPARTMENT

U.S. Marine Corps Bob Stump Training Range Complex (BSTRC)
1. Primary mission—training support for all aspects of Marine Corps tactical aviation
2. CMAGR and BMGR West provide the core training capabilities and capacities
3. ECR and YPG provide supplementary training capabilities and capacities
4. Close to Marine and Navy air stations, Camp Pendleton, and aircraft carriers
5. Year-round flying weather

R-2501N
MCAGCC
R-2501W
R-2501S
R-2501E
Twentynine Palms Expeditionary Airfield

U.S. Marine Corps Air Ground Combat Center at Twentynine Palms (MCAGCC)
1. Primary mission—training combined elements of Marine Air Ground Task Forces
2. Premier pre-deployment training range for Marine expeditionary forces
3. Current training capacity – expeditionary units of up to 3,000 troops
4. Proposed expansion would train expeditionary brigades of 15,000 troops
5. Ranges support combined arms training of infantry, armored, air, and support units
6. Fixed-wing aircraft and helicopter aircrews trained in support of ground forces

U.S. Marine Corps Base (MCB) Camp Pendleton
1. Primary mission—training in amphibious and air assault and ground combat
2. Five amphibious assault landing beaches and inland ground combat ranges
3. Aviation training emphasis is on helicopter air assault and support of ground forces
4. MCAS Camp Pendleton is within the MCB

Camp Pendleton
R-2503C
R-2503B
R-2503A
R-2503D
Marine Corps Air Station Camp Pendleton

U.S. Marine Corps Chocolate Mountain Aerial Gunnery Range (CMAGR)
1. Primary mission—training in air-to-ground attack and air-to-air combat
2. Premier Marine Corps range for air-to-ground training with live explosive ordnance
3. Emphasis on training individual aircrews in flights of one, two, and four aircraft
4. Supports training with most types of conventional explosive and inert ordnance
5. Realistic air-to-ground targets in diverse terrain settings
6. Landing zones, observation posts, other ground sites that support air-ground training
7. Supports large force-on-force aviation training exercises that use all of the BSTRC
8. Hosts Navy SEALs desert training

R-2507N
R-2507E
R-2507S
Kitty Baggage Range
Shade Tree Range
R-2510B
R-2510A
Inkey Barley Range
R-2512
Naval Air Facility El Centro
Loom Lobby Range

U.S. Army Yuma Proving Ground (YPG)
1. Primary mission—testing ground combat and aircraft weapons systems
2. Restricted airspace available for air combat training when not needed for testing
3. Air-to-ground target range with limited training capability
4. Ground units deployment areas to support air combat training

R-2306D
R-2306B
R-2308C
R-2306C
R-2308B
R-2308A
Yuma Proving Ground
R-2306A
R-2309
R-2307
R-2306E
Laguna Army Airfield
R-2311

Luke Air Force Base

U.S. Marine Corps Barry M. Goldwater Range West (BMGR West)
1. Primary mission—training in air-to-air, air-to-ground, and surface-to-air combat
2. Instrumented air combat training range (Tactical Aircrew Combat Training System)
3. Numerous ground units deployment areas to support air combat training
4. Air-to-ground range supporting urban combat operations training
5. Realistic battlefield settings in diverse terrain – limited to inert ordnance
6. Individual aircrew training as well as large-scale air-ground combat exercises
7. Core range for large force-on-force aviation training exercises hosted at the BSTRC

Marine Corps Air Station Yuma
Barry M. Goldwater Range West
R-2301W
R-2301E
Barry M. Goldwater Range East
R-2305
R-2304

Marine Corps Air Station Miramar

Marine Corps Recruit Depot
1. Primary mission – basic training to make civilians into Marines
2. Individual and small unit training

MC Recruit Depot San Diego
Naval Air Station North Island
Naval Amphibious Base (NAB) Coronado

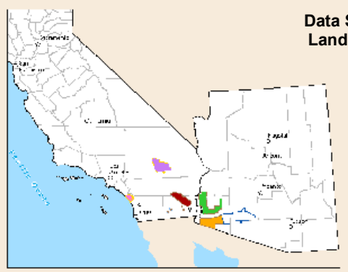
U.S. Navy El Centro Ranges (ECR)
1. Primary mission—training in air-to-air and air-to-ground combat
2. Four small air-to-ground ranges with basic training capabilities
3. Limited to inert ordnance
4. Restricted airspace can be scheduled to support CMAGR missions

- Military Airfield
- Bob Stump Training Range Complex
- Other Marine Corps Range
- Other DoD Range

Special Use Airspace
- Restricted Airspace
- Military Operations Area / Air Traffic Control Assigned Airspace

- 50 Mile Distance from CMAGR
- 100 Mile Distance from CMAGR
- 150 Mile Distance from CMAGR
- 200 Mile Distance from CMAGR
- State Boundary

BMGR West - Barry M. Goldwater Range West
BSTRC - Bob Stump Training Range Complex
ECR - El Centro Ranges
MCAGCC - Marine Corps Air Ground Combat Center
MCAS - Marine Corps Air Station
MCB - Marine Corps Base
YPG - Yuma Proving Ground



Data Source: US Department of Navy, CMAGR Land Withdrawl Draft LEIS, Figure 3-13 (2010)

Figure 4.15.18

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December 16, 2013

Miles
0 20 40

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RIVERSIDE COUNTY PLANNING DEPARTMENT

MILITARY AIRSPACE OVER SOUTHERN CALIFORNIA

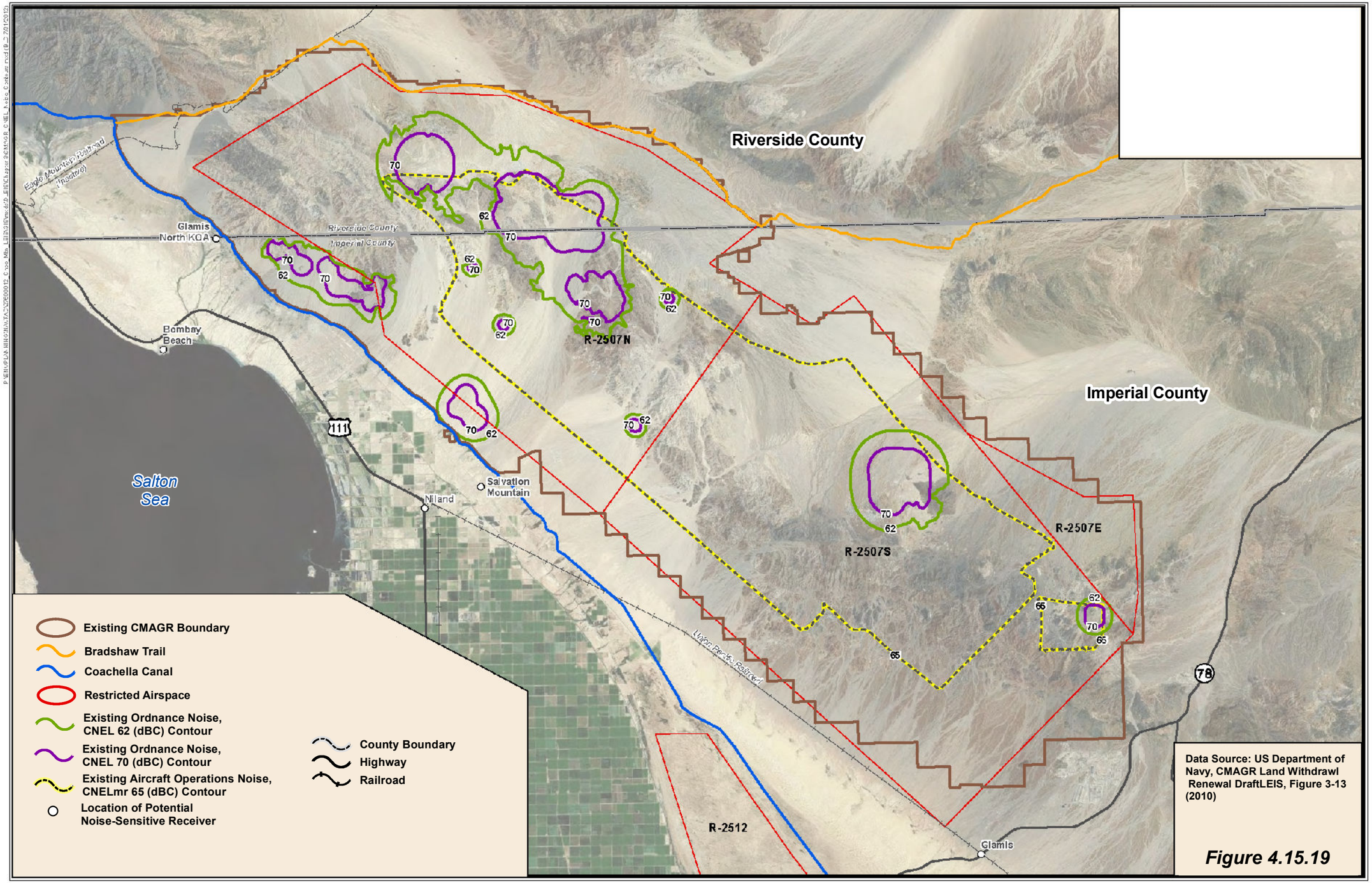

Figure 4.15.19

December 16, 2013

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ACIT GEOGRAPHIC INFORMATION SERVICES
RIVERSIDE COUNTY PLANNING DEPARTMENT
BOARD OF SUPERVISORS Riverside County California

CHOCOLATE MOUNTAIN AERIAL GUNNERY RANGE (CMAGR) EXISTING NOISE CONTOURS

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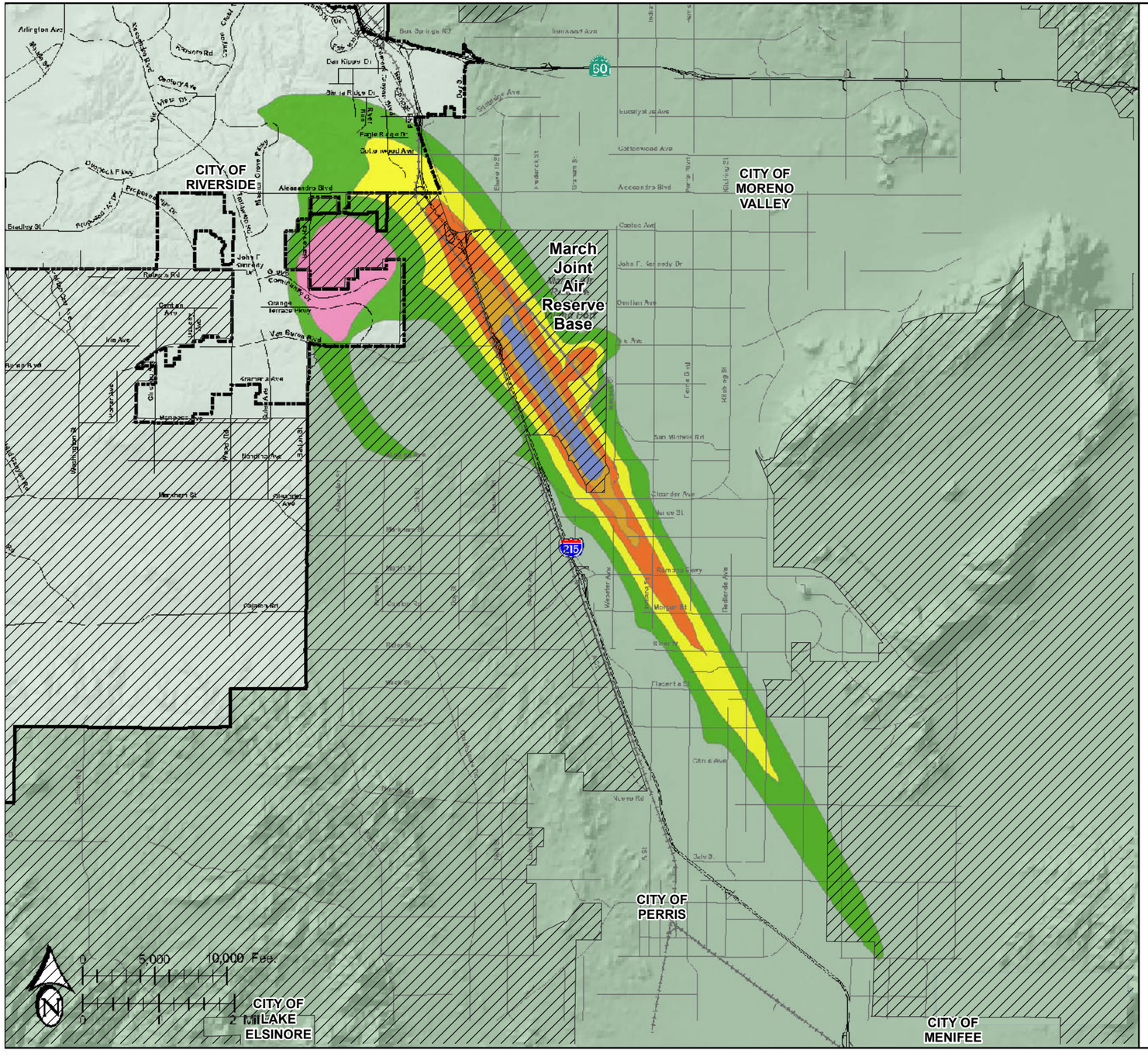

Noise Contours

- 80 CNEL
- 75 CNEL
- 70 CNEL
- 65 CNEL
- 60 CNEL
- 55 CNEL
- Riverside City Boundary
- Unincorporated County Land

Data Source: City of Riverside
2025 General Plan (2010)

Figure 4.15.20

December 16, 2013

Miles
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RIVERSIDE COUNTY PLANNING DEPARTMENT

MARCH JOINT AIR RESERVE BASE
EXISTING NOISE CONTOURS

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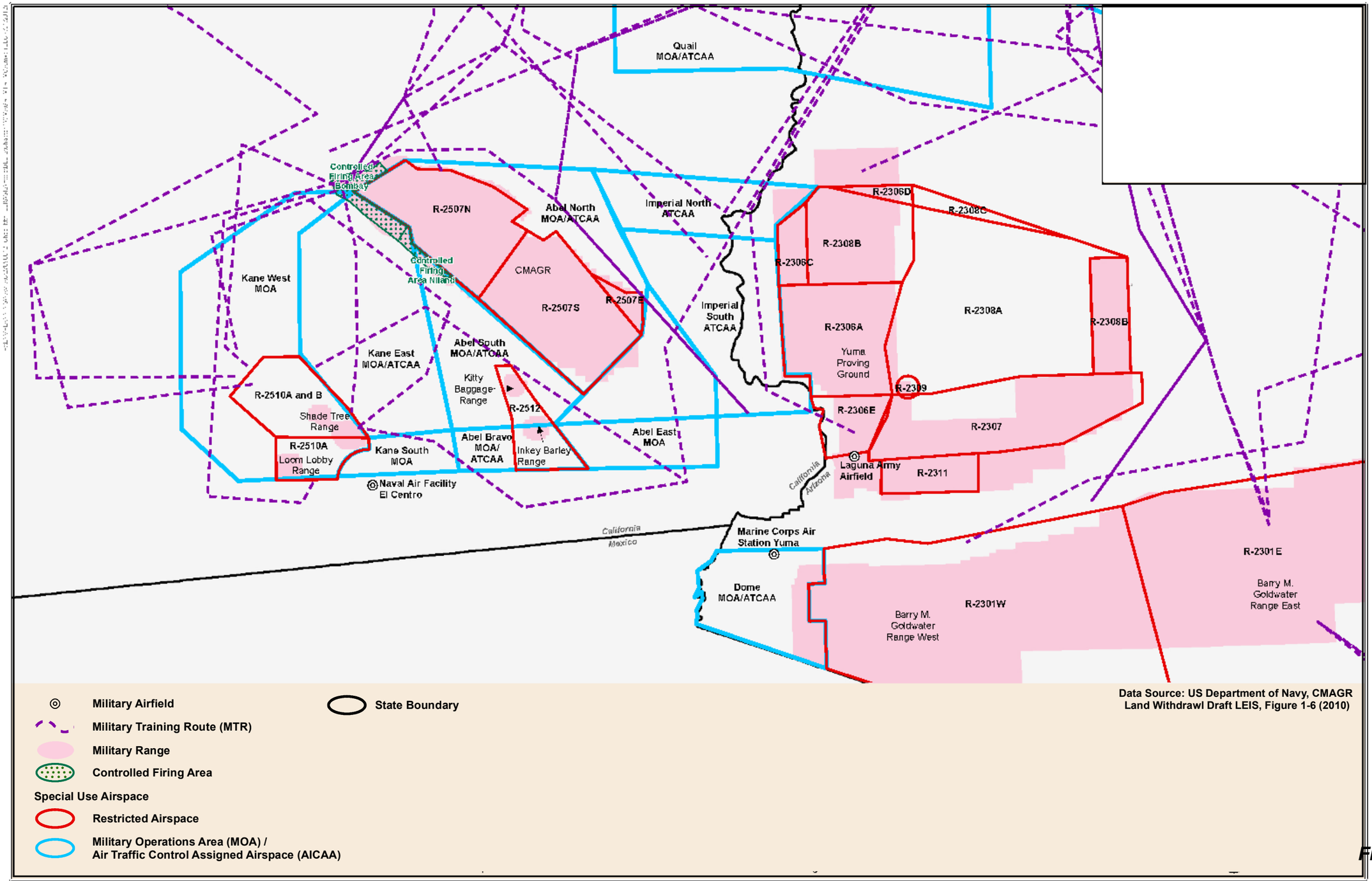

Figure 4.15.21

December 16, 2013

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RIVERSIDE COUNTY PLANNING DEPARTMENT

MILITARY TRAINING AIRSPACE IN THE CMAGR OPERATING AREA

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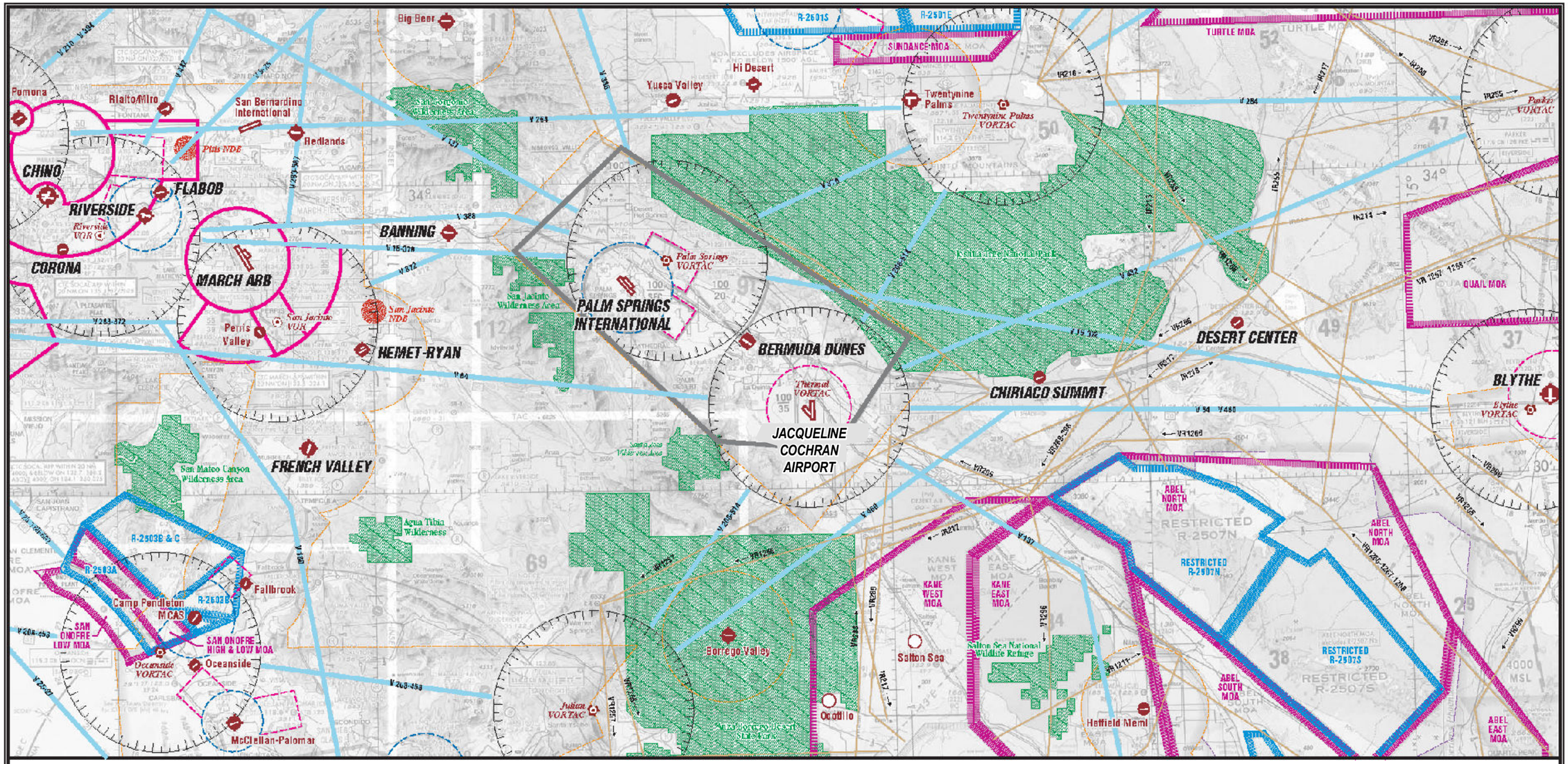

Airport with hard-surfaced runways 1,500' too 8,069' in length

Airport with other than hard-surfaced runways

Airports with hard-surfaced runways greater than 8,069' or some multiple runways less than 8,069'

Wilderness Areas

Non-Directional Radiobeacon (NDB)

Compass Rose

Military Operations Area (MOA)

Prohibited, Restricted, Warning and Alert Areas

VOR

VORTAC

Military Training Routes

Victor Airways

Class C Airspace

Class D Airspace

Class E Airspace

Class E Airspace with floor 700' above surface

Class E Airspace with floor 1200' or greater above surface that abuts Class G Airspace

Terminal Radar Service Area (TRSA)

Data Source: Riverside County Airport Lan Use Comission, Riverside County Airport Land Use Compatibility Plan Document, Map 2 (2004)

Figure 4.15.22

December 16, 2013

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0 10 20

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RCIT — RIVERSIDE COUNTY INFORMATION TECHNOLOGY

RIVERSIDE COUNTY PLANNING DEPARTMENT

BOARD OF SUPERVISORS — Riverside County California — Established 1893

SPECIAL USE AIRSPACE OVER RIVERSIDE COUNTY

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Appendix J:
Community Center Design Guidelines

J. Community Center Design Guidelines

Riverside County Integrated Project

Appendix J

Community Center Guidelines

April 05, 2002

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INTRODUCTION

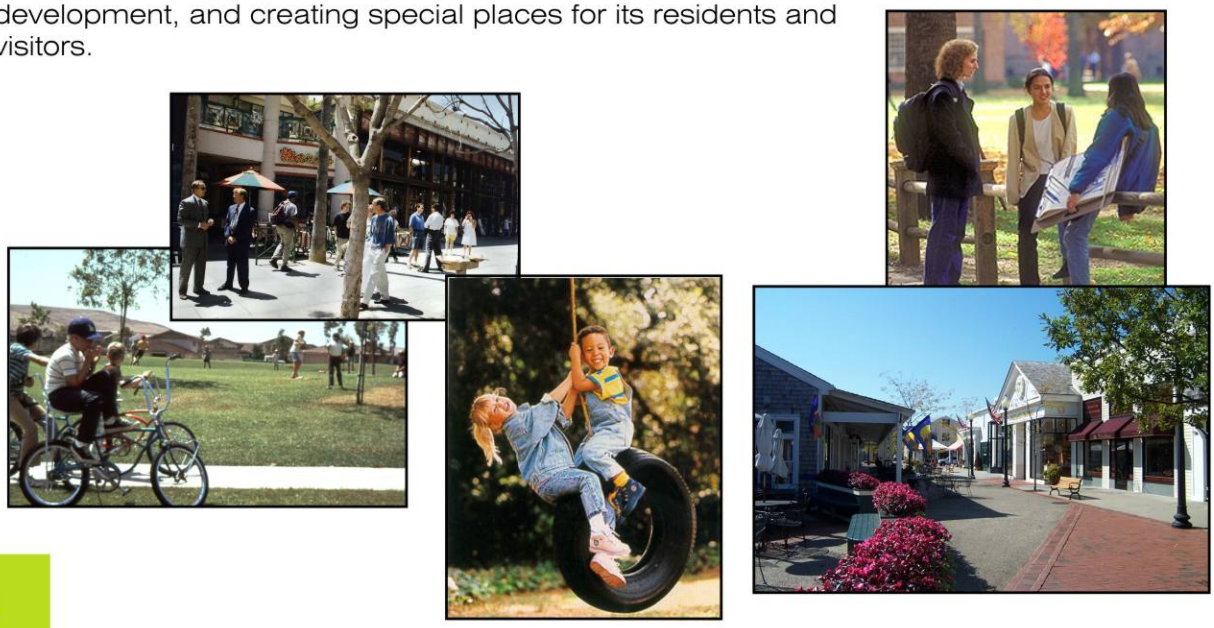
Communities are more than a collection of urban conveniences and necessities; they are a major source of identity for their residents.

People want to live in or have access to communities they consider special, communities that provide a unique identity, create a sense of place, enhance social interaction, and foster civic pride. Indeed, many jurisdictions throughout California are attempting to face the challenge of how to enhance the livability of their communities. The impacts created by sprawl and auto-oriented developments, including civic disenchantment, have lead many municipalities to re-think their current land use policies and place an emphasis on orderly development of land and the creation of focal points and a sense of place for their residents. The growing popularity of revitalized downtowns, new mixed-use urban villages, walkable neighborhoods and communities provides ample testimony to this growing desire for special places.These community centers are intended to be special places that will provide unique and diverse environments and opportunities for working, shopping, living and interacting, while establishing a focal point and source of identity for those unincorporated communities they currently serve or will serve in the future.

Landscaped public plaza amidst multiple uses.

The County of Riverside has embarked upon an exciting and ambitious journey in the evolution of its urban environment. It has become one of those jurisdictions ready to meet the challenge of preserving and enhancing the livability of its family of unique communities. It recognizes that that in order to accommodate a rapidly growing population, ensure efficient and orderly growth, protect its natural resources, and otherwise preserve its quality of life, unique and innovation solutions are in order.

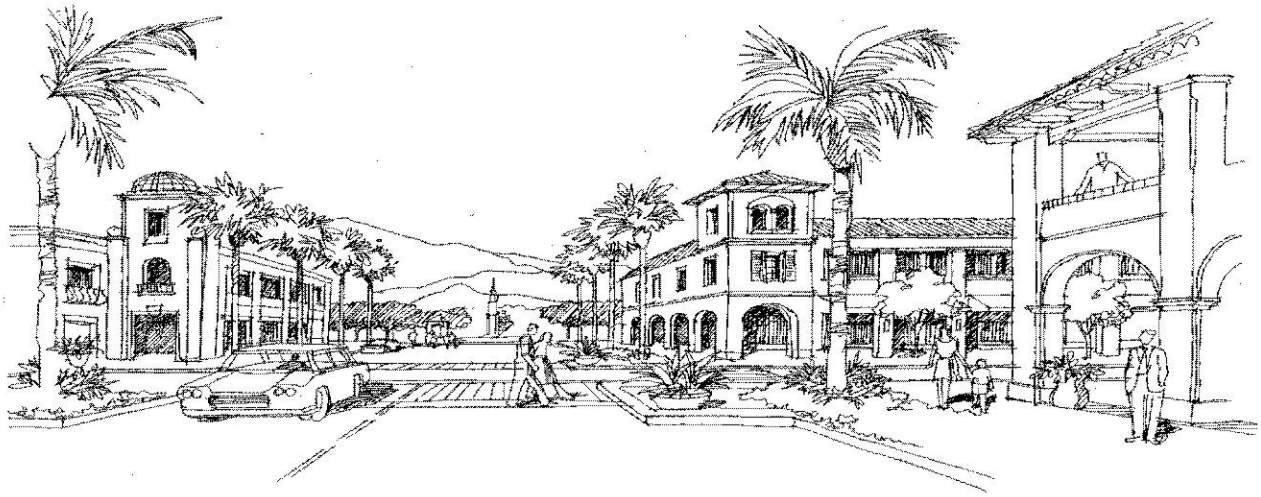
Through its Vision Statement and General Plan processes, the County has selected the establishment of strategically located Community Centers as a means of accommodating population growth, enhancing quality of life, providing orderly development, and creating special places for its residents and visitors.



GUIDE FOR PHYSICAL DEVELOPMENT OF COMMUNITY CENTERS

This document is designed to serve as a guide for the physical development of community centers within Riverside County. As such, the guidelines presented here are intended to be illustrative in nature rather than prescriptive. They establish a flexible framework for design while allowing great latitude for innovation. Each guideline should be considered in terms of how it applies to a given project. They are not intended to impose limitations on innovation or initiative, but rather to ensure that these community centers develop into diverse and vibrant urban places. These guidelines are also written to compliment and reinforce policies identified in the General Plan, including those located in the Housing and Circulation Elements.

A critically important aspect of the Community Center concept is the need to reinforce and stimulate these centers by means other than land use designations and other regulatory development policies. One of the primary implementation tools resulting from the General Plan process is the development of a voluntary incentives program to stimulate desired land uses, development intensities and design standards that will contribute to community identity and focus. The Incentive Program augments standard provisions of the General Plan to assist both in facilitating development within these community centers, and in acquiring open space land that can define community edges. These guidelines are intended to serve as a precursor to the Incentives Program.



"Through its Vision Statement and General Plan processes, the County of Riverside has selected the establishment of strategically located Community Centers as a means of accommodating population growth, enhancing quality of life, providing orderly development, and creating special places for its residents and visitors."

COMMUNITY CENTER CHARACTERISTICS

Community Centers are specially designed urban areas that facilitate a dynamic pedestrian-oriented environment by providing a compact and intimately scaled mix of uses and minimizing the dominance of the automobile.

Community Centers generally consist of the following characteristics:

- Superior design elements that establish character and a sense of place, preserve aesthetic value of development, promote walk-ability and pedestrian orientation, and contribute to a vibrant, engaging and aesthetically pleasing environment.

- A diverse and unique horizontal and vertical mix of uses, including residential, commercial, office, open space and civic, that promotes a lively and dynamic urban setting.

- A diverse multi-modal circulation network of roads, multi-use trails, sidewalks, transit facilities and parking areas designed to facilitate pedestrian movement, provide linkages between adjacent and remote uses and areas, and accommodate efficient vehicular access while minimizing the impacts of the automobile.

Streetscape and road design encourage pedestrian usage

- Buildings and structures are; located close to the street, enhancing the intimacy of the local streetscape; and designed at a scale that encourages pedestrian activity.

- A network of open space features such as pocket parks, plazas, paseos, village greens, and other passive and active open areas. These open spaces serve as transitions between neighborhoods, establish pedestrian linkages between uses, and provide areas for gathering and recreation.

- A dynamic streetscape consisting of pedestrian activity, sidewalk amenities, detailed landscaping, traffic-calming devices, and intimately scaled mix of uses.
- Developed at a scale, mix, intensity and level of detail that distinguishes itself from adjacent uses and enhances them by virtue of design quality.

Building design oriented towards the sidewalk

This mixed use project is located adjacent to single family homes. Quality architecture and building design make the project compatible with the neighborhood.

- Contain both a centralized **core area** where the concentration and intensity of uses is highest, and an adjacent **core support** of residential, civic, open space and employment-generating uses that lessen in density and intensity as development radiates away from the core.
- Though different in scale and design quality from adjacent uses, Community Centers are not isolated "mini-cities." With careful site planning and strategic use of landscaping and open space areas, Community Centers can be relatively seamless areas that easily transition into adjacent neighborhoods and communities.
- Use indigenous materials and design features that promote a strong sense of place.
- Provide several opportunities for social interaction, including public spaces, open spaces, streetscape amenities, and civic uses that facilitate community activities.

BENEFITS

Community Centers:

- Use land more efficiently by accommodating increased densities and intensities of use within concentrated areas, thus minimizing sprawl and consuming less open space land.
- Create a walkable, pedestrian-friendly environment that enhances community vitality.
- Reduces automobile reliance and vehicular trips by providing a variety of transit and pedestrian facilities, and a mix of amenities and uses in close proximity.
- Establish sufficient density to support some form of bus or rail transit.Provide a more efficient use of infrastructure.
- Conveniently accommodates automobile use, yet is designed to both prevent vehicular traffic from dominating the urban fabric, and enhance pedestrian activity.
- Provide additional housing choices and opportunities for local residents and workers.
- May reduce vehicle miles traveled by locating employment and residential uses in close proximity.
- Create a strong sense of place through superior design elements.
- Promote economic vitality and job creation by providing areas for employment uses, and establishing a population base to support retail and office uses.

Many new and revitalized town and village centers throughout the country are centered on substantial commercial retail developments, most of which are anchored by regional-serving national tenants. While these types of uses are important components, Community Centers should also feature commercial and civic uses that cater to local residents. An emphasis on local shopping and services sustains urban activity over longer periods and allows the Community Center to withstand the cyclical nature of retail uses. A prominent mix of locally-owned businesses and unique civic uses adds a certain urban "flavor' to the community that is typically absent from traditional, corporate, chain-dominated shopping malls.

Though retail uses serve an important focus and help promote activity throughout the day and evening hours, the presence of people is what comprises Community Center vitality. A substantial residential component is a critical element to the success of a Community Center. Residential uses provide the population base that maintains retail and civic vitality. Other uses such as schools, parks, office complexes, and recreational facilities also enhance activity.

Community centers not only enhance the physical environment of a community, they also create opportunities for social interaction. These areas provide places that people want to be a part of and can easily be recognized by other. Community Centers are the places where communities can relate with one another in an environment outside of their homes, and the experiences occurring there can sometimes make a more lasting impression than the architecture and landscaping. They are places that are comfortable to and familiar to the communities they serve and truly can be the "heart" of the community.

CHALLENGES TO CREATING COMMUNITY CENTERS

The growth of our urban environment over the last several decades, generally in the form of suburban style development, has several roots, primary among them the desire to escape the numerous urban and social ills associated with dilapidated, crowded downtown living. Suburban style development, with its expansive areas of low-rise, low density, and segregated land uses, was seen as a perfect antidote for minimizing or eliminating the impacts of incompatible land uses, and for establishing a more safe, more secure and less intimidating urban environ. Suburbs have afforded their residents and businesses numerous benefits. Despite the apparent benefits of suburban communities, the predominant style of development has resulted in several unintended negative consequences that are the topics of much debate:

- Inflexible zoning and general plan regulations governing land use have often resulted in the design and layout of similar-looking residential subdivisions, business parks and strip commercial developments that have made many communities virtually indistinguishable from one another.
- The segregation of uses such as job centers, commercial malls and residential neighborhoods has lead to congested local roads and regional highways, long commutes, poor air quality, and other degradations of the environmental and social fabric of communities.
- Arterial highways are often lined with poorly designed or deteriorating commercial centers, which may consist of antiquated building designs, underutilized parking lots, and a preponderance of unsightly signs, utility poles, and other supporting infrastructure.
- Due to the low-density nature of suburban development, it has used up a tremendous amount of open space, permanently altering the landscape and often resulting in irreparable damage to habitat lands and other natural resources.
- Zoning regulations have typically been written in such a manner that they prevent the development of a Community Center project.

LOCATION OF COMMUNITY CENTERS

Community Centers may generally be located in areas consisting of one or more of the following characteristics:

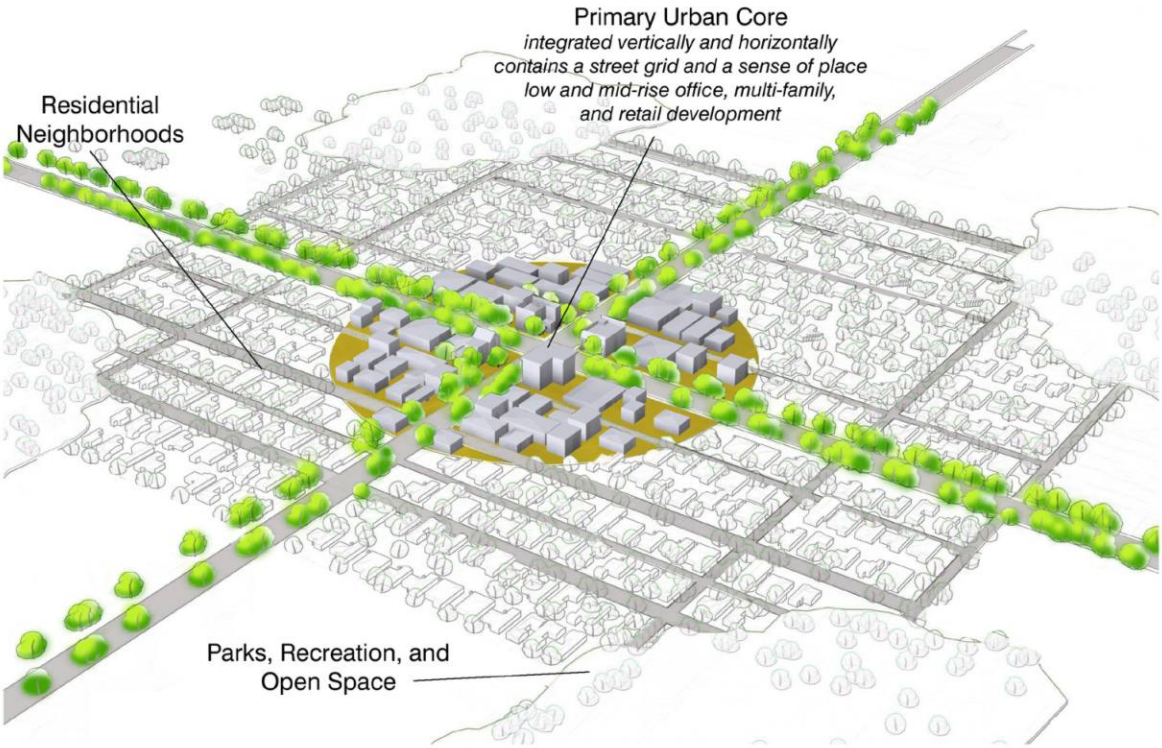
- A locally recognized center of an existing community.
- The historical focal point of an area.
- Potential for attracting new and more diverse uses because of certain physical characteristics or synergy of existing development.
- The lack of an identified "center" or demonstrating a need for a focal point to help create a sense of place.

The combination of residential above retail uses helps to create activity and a sense of place.

- Location within an existing "greenfield" area where urbanization is rapidly occurring or is planned to occur.
- Proximity to existing or planned major transportation corridors and other supporting infrastructure.
- An aging urban area in need of revitalization.

COMMUNITY CENTER STRUCTURE

Community Centers generally consist of two distinct sub-areas: a centralized **Core Area**, which accommodates the highest levels of urban activity and building development; and a **Core Support Area**, which is an area that is contiguous to the central core, but accommodates a more gradual yet distinguishable decrease in development intensity and

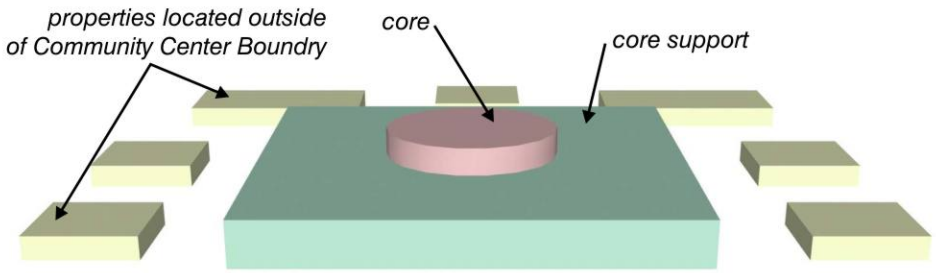


COMMUNITY CENTER CORE

The core is the "heart" of the Community Center. It is the center of public activity and because of its design characteristics has a distinct sense of place. Core areas typically range in size from 10 to 60 acres. The formof development and mix of uses within the core are more compact and intimately scaled, resulting in a environment that is tailored for pedestrian use. The core promotes density, compactness, centrality, proximity and continuity of land-forms and uses.

Public spaces developed within the Community Center core can help to create an identity for an area by establishing unique environments that are different from any other community. Open spaces create a "sense of place" that allows the public to quickly identify with and participate in the community that they are in. Landmark water features, gathering places, walkways, community activities, and landscape treatments can provide an identity to the area that would not be as prevalent if these features did not exist. Public spaces help to distinguish one community from another; users are exposed to unique experiences that are unlike those in other areas. Sidewalks are a critical public component of the Community Center core since the majority of the activity will occur in these spaces (sidewalk cafes, window shopping, etc).

Community Center core areas combine ground-floor retail uses with higher density residential uses and/or professional office located above. This allows the retail uses to be easily accessible to residents and reduces the use of the automobile for routine shopping trips. In addition, many successful stores operate during hours before 8:00 am and after 5:00 pm. Since community centers are meant to create "hubs" of activity, extended business hours can encourage the use of public spaces for longer periods of time.



Community Center Boundary

Automobiles have a presence in the core, but are secondary to the pedestrian. On-street parking is available in limited quantities, as the majority of parking is provided behind buildings or within structures to minimize their impact on the pedestrian activity found on the street. Major thoroughfares are not located within the core. Streets located outside of the periphery of the Community Center accommodate the majority of through-traffic; vehicular paths within the core are limited and speeds are greatly reduced to support the pedestrian friendly and walkable characteristics of the area. Wider streets that accommodate higher levels of traffic create vehicular and pedestrian conflicts and as a result they should be located outside of the immediate core area.

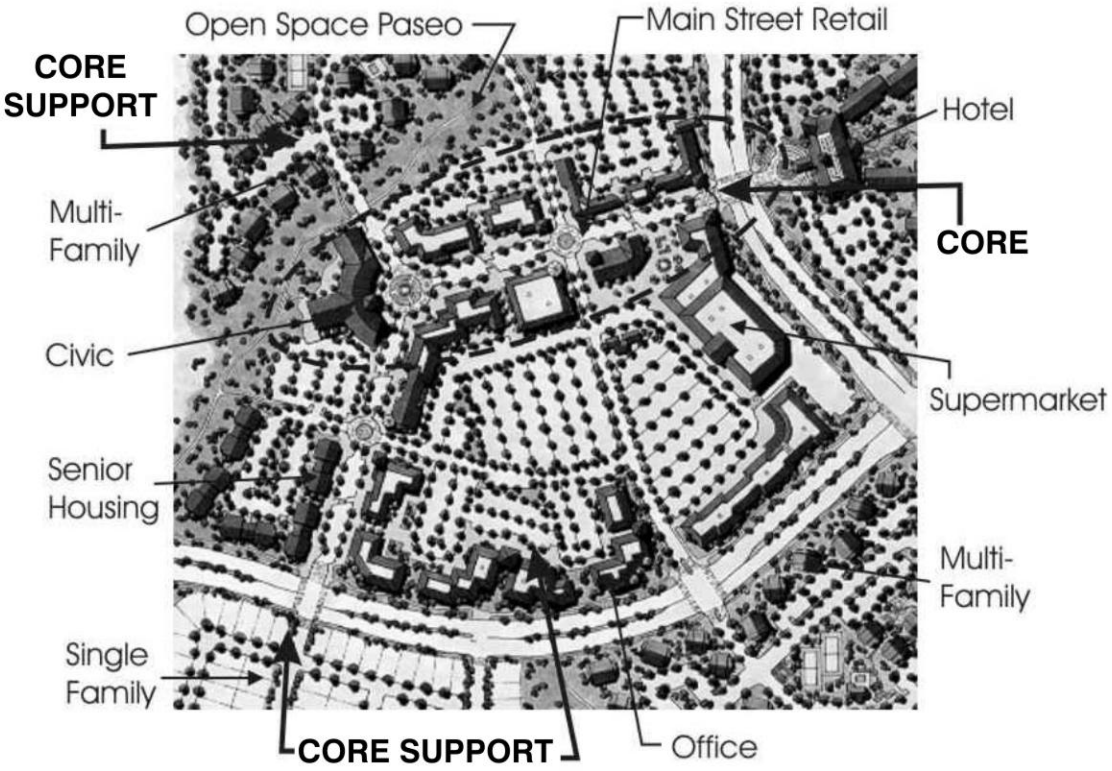
CORE SUPPORT

The areas located within Community Center boundaries immediately outside of the core are classified as the core support. The core support is ancillary to the Community Center core, but is a critical component as it supports the vitality of core activity. These areas generally consist of a mix of single-family and multi-family residential neighborhoods, clustered business parks and professional offices, and neighborhood commercial uses at densities less intense than those found in the core, but greater than densities found in typical suburban neighborhoods. Unlike the core area where the urban fabric is compact, the core support of is appropriate for public uses such as schools, day care facilities, houses of worship, community buildings, and recreational fields that generate significant amounts of activity.

The vitality and longevity of a Community Center core is heavily based upon a network of linkages connecting the core support area to the core. This creates a circulation pattern that provides efficient access to activities and amenities, and allows a constant flow between the core support area and the core. These networks bring life to the heart of the community.

Although development intensity becomes gradually less dense, many of the design characteristics exhibited by the core also apply to these outlying areas:

- Unique mix and blending of uses.
- Superior architectural and site design elements.
- Walkable, and intimately scaled residential neighborhoods, commercial centers and office/business complexes.
- Distinguishing gateways into the community center area.
- A network of open space areas.
- A system of pedestrian walkways and multi-use trails.
- Well landscaped streetscapes.
- Location and design of roadway and parking facilities that de-emphasizes the presence of the automobile.



The following table provides a summary comparison of development characteristics between the Community Center core and outer ring, and outlying suburban areas.

Table 1: Development Characteristics Comparison

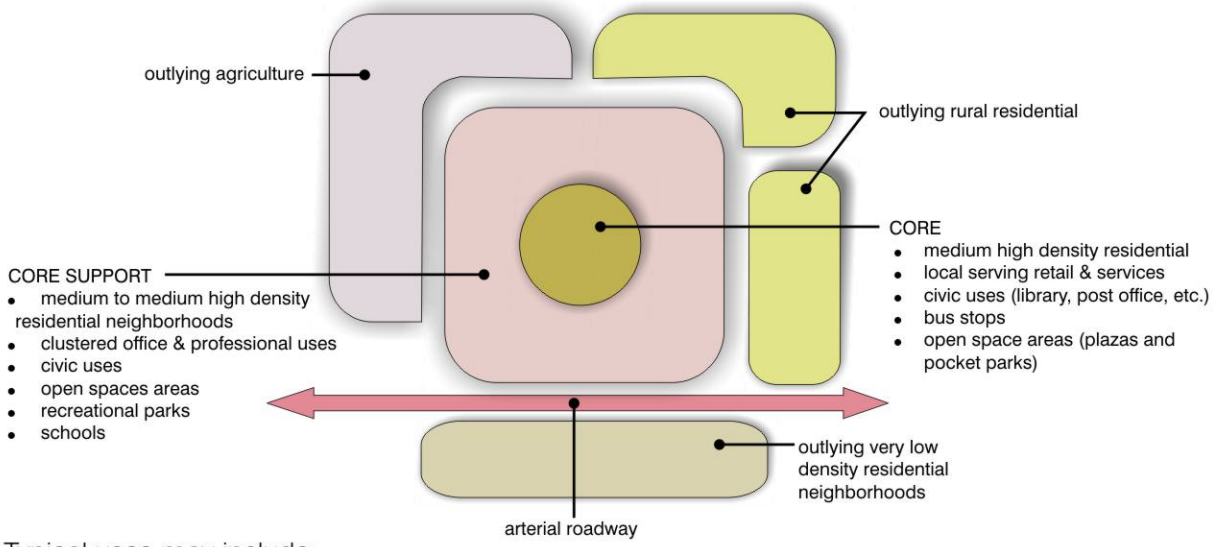
Development Characteristic	Core	Core Support	Areas outside of Community Center
Mix of Uses	High	Good	Minimal
Density	High/Medium High	Medium	Low
Pedestrian Orientation	High	Good	Low
Quality of Design	High	High	Medium
Spatial Separation	Very Low	Low	High
Auto Dominance	Very Low	Low	High
Parking Facilities	Parking Structure/ Surface Lots/On-street	Surface Lots/On-Street	On-street/Surface Lots
Transportation Choices	High	Good	Minimal

COMMUNITY CENTER TYPES

The General Plan Land Use Element identifies four types of Community Centers, each differentiated by size, scale and land use emphasis: Village Centers, Town Centers, Employment Centers, and Entertainment Centers. The design principles detailed in this document can be applied to all the community center types. However, the distinction of types is seen in the intensity and unique distribution of land uses within each community center type.

VILLAGE CENTERS

Village Centers are the smallest in form and scale of all community center types, and are generally designed to serve the immediate local population in adjacent and nearby residential neighborhoods rather than a regional area. This type of development is typical to that of a small, intimately scaled hamlet or rural village.



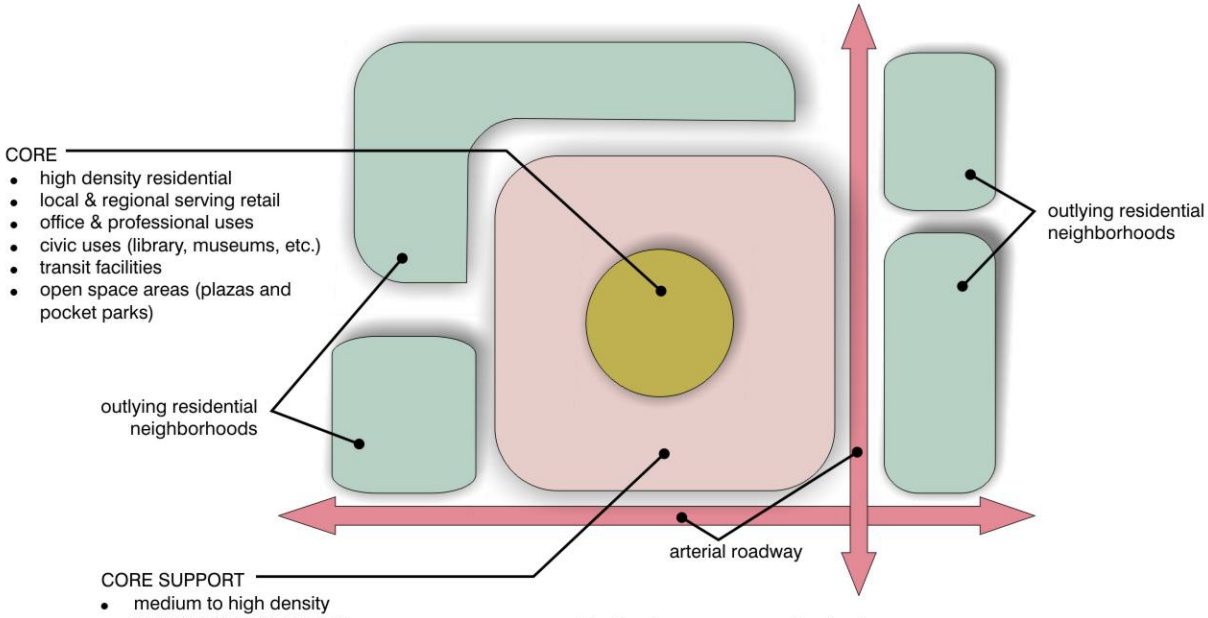
Typical uses may include:

- Small-lot single family detached residential units, clustered and/or attached single-family and multi-family residential units such as apartments and townhouses.
- Neighborhood-serving retail uses such as a grocery store, drug store, and commercial services.
- Office uses such as doctor, financial and similar professional services.
- Small-scale lodging uses such as inns and bed & breakfast establishments.
- Public uses such as schools, post offices and other civic or cultural uses.
- Recreational open space such as parks and trails.

core area centered around a village green

TOWN CENTERS

Town Centers are larger in scale and accommodate a more intense mix of land uses than any of the other Community Center types. They accommodate regional attractions and facilities in addition to those uses that serve local residents and workers. The scale and mix of uses resembles that of more "traditional" downtown areas. They will typically have one or more "anchor" uses such as a major department store, cultural facility, or public building.



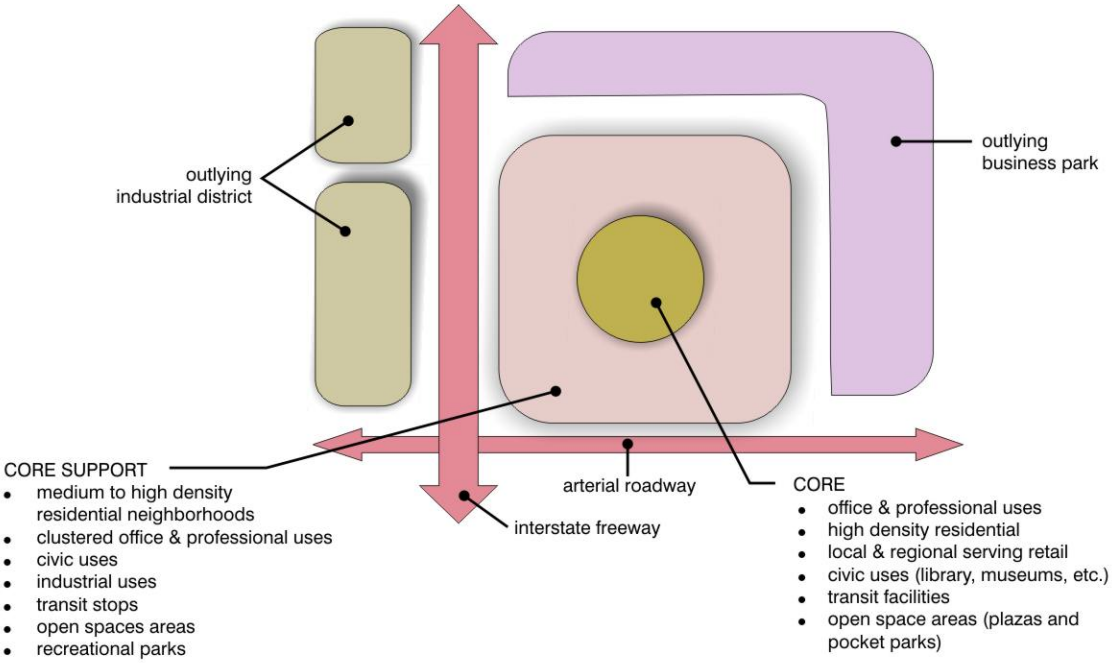
Typical uses may include:

- Multi-family residential units such as mixed-use lofts and apartments, condos and townhouses.
- Local and regional serving retail uses such as restaurants, specialty stores, bookstores, department stores, and hotels/inns.
- Office complexes and other ancillary office and business support uses.
- Hospitals, day care centers
- Public uses such as libraries, post offices, community centers, theaters, hospitals, and day care centers.
- Recreational open space such as urban parks, and plazas.

A typical town center core. Note the placement of buildings directly adjacent to the sidewalk, narrow street widths, wide sidewalks, provision of outdoor seating, and the placement of attractive streetscape elements such as street trees, decorative light posts and bollards.

JOB CENTERS

Job Centers are another type of Community Center that provides an area nfor intensive business and employment-generating uses, resulting in the strengthening of the job base for the region. These include a clustered mix of business park and office uses, light industrial and commercial uses, and higher density residential uses.



Pedestrian linkage connecting to employment center use.

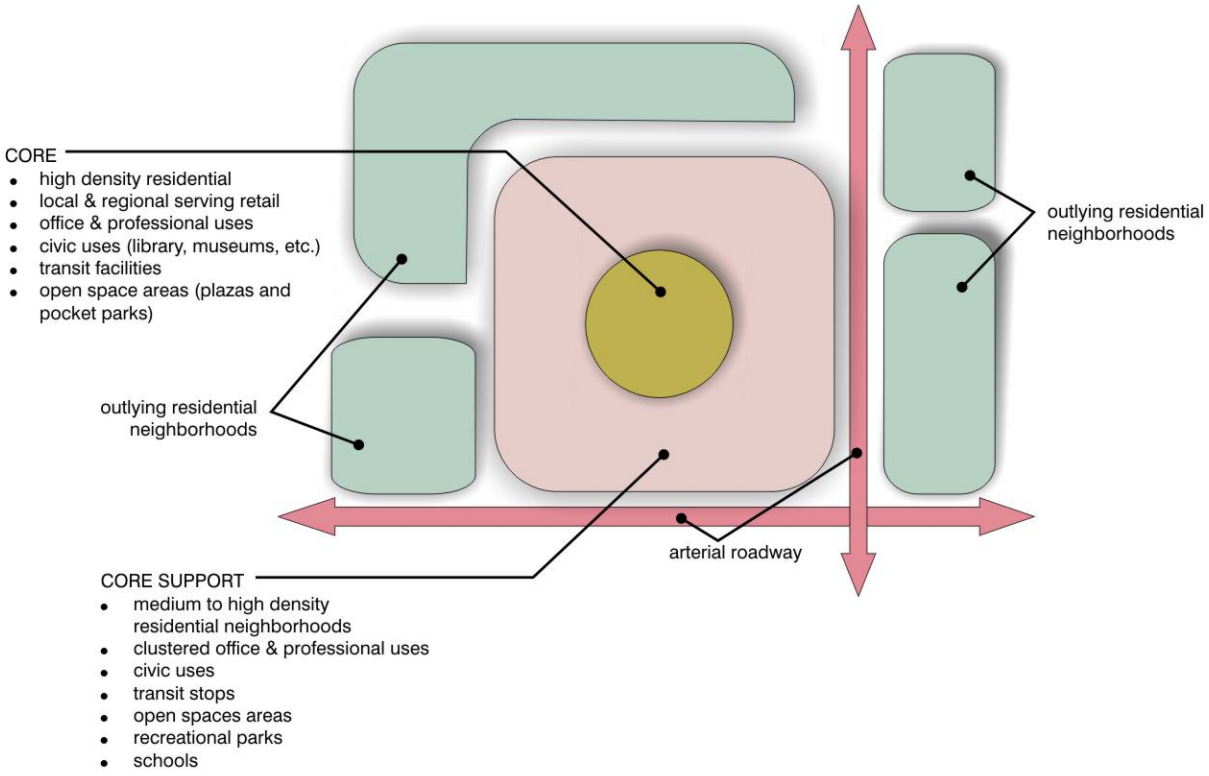
Typical office use, with extensive landscaping and public area.

Primary uses consist of:

- Employment-generating uses such as mid-rise office and professional complexes and research and development centers.
- Support commercial uses such as restaurants, dry cleaners, copy centers and health clubs.
- Residential uses such as mid-rise apartment and condominium complexes, and attached townhouses.
- Recreational open space such as urban parks and trails.
- Industrial uses.
- Civic uses including educational and cultural facilities.

ENTERTAINMENT CENTERS

Entertainment Centers cater to a regional area and allow the greatest variation in intensity, from resort communities to high-use recreational centers and tourist destinations.



Primary uses consist of:

- Tourist-oriented recreational and entertainment facilities, including golf courses, water parks, hotels, athletic fields, and amusement parks.
- Local and regional serving retail uses such as restaurants, specialty stores, theaters, hotels and motels.

Pedestrian linkage within entertainment center core area.

- Business support services and ancillary office uses such as financial institutions.
- Small-lot detached residential units, attached single-family units and multi-family units.
- Public/civic uses such as a visitor's center, cultural center, or museum.
- Recreational open space such as parks and trails.

DEVELOPMENT STANDARDS

Table 2: Recommended Development Standards

	Village Center	Town Center	Job Center	Entertainment Center
RESIDENTIAL DENSITY (DU/AC)				
Core	8-14	20-40	20-40	14-20
Core Support	5-14	5-20	5-20	8-14
NON-RESIDENTIAL INTENSITY (FAR)				
Core	0.5-0.8	0.5-1.0	0.5-1.0	0.5-0.75
Core Support	0.3-0.5	0.35-0.5	0.3-0.5	0.35-0.5
MAXIMUM NO. OF FLOORS*	3	6	6	4
DISTRIBUTION OF USES*				
Commercial	20-30%	20-40%	10-20%	20-40%
Office & Professional	10-20%	20-40%	50-70%	10-20%
Open Space	10-20%	10-15%	10-15%	10-20%
Residential	50-80%	40-80%	40-60%	60-80%

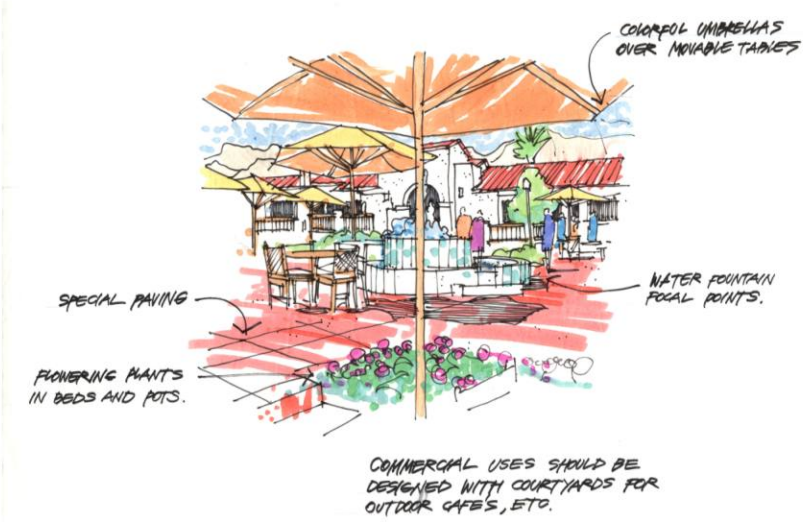
CORE GUIDELINES

LAND USE

The key element of the dynamic and lively nature of Community Centers is a unique mix of complementary uses in close proximity to one another. Mixing of uses encourages people to get out of their cars and participate in a pedestrian experience, because residential, commercial, and public uses are within a short walking distance of one another. Variety of use results in extended periods of urban activity and leads to a synergy that simply cannot happen in an environment of spread out, segregated uses. Though some uses may be inherently incompatible with one another, several design and siting treatments can be applied to minimize or eliminate negative impacts while preserving the intimate pedestrian feel of these mixed-use centers.

- Incorporate a dynamic and diverse mix of uses that promote care vitality.
- Allow a mix of attached multi-family housing, retail, offices, hotels, civic, educational, entertainment and recreational uses. Concentrate these diverse uses to promote pedestrian activity.
- Integrate a horizontal mix of compatible uses within a single lot or project area, including some combination of residential, retail, office, and public uses.

- Integrate a vertical mix of uses into a single structure, with retail and/or office uses on the lower level, and office and/or residential uses on upper levels.
- Be selective about the size, distribution and types of uses that are permitted within the Community Center core.
- Incorporate public uses that promote pedestrian activity, such as libraries, adult education facilities, university extensions, cultural centers, museums, Community Center facilities, and government annexes into the mix of uses encouraged in the core.
- Integrate open space plazas, green spaces and similar community gathering spaces within project developments. These uses are integral parts of Community Centers as they provide opportunities for social interaction and passive recreation, serve as transition areas between uses, and provide visual relief.
- Locate uses that require a substantial amount of acreage, such as golf courses or recreational parks outside of the core area. The design of these uses would destroy the pedestrian feel of the Community Center because they require large amounts of land.
- Utilize well designed open space areas as a buffer to provide a seamless transition between the Community Center core and adjacent neighborhoods. Surrounding neighborhoods are typically less intense in scale and activity as compared to the core. Open space areas soften the transition between these adjacent and differing intensities, and can serve as pedestrian access routes.



- Accommodate live-work spaces such as artist studios/lofts that combine residential and office/commercial uses within the same unit.
- Balance concentrations of governmental or office uses with commercial and residential uses to prevent the creation of a core that contains only weekday activity during daytime hours. Excessive concentrations of office or government uses often result in "dead" areas and/or extended periods of inactivity, thus detracting from the pedestrian vitality of core areas.
- Avoid industrial or warehousing/distribution uses within the core.

RESIDENTIAL USES

- Ensure a healthy mix of residential uses within core areas. Residential uses are a critical component of community center vitality. They provide a critical mass of people for the support of commercial and public uses, as well as the viability of transit facilities. They help ensure constant activity within Community centers.
- Locate residential uses within mid-block areas to minimize exposure to roadway intersections.
- Do not locate residential units above restaurants, taverns or similar uses that cater to a nighttime clientele.
- Minimize exposure of residential units to loading docks, storage areas, and other ancillary commercial uses. Locate these areas away from residential units, or provide some type of screening that minimizes their nuisance.

Mixed use project with residential units located over ground floor retail businesses.

CLUSTER ACTIVITY

- Within core areas, segment activity clusters on blocks no longer than 600 feet in length. Break up continuous rows of development through the location of side streets, pedestrian linkages, public plazas and green spaces at regular intervals to provide visual relief and places for relaxation and rest.
- Ensure that the mix of uses creates constant daytime and evening activity.

COMMERCIAL USES

- Establish commercial and public "anchor" or "destination" uses that promote core focus and vitality. Anchor uses include department stores, post offices, coffeehouses, grocery stores, libraries and restaurants.
- Locate commercial uses along the ground floor to enhance visibility and viability. In addition, locate intense commercial uses such as restaurants, taverns and other entertainment oriented uses at or near street intersections.
- In Job Centers, Entertainment Centers and Town Centers, provide a mix of retail uses to service both a local and regional clientele. Everyday uses such as dry cleaners, copy centers, medical offices, delis, grocery stores, and similar uses serving the day-to-day needs of local residents, as well as regional serving uses such as specialty shops, department stores, and bookstores, provide flexibility and variety within .retail areas, thus ensuring their long-term viability. Village Center commercial uses should serve primarily local neighborhoods.

Mixed use office and retail building with adjacent pedestrian plaza.

ARCHITECTURAL DESIGN

Architectural design of the built environment greatly impacts the way that a Community Center is experienced aesthetically. Community Center design requires an understanding of building form, scale, orientation, setbacks, and existing terrain. Attention to design detail is critically important in the creation of community centers. Well-designed, aesthetically pleasing structures constructed of high quality materials reflect a community that is willing to invest in itself and in the longevity and sustainability of its environment. This discussion of structures includes buildings, walls and fences, and ancillary structures such as storage areas.

- Achieve architectural excellence and superior quality of development.
- Define, for each Community Center, the attributes that constitute "architectural excellence" and identify themes that will be promoted in the community.
- Integrate detailed architectural treatment on all building exteriors. Provide the same level of detail on rear-facing building facades as with front and side elevations.
- Avoid repetitive structures that will produce monotonous street scenes.

Detailed architectural facade treatment with third story setback, awnings, recessed entry-ways, arches, and color variety.

- Utilize differing but complimentary forms of architectural styles and designs. Creative architecture establishes the feeling of a unique place, and contributes to a community's "personality."
- Utilize architectural styles that incorporate representative characteristics of a given area
- Discourage the development of overly themed or "cartoonish" environments.
- Provide special building form elements such as towers and archways and other building massing elements to help distinguish the core and establish landmarks within the community fabric.

The balconies, columns archways and bright colors contribute to the charm of this Community Center.

- Integrate stairs, balconies, porches, awnings and patios into the overall design of the building. Provide private open space areas such as interior patios, courtyards or balconies, for each residential use.
- Provide windows, doorways and other architectural elements at frequent intervals along ground floor elevations. Storefront windows create interesting displays that draw activity from open space areas inward.

BUILDING ORIENTATION

Building orientation addresses the relationships of structures to the street. The position of the building and surrounding elements can be just as important as the design of the building. Building facades were traditionally oriented parallel to the street, with shallow setbacks and architectural details intended for pedestrians walking past on the sidewalks. Postwar development and the domination of the automobile, however, has led to increased setbacks and buildings facing the parking lots or away from the street. Community Centers utilize varied setbacks and landscaping to appeal to pedestrians, increase public safety, and enhance street activity.

- Orient structures and landscaping to preserve significant view and enhance the vitality of public spaces such as plazas and paseos.
- Locate structures along front and side property lines, adjacent to sidewalks and open space plazas.
- Orient and design buildings and public spaces to maximize views between uses. Techniques such as the use of balconies, porches, and windows facing public areas aids in keeping "eyes on the street," enhances the visibility of public areas, encourages community interaction and heightens a sense of security.

Large prominent windows create visual interest along building facades.

- Preserve, protect, and create interesting views from pedestrian areas.

STREETSCAPES

Streetscapes consist of many of the elements described in this guidelines section, including structures, land uses, public spaces, and streets. Sidewalks are another key element to streetscapes, serving as the dynamic interface where these structural elements come together. The multi-functional nature of sidewalks makes them one of the most vital components of community centers, as they facilitate a tremendous amount of urban activity. Another important element in the design of streetscapes is the distribution of numerous pedestrian amenities such as benches, water fountains and trash receptacles. These elements, if well designed and distributed, provide great convenience for pedestrians, enhance visual aesthetics, and promote streetscape vitality. They also create a functional, comfortable and interactive street scene for pedestrians. It is these streetscape components plus the relationship between the various elements described throughout these guidelines that give Community Centers their zest.

STRUCTURAL VARIATION

Building characteristics such as façade design, height, and entrances should be varied to prevent monotonous streetscapes. Such techniques can encourage people to explore the streets scene and enhance the views for automobiles. Community Centers encourage the construction of unique and creative structures that beautify the streetscape.

Varied building heights, window treatments and building setbacks create appealing streetscapes.

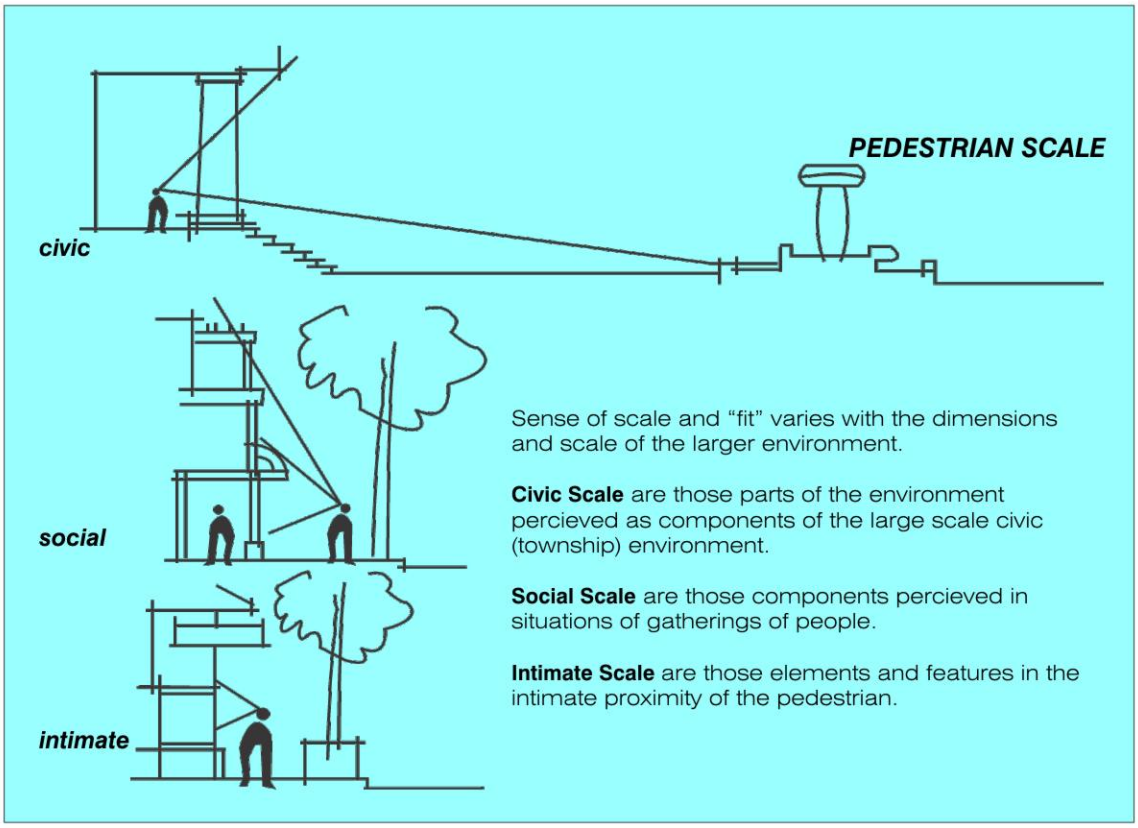
- Allow for visual relief and avoid large expanses of blank walls. Wall surfaces should contain a variety of articulations, such as offsets, projections, step-backs and penetrations, and surface textures.
- Provide variations in building heights and rooflines. These variations can lead to a more visually interesting street scene.
- Include variation in colors, materials and texture treatments to enhance visual aesthetics.
- Provide a variety of defensible spaces for pedestrian use, such as arcades, overhangs and recessed storefront entries.
- Design exterior windows utilizing varying elements such as size or facade treatment, or by creating interesting patterns.
- Provide facade variation that will create a unique and visually stimulating environment.
- Encourage varied building setbacks. Buildings constructed using the same setback distances can often be uninteresting and monotonous. Varied setbacks create character and allow for creative building design.

Note variations in building facade treatment including awnings, trellises structures, pilasters, and display windows.

SCALE

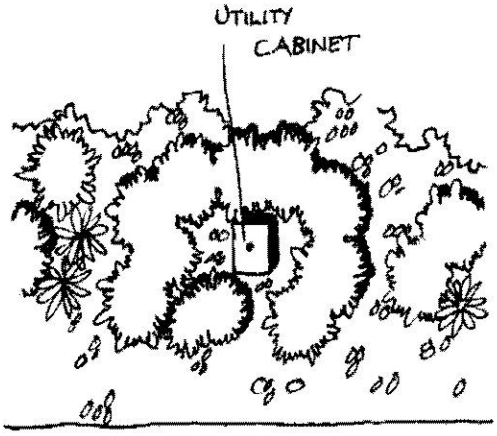
The scale of a development concerns the relationship of the buildings, streetscape, and activities. In a prosperous community, the development is not overbuilt or overused and is sensitive to the existing natural, historical, and cultural environments. Community Centers should develop at a scale appropriate to the surrounding environment and intended activity.

- Locate and design structures at a scale and function that enhances pedestrian activity.
- Create structures at a scale that promotes intimacy of activity, and ensure that building mass does not dominate the streetscape; buildings with substantial mass can be intimidating to the pedestrian.
- Create building facades that are architecturally interesting and in scale with the pedestrian.
- Ensure that infill projects are compatible with the scale and design of neighboring structures.
- Respect the scale and character of adjacent uses. Development should not overwhelm or detract from the character of an existing neighborhood or district. This is especially important in areas with significant historical resources.
- Set back upper levels of structures above the second floor to maintain pedestrian scale.



ACCESSORY STRUCTURES

Accessory structures such as mechanical equipment, storage areas, garbage bins, loading docks, parking structures, security fences, telecommunications equipment and similar uses are essential for the operation of community centers. Though their use is often taken for granted, poorly located or designed accessory structures can visually detract from what otherwise may be a quality development. It is essential for accessory uses to receive the same quality design and siting detail as primary structures. Utilize architectural and landscape treatments to minimize visual impact of accessory structures.

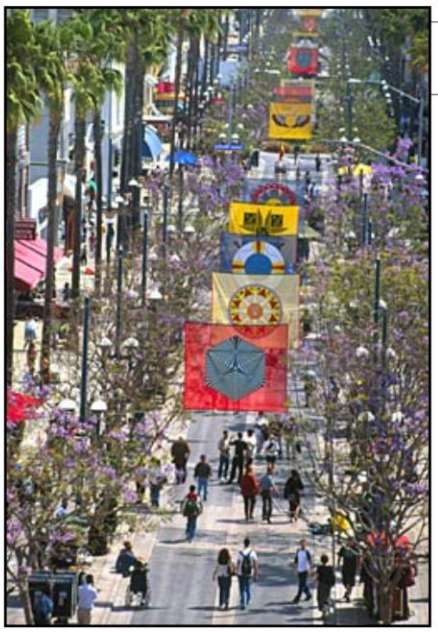


- Design accessory uses, to look as if they are a logical extension of existing structures. Integration of accessory uses into main structures preserves the consistency and integrity of architectural and streetscape design.
- Any screening constructed for accessory structures should be designed in a manner that maintains the functionality and accessibility of the equipment.
- Orient service and storage areas away from public views.
- Provide ornamental screening for utility boxes, trash bins and outdoor storage areas.
- Locate utility lines underground.

Unsightly trash receptacles or mechanical equipment should be screened from view utilizing landscaping or screen walls that compliment the main structure. The enclosures in this photo could be further enhanced by additional landscaping.

PUBLIC SPACES

Community Centers concentrate activities and mix uses to provide a more focused development pattern. Public spaces are used as the "common threads" that tie differing uses together by creating a central location for activity. The activity generated within public spaces plays a significant role in sustaining the vitality of the Community Center. It is in these public arenas that interaction with the community is encouraged and welcomed. Public spaces create "hubs" of activity within the Community Center, and the integration of open space areas into the heart of the Community Center provides a common ground for people to gather and interact outside of their home environment. The activity created by these features will generate onlookers. Interesting, activity-generating elements create memorable places that encourage the public (members of the community and visitors) to return to the space to relive a positive experience.



The colorful banners in this public space contribute to its liveliness and interest.

- Integrate public spaces throughout the Community Center.
- Orient development toward plazas, parks, village greens, outdoor eating areas, and other public gathering places.

- Locate public spaces adjacent to areas with high concentrations of activity.
- Provide convenient access between public spaces and core uses. By accommodating these spaces within the core, the public can be encouraged to linger while waiting to conduct personal business.
- Locate public spaces in visible, well-lit areas that provide a heightened sense of safety and security.

The water-features in this courtyard provide an element that can be enjoyed by uses on the ground floor and provide appealing views to the residential uses above.

- Create public spaces that can be used by all age levels.
- Provide amenities in public spaces that can be easily used by children, such as child-sized seating and tables.
- Ensure that areas that are heavily used by children are readily visible to their caretakers.
- Integrate trails, transit, sidewalks and other non-motorized transportation facilities within public spaces.
- Enhance accessibility to and from transit and non-motorized transportation facilities.

Active public space that provide areas for gathering, resting, and people-watching.

- Provide ample seating opportunities and ease of access to public spaces.
- Ensure that all public areas meet ADA access requirements and are also easily accessible by the elderly and small children.
- Design public spaces that contain unique features or elements that encourage activity.
- Incorporate design features that encourage interaction, such as fountains, outdoor seating areas, small amphitheaters or staging areas, and terraced walkways and patios.

This well-landscaped plaza provides sitting areas and shade trees that provide a respite from the sun. Mature trees also provide a sense of longevity and permanence reinforcing the importance of this space.

PUBLIC ART

The most successful public spaces are consistently used; the people who utilize them feel a sense of ownership in them or they connect to them in a special way from past experiences. Public art is instrumental in creating this connection between the public and a community; public art allows people to quickly identify which community they are experiencing. Public art makes a space interesting; landmark water features, sculptures, and murals are all forms of public art that can be used to tell a story or make a statement about a community's history or character. In addition, art in public places also helps to distinguish one community from another by creating landmarks that are easily recognizable and create a unique experience.

- Integrate civic art into public spaces.
- Utilize art to attract attention and stimulate interest in a particular location.
- Create art that is functional and interactive such as park bench sculptures or chess tables. Reflect the personality of the community in the art that is chosen.
- Use art to make a statement about where the community has been and what it envisions for its future.
- Create civic pride through the establishment of a prominent, visible art collection.

LANDSCAPING

Mature trees provide valuable shading that creates a comfortable pedestrian experience. Trees and landscaping can also soften harsh building lines that are created by more intense uses. Mature trees give the feeling of an established place and a feeling of longevity, and they narrow the perceived width of streets giving spaces identity, dignity, and character.

- Utilize creative parkway landscaping or sidewalk design, such as patterned or textured paving materials, ornamental lighting and street furniture, and natural vegetation. Attention to detail encourages continuity and vitality throughout the core area.

- Provide extensive natural landscaping such as street trees and shrubs along roadways. The use of vegetation serves to shape urban spaces, provide scale, frame the street scene, and provide shade for pedestrians, while enhancing the scenic qualities of the community core.

- Emphasize well-planned vegetative landscape elements that enhance interest, provide tranquility and shade, and accentuate aesthetic design.

- If available, incorporate specimen trees into the landscape of the Core.

The landscaping in this public space provides a focal point for the street and emphasizes the importance of this space.

- Provide landscaping and open space areas as a linkage between the core and adjacent neighborhoods or other potentially sensitive uses. Utilize landscaping to visually connect separate neighborhoods or districts at the street level.
- Use landscaping, screening, open space uses and architectural features to minimize impacts between uses.
- Soften blank walls with vertical plantings.
- Provide an abundance of landscaping and natural vegetation, including shade trees in public spaces. Trees and landscaping can soften harsh building lines that are created by more intense uses. Mature trees provide valuable shade and give the feeling of a well-established place.

AMENITIES

Streetscape amenities includes benches, kiosks, fountains, telephones, display areas, public art, outdoor eating spaces, clocks, trash receptacles, restrooms, bollards, tree and drainage gates, bike racks, and magazine/ newspaper racks. These amenities should be compatible in design to adjacent uses, establish community identity, enhance the pedestrian experience, and contribute to the liveliness of the community.

- Install streetscape amenities that are durable and easy to maintain.
- Liberally locate trash receptacles along heavily traveled pedestrian paths.
- Ensure that the distribution of amenities and uses along street scenes creates continuity and flow, and help lead pedestrians to the next venue.
- Provide bicycle racks, benches, and other amenities that encourage use of non-motorized transportation.

Benches and trash receptacles that are easily accessible from the sidewalk make the pedestrian experience more enjoyable.

SIDEWALKS AND PAVING

Textured sidewalks and streets provide direction to key destination points and highlight major intersections or entry points of the Community Center. Standard paving and sidewalks that are uniform in size and texture facilitate high-speed auto traffic and do not encourage pedestrian usage. Community Centers employ a number of paving treatments on both streets and sidewalks to slow traffic, increase pedestrian safety, and improve streetscape appearance.

- Utilize a variety of special paving treatments such as colored and/or stamped concrete, and stone or brick pavers, to identify and visually enhance sidewalks, intersections and pedestrian crossings.
- Explore creative alternatives to the standard sidewalk.
- Construct a sidewalk area wide enough to accommodate comfortable and leisurely pedestrian activity.
- Create sidewalk dining/drinking venues with proper security and access controls.

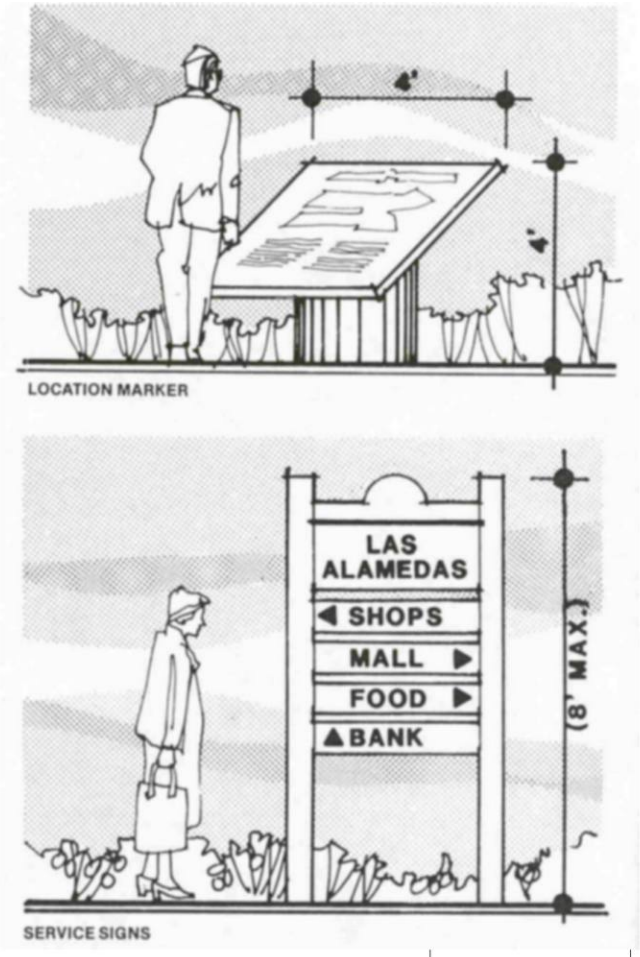
Mid-block pedestrian crossing with textured pavement, along with landscaped center median. Narrow street widths help to maintain traffic speeds through core area.

The paving treatment and decorative tree grates of this sidewalk are examples of the attention to detail that is typically found in Community Center streescapes.

SIGNS

Because of their high visibility, signs are prominent elements of the physical environment that can help people navigate through the Community Center. Interesting sign designs contribute to the unique identity of a community and also contribute to the creation of a sense of place.

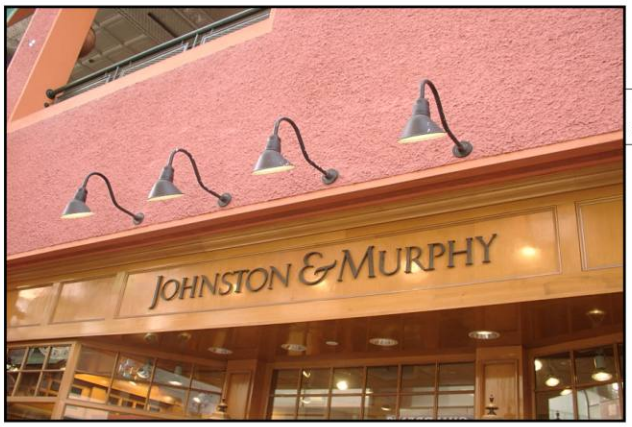
- Use signage that is visually compelling and informative, and that adds interest to the pedestrian experience.
- Create visually interesting, unique and original signage that identify areas and guide users from one venue or area to another.
- Place well-designed monument signs and landscaping at roadway entries into the core area.
- Require signs to be compatible with building and site design in terms of color, material and placement.
- Design noticeable signs utilizing materials and color palettes that are compatible with the architecture and designs of the surrounding environment.



Pedestrian-scale signs

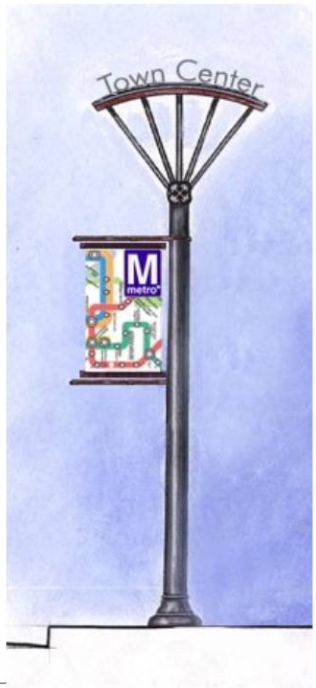
This sign is at an appropriate scale and compliments the building.

- Utilize materials that complement established architectural features and themes.
- Carefully design and place signs so as not to dominate and detract from the visual aesthetics of the core.



The lighting associated with this sign accentuates the text without over powering it

- Ensure that signs are properly maintained.
- Minimize the amount of text placed on commercial signs. Busy signs tend to make an area look cluttered or unorganized.
- Integrate lighting elements into sign designs. Conceal lighting mechanics so that they do not detract from sign aesthetics
- Discourage the use of flashing, moving or audible signs.
- Eliminate temporary signs posted in store windows, as they can detract from the visual quality of the a streetscape. Instead place emphasis on window displays and visibility of merchandise inside of stores.
- Create street signs that clearly identify street name and community. Street signage contributes to the identification of the core and the development of a sense of place.
- Utilize a neighborhood icon or graphic in street signage it immediately identifies the neighborhood in which the street is located.
- Use banners and flags to define districts and neighborhoods, enhance aesthetics, serve as visual markers, establish character, enhance civic pride, and provide information.
- Provide landscaped and decorative monument signing at key core gateway entries.
- Provide directional signs that are easy to read.



This sign has a dual purpose: it serves as a neighborhood identifier and transit stop sign. Combining signs minimizes the amount of sidewalk space used foru uses other than pedestrian traffic flow.

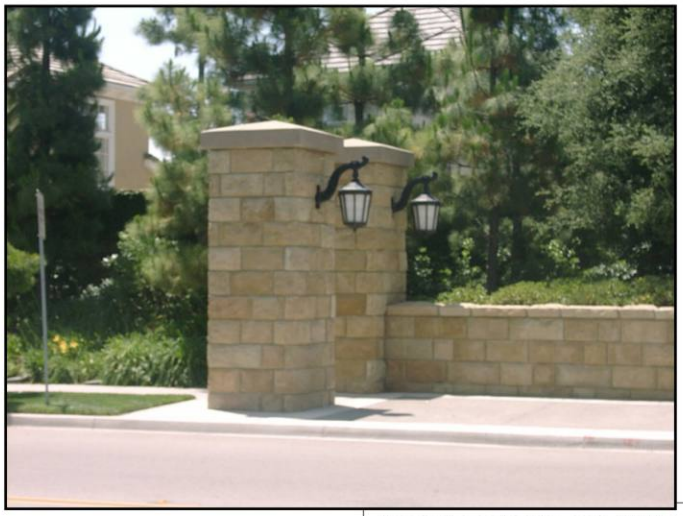
Commercial signs that blend well with the structure

LIGHTING

The liberal distribution of lighting throughout the Community Center contributes significantly to the design and function of streetscapes. It is essential for the safety and convenience of pedestrians and drivers. Lighting is also a critical element in creating nighttime vitality. Lighting opportunities can include street lighting, trail and pedestrian pathway/plaza lighting, sign and building illumination, light fixtures and accent lighting.

- Install lighting that provides a desirable level of security and illumination.
- Minimize the glare of lighting on adjacent uses.
- Provide ornamental lighting fixtures that are compatible in style with adjacent uses.
- Integrate lighting and fixtures with the design and layout of the urban environment.

A low decorative fence with accent lighting combine to create a barrier that is aesthetically appealing. This fence successfully separates spaces without creating a "walled off" appearance.

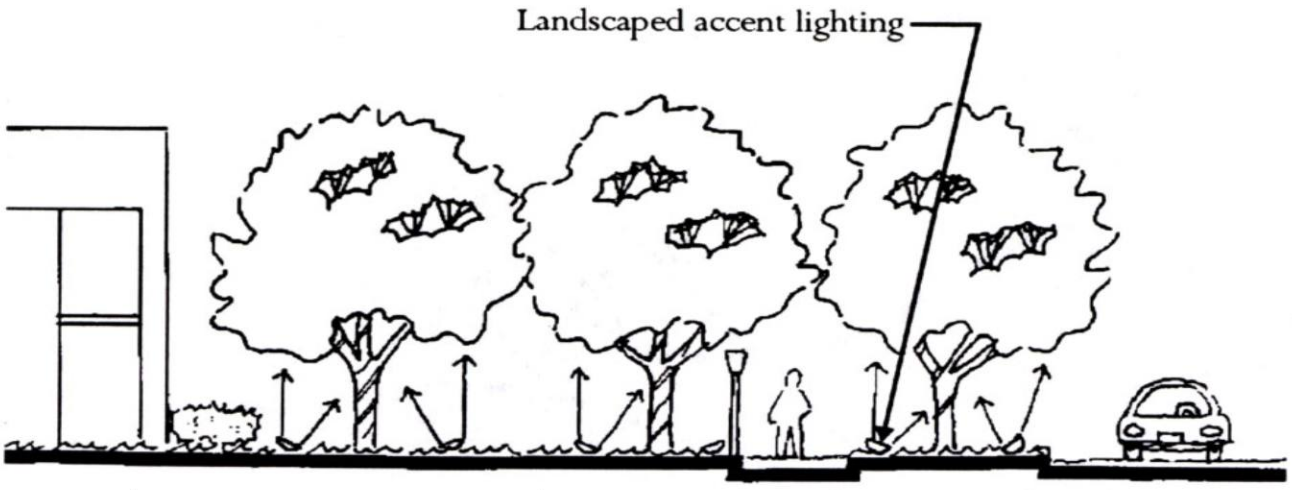


Decorative pedestrian-scale lighting attached to gateway entrance

Decorative lighting with banners

- Relate the scale of lighting to the human scale.
- Encourage the use of lighting as both a decorative and functional feature of the streetscape.

These bollards not only serve as a deterant for vehicular traffic; they also provide an opportunity to create attractive lighting elements.



Lighting can also be used to enhance mature landscaping or significant landmarks.

ADAPTATION OF HISTORICAL BUILDINGS

Historical or socially significant structures can play an important role in the development of a Community Center. Over time, communities develop around uses that are important to their residents, including churches, businesses, or civic buildings. The original uses of historic structures may no longer be desirable in the core of the Community Center, however, new uses can be integrated into the fabric of the Community Center by adapting the structures to accommodate new uses.

This prominent structure was once used as a church. Instead of eliminating the structure completely, it was converted into a mixed use project containing retail businesses and a community theatre.

- Whenever possible, historic structures located in the core of the community should be preserved and incorporated into new development.
- Utilize historic buildings to help define the town center. They can serve as locally recognizable landmarks within a community and represent the sustainability of the area.
- Enhance special attributes of existing streets using existing historic structures as focal points around which new projects will be constructed.

LANDMARKS

Landmarks serves a prominent visual marker of a town or community. Landmark structures are easy to recognize, and they define areas of importance or interest. Each Community Center should contain a landmark feature which can be natural like a stream or physical structure that reflects the character of the area and it's history.

- Utilize landmark structures such as towers, couplas or other prominemt architectural features to help identify the Community Center.
- Create axial view lines to selected landmarks and distinctive features.

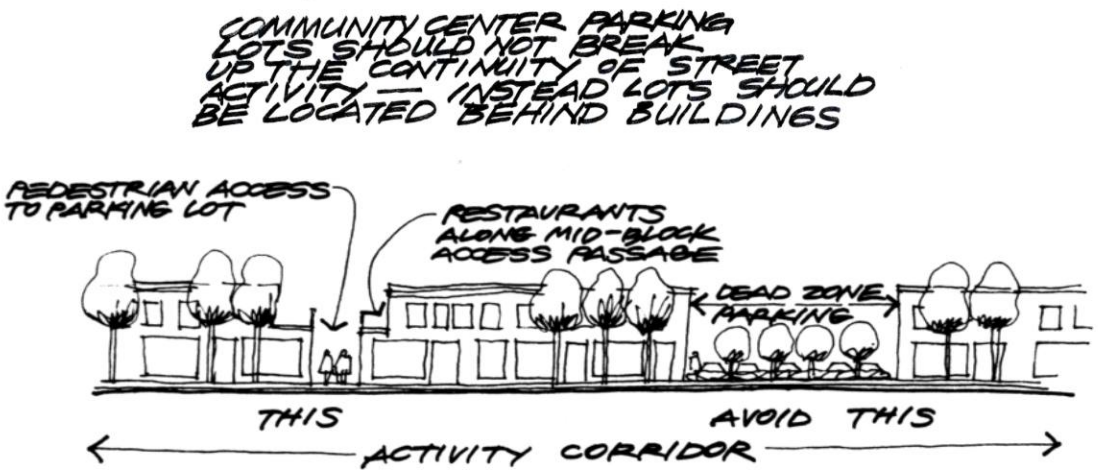
Prominent visual landmark.

This fountain is a landmark centrally located within this mixed use project.

PARKING

Parking areas are essential facilities for most types of uses. Simply put, automobiles need a place to stay while people conduct their business and run their lives. Unfortunately, the amount of land devoted to accommodating motor vehicles is generally so excessive that roadway and parking facilities inhibit pedestrian orientation and detract from the aesthetics of urban areas, particularly when plagued by poor design or location. In terms of parking as well as other auto facilities, the compact and pedestrian nature of community centers mandates that unique and innovative solutions be applied to sufficiently accommodate vehicular traffic, while concurrently utilizing land more efficiently, maintaining the pedestrian feel of the area, and creating aesthetically pleasing yet less intrusive parking areas.

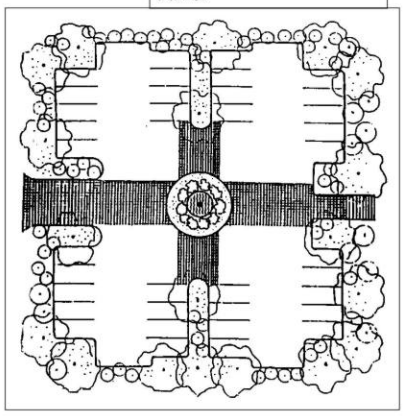
Well landscaped surface parking lot.



OFF-STREET PARKING

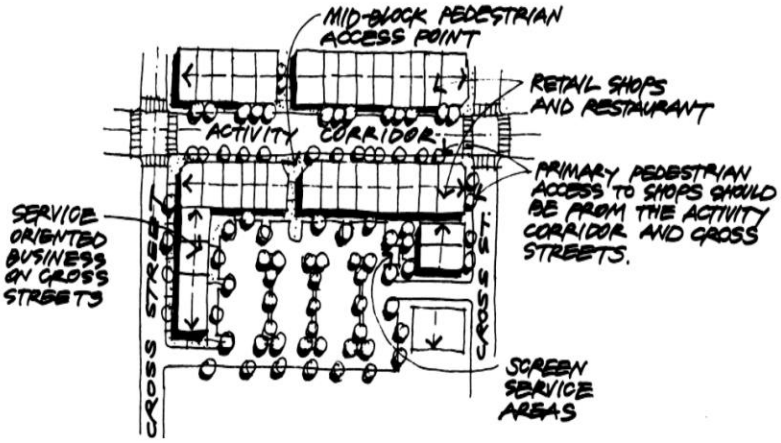
- Ensure ease of accessibility by providing plentiful, free parking.
- Size parking to meet a reasonable demand.
- Create parking districts to plan and manage for greater efficiency.
- Provide several pedestrian walkways connecting lots with adjacent uses.

Plan view of a lot. Note the pedestrian pathways that minimize conflicts between pedestrians and vehicular traffic.

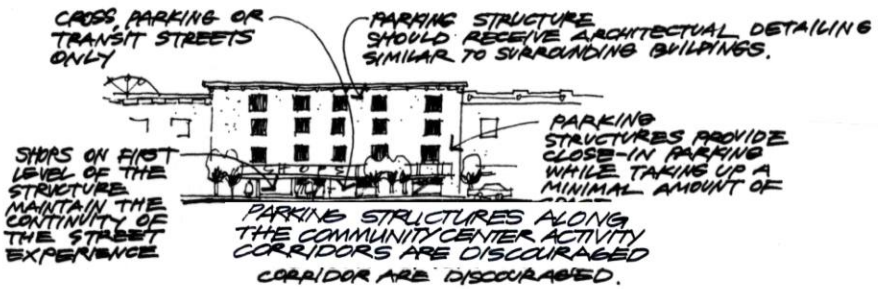


Surface parking lots should be screened with landscapeing and should not break up the continuity of the streetscape. Surface parking lots should serve multiple uses and should be used as a temporary solution untill more dense, structured parking can be constructed.

- Create surface lots with length of stay in mind. Parking lots should be convenient, short walks to activity centers and adjacent uses. No space should be greater than 300 feet from any activity access point.
- Do not allow off-street parking lots to dominate the street scene or urban fabric of the community.
- Locate surface parking lots to the rear of businesses fronting main streets. Surface parking lots directly fronting onto main streets interrupt the continuity of building structures and pedestrian walking experience and should be discouraged within the core.
- Treat surface parking lots as detailed landscape elements.
- Utilize landscaping treatments to minimize the visual obtrusiveness of surface parking lots. Techniques such as the use of landscaped berms, vegetation, and decorative fencing can alleviate potential visual dominance of surface lots.
- Plan for shared parking among adjacent uses to minimize the amount of underutilized parking area.
- Cluster parking areas rather than create large expansive parking lots. Larger lots, particularly in commercial areas, tend to have several "dead" areas where parking is seldom utilized.
- Provide extensive vegetated landscaping between sections and rows of stalls, along the perimeter of lots, and at lot entryways. Landscape surface lots so that their visual appearance is one of "cars are in a park" rather than trees in a parking lot.

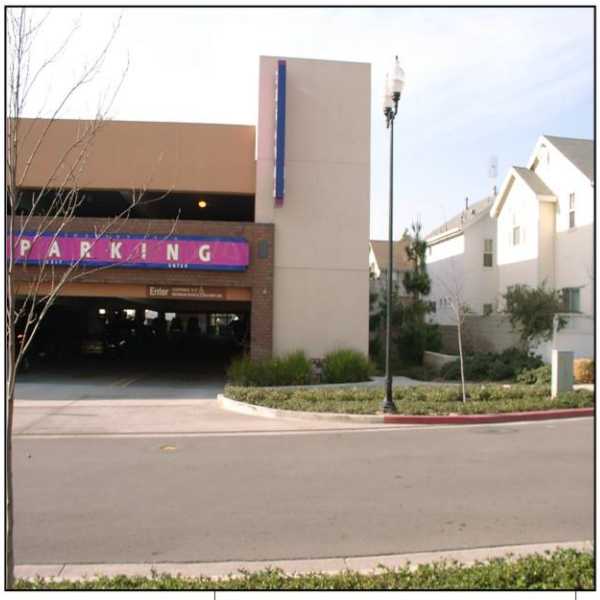


- Provide ample shade through the generous distribution of large-canopied trees.
- Use decorative paving materials to define walkways and parking bays.
- Provide carports for long-term parking especially in desert zones. Encourage design treatments on end walls and roofs that are compatible with the architecture of the uses that the carports serve.



STRUCTURED PARKING

- Provide structured multi-level parking to provide ample parking adjacent to activity centers while minimizing land consumption for parking.
- Ensure that multi-level parking structures and subterranean parking facilities are safe, convenient, and well integrated with surrounding uses.



This parking structure is located adjacent to residential properties. Note the minimal height of the parking structure and landscaped transition area between the uses

- Create aesthetically appealing parking garages, with variations in facade treatment and extensive landscaping to soften their appearance. Architectural style of structures should be compatible with adjacent uses.
- Place retail or office uses along the bottom floor frontage of parking structures to promote a more lively and interactive street scene.

This parking structure was designed to compliment surrounding architecture and as a result, it's visual prominence is minimized.

- Design parking structures with safety and convenience in mind. They should be well-lit, provide several linkages to adjacent uses, and be located next to high-use areas.
- Provide wide, prominently displayed garage entryways to eliminate confusion and reduce traffic congestion on main streets.
- Provide segregated residential-only parking within structures that service a mix of uses such as residential and commercial.

ON-STREET PARKING

The paved roadways, sidewalks and crosswalks contribute to the character and identity of this area.

- Provide areas for diagonal or parallel parking, particularly near high-activity uses. On-street parking provides a protective barrier between auto traffic and pedestrians, and serves as a traffic-calming technique, as drivers must consider this element when negotiating the roadway.
- Provide limited on-street parking as part of the core streetscape.
- Utilize parkway landscaping to minimize the visual impacts of on-street parking on the pedestrian experience.
- Allow ample ingress/egress bays for transit vehicles.

On street diagonal parking with adjacent parkway landscaping and center median.

WALLS AND FENCES

Walls and fences are important structural and design elements within community centers that serve several functions. They provide security and privacy, shape open spaces and the flow of activity, enhance visual aesthetics, retain sloping terrain, and in some instances provide areas for people to sit and engage in leisure activities.

The whimsical design of this fence clearly delineates boundaries, but does not eliminate visibility to the activity on the other side.

- Strategically locate fences and walls. Excessive distribution of walls can inhibit the flow between uses.
- Design walls and fences that are well integrated in style with adjacent structures and terrain.
- Provide variations in color, texture, materials, articulation, and architectural treatments. Avoid long expanses of blank, monotonous walls or fences.
- Utilize landscaping and vegetation materials to soften the appearance of walls and fences and enhance their integration with adjacent uses.

This ornamental stone retaining wall helps shape the walkway and provides a pleasant visual aesthetic.

CIRCULATION

Though one of the major purposes of community centers is to establish a pedestrian friendly environment, accommodation of vehicular traffic remains an essential component. This is particularly important for those community centers that serve as regional destinations, such as Town, Job and Entertainment Centers. Despite the necessity of this component, it remains vital that the design and character of community centers be distinctly pedestrian in orientation. In fact, there are several useful design techniques that can be applied to roadway design and function to minimize conflicts between pedestrians and automobiles, ensure efficient movement of vehicles throughout the community center, and enhance pedestrian scale and comfort.

- Design roadways to minimize street widths, travel lanes and travel speeds to encourage a more pedestrian friendly and walkable area, while efficiently accommodating automobile traffic.
- Do not allow accommodation of the automobile to dominate the community fabric.
- Evenly distribute traffic loads throughout the core area.
- Require wide sidewalks along all core roadways to facilitate pedestrian movement and core vitality.

Creative fountain median

TRAFFIC CALMING

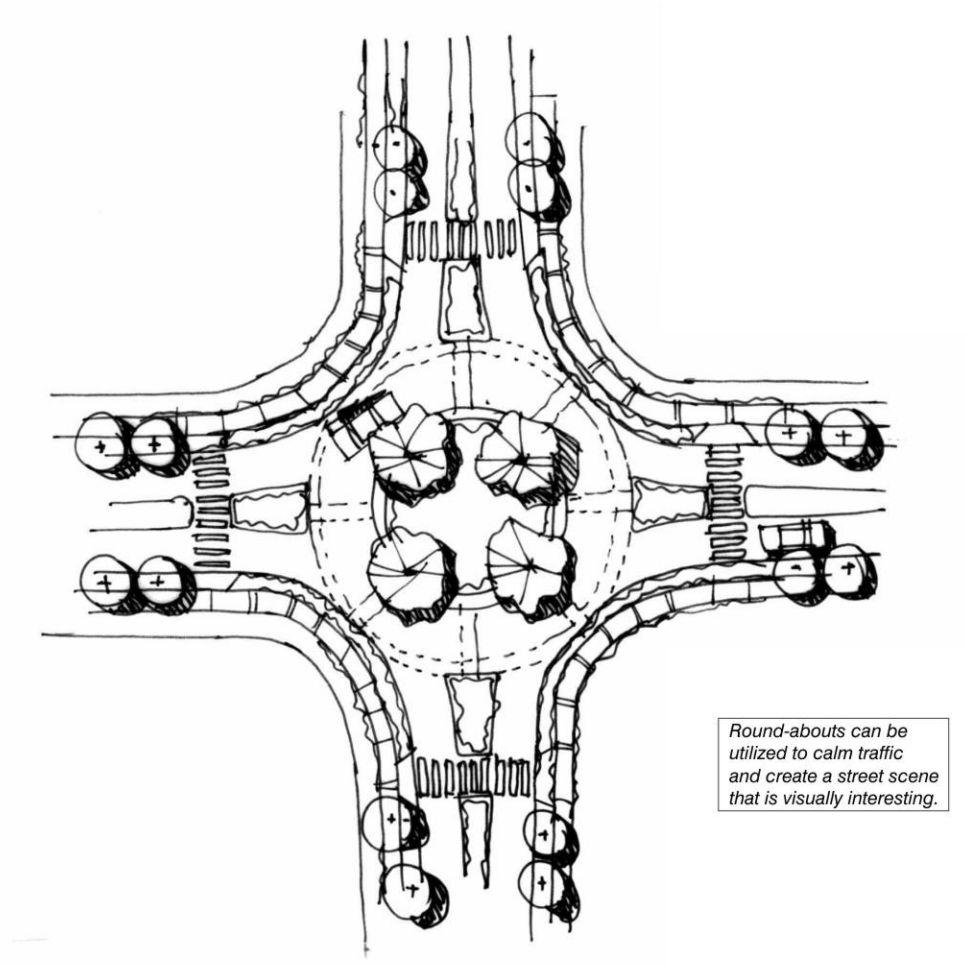
Traffic calming uses a number of techniques to reduce traffic speeds, volume, and noise. Traffic calming also improves the aesthetics of the street, and increases safety for pedestrians, bicyclists, and vehicles. Three techniques are illustrated below, all of which provide visual and textural cues for vehicles to slow down and be aware of pedestrian or bicycle traffic.

raised crosswalk

speed bump

raised intersection

- Allow on-street parking to buffer pedestrians from roadway traffic.
- Create safe, interesting roadway intersections.
- Minimize the radius of corners where pedestrian walkways cross at intersections.
- Provide handicap accessible ramps at all corners.
- Apply special paving at major intersections and crosswalks it creates a visual cue to slow traffic speeds.
- Consider alternative intersection controls such as traffic circles to maintain traffic flow without stop signs or lights.
- Maintain clear sight lines at intersections.
- Prominently display intersections with off-road trails by incorporating signs, striping or special paving, and signalized lights.
- Keep truck traffic in its place and do not allow through truck traffic within the core area or in residential neighborhoods.



Round-abouts can be utilized to calm traffic and create a street scene that is visually interesting.

- Orient development around a single main street that serves as the primary roadway into the Community Center core. A Main Street serves as thread that brings a mix of differing uses and public spaces together, and provides a focal area within the core. Community Center activities not limited only to the main street; often activity areas flow over onto secondary streets or roadways.

Roundabouts, medians and neck downs

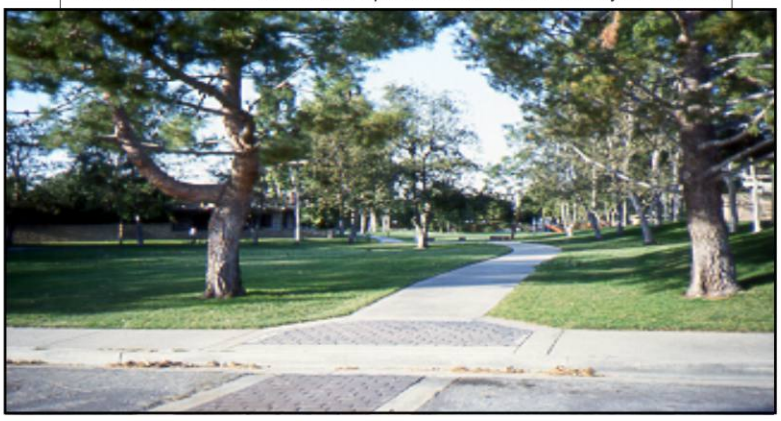
- Locate loading and bays to the rear of development, away from primary vehicular routes so that they do not open directly onto the street.
- Minimize the number of curb cuts within a particular block of development. This will reduce the areas where pedestrians and automobiles cross paths.
- Utilize landscaping to buffer pedestrians from vehicular street traffic.
- Do not allow large-capacity arterial highways that carry regional through-traffic to bisect community centers. These types of auto facilities destroy the intimate fabric and pedestrian feel of Community Centers. Use traffic calming techniques such as bulbouts, mid-block intersections, roundabouts, landscaped medians and street trees to reduce traffic speeds and ensure compatibility with pedestrian circulation.
- Ensure sufficient roadway width to accommodate bicycle lanes.

The median island and narrow street widths.

MULTI-USE TRAILS

Off-road trails that accommodate a variety of pedestrian, leisure and recreational activities greatly add to the livability and function of community centers. When networked together, they serve to link activity centers, residential neighborhoods, open space areas, and transit facilities, serving as a crucial feature that greatly enhances pedestrian accessibility within community centers. Attention to detail is important here to ensure safety among multiple types of users and to minimize conflicts with vehicular roadway intersections.

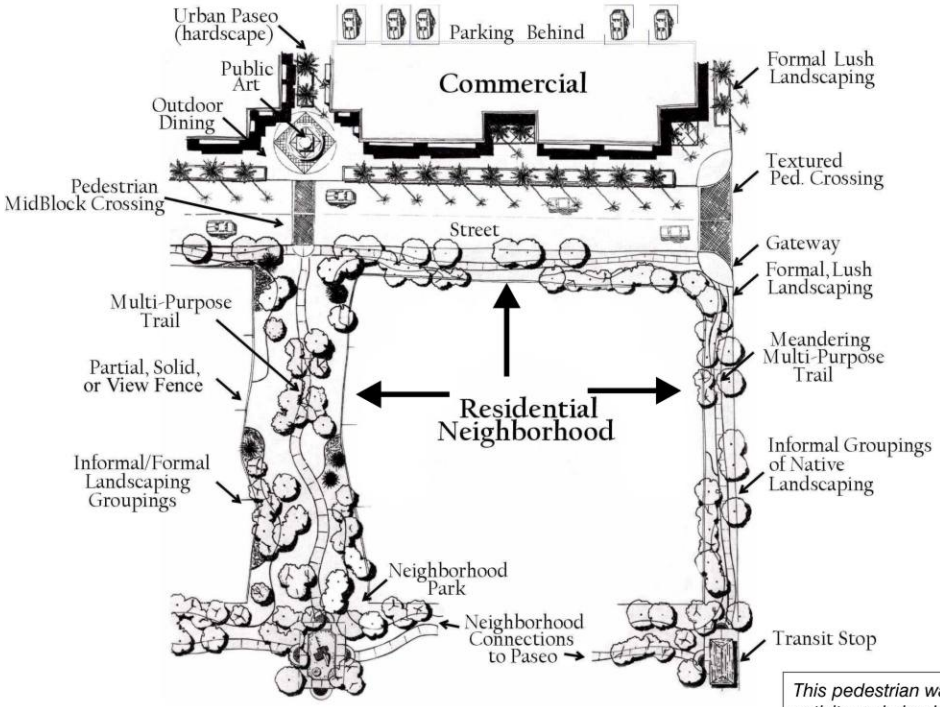
Open space pedestrian linkage at transition between core support area and uses in the core. Note textured pavement at this trail/roadway intersection.



- Provide a network of sidewalks, paseos, and off-road trails throughout the core, linking activity centers, commercial uses, recreation and open space areas, and residential uses. This network of trail facilities promotes pedestrian activity within community centers and encourages people to get out of their cars.

- Allow a variety of non-motorized travel modes, including bicycling, walking, jogging, and roller-skating.
- Vary the "pace" of off-road trail configurations to allow users places to enjoy views, rest, etc.
- Create berms within trail corridors to afford vistas, panoramas, and interesting vertical movement to trails. Create interesting trail experiences by changing planes, altering landscapes, etc.
- Design trails to minimize conflicts between pedestrians and bicyclists.
- Provide signage and other directional markers to facilitate orientation.

This trail is clearly identified and can serve as a vital link between the Community Center core and adjacent uses.



- Provide amenities such as benches and lighting to enhance safety and ensure a pleasant experience for users.
- Provide extensive landscaping such as plant materials and fencing to shape trail spaces, influence climates, and buffer adjacent uses.
- Ensure a minimum clearance of vegetation to maintain pedestrian flow.

This pedestrian walkway facilitates pedestrian activity and circulation within the Community Center

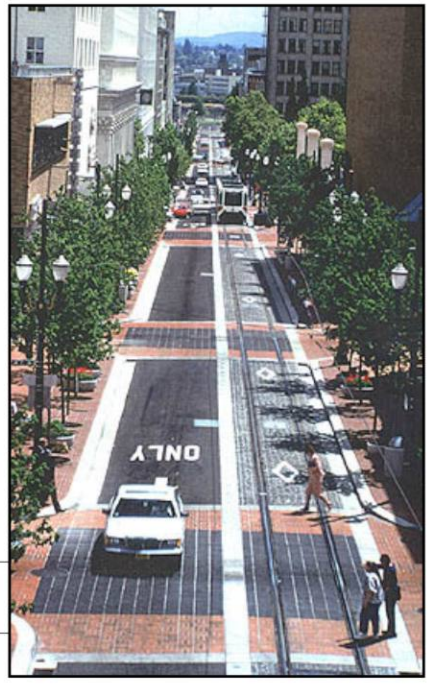
Meandering trails through neighborhood park

- Design trails to prevent ponding and silt accumulation from rain storms.
- Provide special paving and signage at intersections with roadways and other trails.
- Provide secure bicycle storage facilities and lockers near transit stations and other high-use areas.

TRANSIT FACILITIES

The provision of transit facilities within community centers affords residents and visitors with another option of moving within and outside of the core without the use of an automobile. Transit facilities should be attractively designed, easily accessible, safe, clean and convenient to use. When designed with these ideas in mind, transit facilities provide another element in the vitality and function of community center core areas.

- Locate transit facilities such as transit stations and bus stops within activity centers and highly desired destination points. This close proximity between uses enhances the viability and convenience of transit.
- Orient high-use developments around transit facilities to enhance transit ridership.



This roadway contains vehicular and transit lanes and has been designed at a scale that is friendly to pedestrians

- Create transit stations that are visually appealing and fit in well with the design of adjacent uses.
- Provide extensive landscaping treatments of transit stops and their linkages to enhance visual compatibility.
- Within Town Centers and Job Centers, designate sufficient right-of-way to accommodate future light rail facilities.
- Ensure that transit facilities are linked with the greater County transit network.

Transit lines adjacent to commercial center

Transit typical of those that can be found in Community Centers.

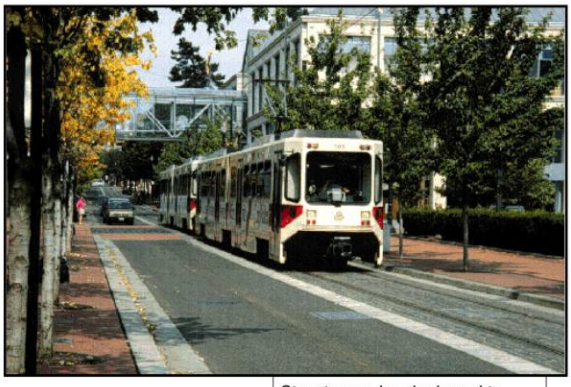
A Word on Transit

A common element found within each Community Center type is the accommodation of some mode of transit to supplement use of the automobile. Community Centers are designed at a scale and compactness that would reinforce and benefit from transit service. Depending upon the size and intensity of uses of each Community Center, transit stations and/or bus stops are well-integrated into the core and adjacent areas. Within some of the larger Town Center and Employment Center designated areas of the County, a transit concept known as the Oasis Transit System has been developed to fit some of the more unique transportation needs associated with these uses. This system entails a localized transit loop centered within the core of the Community Center, which in turn is connected to the regional transportation system, including Metrolink. For the foreseeable future, the system would consist of rubber-tired vehicles resembling small rail cars, and would connect to adjacent residential neighborhoods and high-use activity centers through transit stations integrated into the surrounding development.

This transit station serves as a an architectural gateway as well as transportation hub for this area of concentrated uses and activity.

- Include amenities such as benches, directional maps, information kiosks, bicycle racks, lockers, and pay phones within transit centers. A variety of amenities enhance the convenience of transit facilities.
- When transit routes are routed through a public plaza or park, utilize paving materials that distinguish the route from surrounding surfaces, especially if the route is constructed at level with existing surfaces.
- Provide bicycle facilities, passenger drop-off areas and structured park-and-ride lots adjacent to transit centers.
- Link multi-purpose/bicycle/pedestrian trails with transit facilities to enhance pedestrian access.

Bicycle storage area next to transit stop.



Streets can be designed to accommodate both automobile and transit uses.

CREATING COMMUNITY CENTERS

OVERVIEW

Dynamic, sustainable Community Centers don't "just happen" as the result of designating them on a land use map; they require proactive efforts from the government, private investors, and the public to create a framework that promotes creative planning and the production of unique communities. The successful implementation of a Community Center project is largely due to the political will of a community to create this type of a development as well as the success of the public/private partnerships that are formed as the project evolves.

Implementation strategies are a critical component of the success of a Community Center; they enable communities to establish new policies as well as make modifications to existing policies that may be preventing the establishment of quality, sustainable developments. It is particularly important to generate implementation strategies that can weather scrutiny from a variety of sources, since the Community Center concept will introduce a type of development that has not been attempted in many communities.

Decision-makers are much more likely to support a Community Center project if they are aware that key players of the community have been involved in the process from the very beginning and have had the opportunity to contribute to the shaping of the final product. Establishing an open dialogue with the public and key players will provide the opportunity for jurisdictions to work out any prevailing issues before the project is reviewed by any decision making body. These positive relationships embody a true collaboration between the public and the private; this partnership will give the Community Center concept the momentum it needs to be accepted politically.

Previous chapters discuss the specific characteristics that comprise viable Community Centers. This section focuses on implementation strategies and working relationships that are necessary for the development and long-term viability of a Community Center.

DO YOUR HOMEWORK

Preliminary research must be completed that analyzes the feasibility of a Community Center development within a particular location. It is important to "do your homework" to understand the specific market forces at work in the location of the community center, and to tailor the Community Center program according to the unique circumstances that pertain to the area. Each jurisdiction should understand the relationship between land values, densities, market demographics, and access capabilities as these factors will determine the most appropriate land use ratios for the Community Center core and outer ring. Jurisdictions need to know what uses their community would benefit from most and which uses that the public is going elsewhere to find. With this information, a strategy can be created that attracts appropriate uses to the Community Center core that will best fit the community's needs and help to retain sales tax dollars. Uses must not conflict with the circulation and design components that the Community Center has outlined.

Zoning analyses of existing and proposed land use designations should include properties located outside of the Community Center boundaries. It is important to understand the types of existing uses that are located in close proximity to the Community Center and what potential impacts they will have on the uses that could locate within the Community Center core and outer ring. A synergistic relationship exists between the uses within the Community Center boundaries and those outside of it, and jurisdictions should take special caution to carefully select uses that will compliment one another. For example, commercial development in proximity to (in same market area as) the proposed Community Center, particularly strip commercial development along arterial highways and big boxes, should be controlled and regulated. Strip center commercial developments draw commercial customers away from the commercial uses that are located within the Community Center core, and therefore should be regulated to ensure that their placement does not detract from the vitality of the Community Center. In addition, jurisdictions need to be careful that they do not over-concentrate commercial uses in the Community Center core because the remaining uses may not be able to support them.

GENERATE PUBLIC SUPPORT

Form a partnership with business and property owners when developing the Community Center concept. Involving special interest groups in the process can help jurisdictions gain valuable insight from the community while simultaneously building valuable working relationships. Additionally, jurisdictions should generate support and acceptance of the Community Center concept by the public. Hold public workshops, take the time to listen to community concerns, and find ways to educate those involved about the true impacts and features of a Community Center development.

CHANGE ATTITUDES ABOUT HIGH DENSITY DEVELOPMENT

Jurisdictions are frequently confronted with changing negative attitudes from the public related to dense development. High density residential units are perceived to be the cause of many undesired elements found in communities. Community Centers must overcome negative image that has been associated with mixed-use developments in the past in order to gain public support. It is critical to promote the advantages of the development of a Community Center to the public. If feasible, jurisdictions should consider providing guided tours of local examples of Community Center projects that have successfully integrated a compact and intense mix of uses.

CREATE A VISION

A Community Center Vision should be created by local citizens, stakeholders, civic leaders and government agencies to memorialize a positive description of the characteristics that comprise a successful, sustainable Community Center. Visioning can involve special interest groups such as business associations as well as members of the general public. Participation from a variety of sources allows the public to take an active role in shaping the future of their community. A Community Center vision statement molded by the key players of a community serves as a foundation for the Community Center concept and also ensures that all parties are working to achieve the same end.

GENERATE INTERGOVERNMENTAL SUPPORT

Once a solid understanding of the issues surrounding the development of a Community Center is obtained, the next logical step is to generate intergovernmental support for the Community Center concept. Get all agencies and departments together on the same page. Communal support from public safety, public works, water districts, economic development, housing, school districts, local and regional agencies, or state and federal agencies can make a powerful statement when it comes time to promote the Community Center concept.

CREATE EFFECTIVE REGULATORY TOOLS

Most jurisdictions have builders, not community developers; this makes it more difficult to obtain support of the Community Center concept by the public and decision-makers. Community Centers require much more planning and preparation than the standard subdivision; the mix of uses and the policies required to create the Community Center area need to be carefully balanced so that they are complimentary of one another.

Inflexible zoning and general plan regulations governing land use have often resulted in the design and layout of similar-looking residential subdivisions, business parks and strip commercial developments that have made many communities virtually indistinguishable from one another. Local jurisdictions have at their disposal several tools to govern and plan the distribution and development of land uses within their boundaries. Among them, the use of general plans, specific plans, zoning and subdivision ordinances are the most commonly used regulatory tools. In fact, most jurisdictions mandate that all development comply with the rules and policies contained within their respective plans and ordinances. Far too often, public agencies create regulatory documents that are so strict that they do not grant flexibility to the developer. Governmental agencies can facilitate the implementation of Community Centers by creating specialized regulations that provide detailed, clear direction to government agencies, developers and the public. Community Center policies or guidelines should be written to motivate potential developers to create inventive solutions to the standard development product.

MIXED USE ZONING REGULATIONS

One regulatory option is the development of mixed-use zoning regulations. Standard zoning development codes generally do not have the flexibility to accommodate a mix of uses on the same property. Amendments to zoning ordinances to allow for a horizontal and vertical mix of uses are necessary to implement a Community Center. The application of mixed use zoning encourages the development of a community where businesses can benefit from the residential uses located in the same proximity and vice versa. Community Centers strive to be walkable environments, the application of mixed-use zoning supports that principle.

IMPACT-BASED REGULATIONS

An alternative approach to development standards can include a shift from use-based regulation of development to design-based or impact based regulations that are much more flexible. Incompatibilities that occur between neighboring properties are often a function of the design of the project verses a difference in land uses. These regulations are more accommodating to mixed-uses as long as a logical transition is made between projects or properties. Flexibility in regulations can also motivate a project proponent to create more interesting architectural designs or projecting features.

OFFER FINANCIAL AND REGULATORY INCENTIVES TO DEVELOPERS AND BUILDERS

The traditional approach to development and the urbanization process does not lend itself to the development of community centers in some jurisdictions. Community Centers are community-building ventures first and foremost, but they also must be an investment opportunity for developers. Jurisdictions should expand the use of implementation tools such as transfer of development rights (TDRs), business improvement districts (BIDs), eminent domain, tax abatement policies, density/intensity incentives, vertical zoning and accelerated approval processes.

Many areas that can be designated as Community Centers are comprised of small parcels that are owned by different property owners. Local jurisdictions should provide regulatory options and incentives that encourage land assembly for areas with multiple property owners. The consolidation of fragmented parcels is critical to the implementation of the Community Center concept. Without large consolidated parcels, development can be piecemeal and unorganized, detracting from the guiding principle of a Community Center that identifies a centralized, intensified core.

Many jurisdictions approve the use of these tools; however, many times they are not fully utilized due to lack of political will to implement, lack of knowledge by potential developers of the available streamlined processes, or lack of support by staff to undertake a process that is different from "the norm." It will be critical to ensure that once these tools are in place, that they will be utilized by the jurisdictions and understood by the decision making bodies that will ultimately be responsible for reviewing and approving the projects.

Formal planning and management entities that are subordinate to, but separate from, responsible government agencies are an integral part of implementation strategies. Development Corporations or business improvement districts or a combination of the two should:

- Participate in the development of the vision of what the Community Center should be at its maximum potential;
- acquire, assemble, and parcelize land to encourage new forms of Community Center development;
- coordinate and participate in real estate development and infrastructure financing;
- collect and disseminate market, economic, social, demographic and traffic data and information to perspective investors, developers, retailers, consumers and public agencies; and
- handle marketing and promotion of the Community Center project.

STRONG LEADERSHIP IS CRITICAL

Development of creative guidelines and policies requires decision-makers to think "outside of the box" and to take action supporting new approaches to community building. Decision-makers can be leery of taking risks especially if it is not politically prudent to do so. Visionary leadership is required from elected officials and staff so the integrity of the Community Center vision is not compromised. Key officials need to commit to the Community Center concept so that the ultimate development will not be compromised by the personal agendas of a select number of influential parties or property owners. Jurisdictions must take ownership of the Community Center vision and put measures in place so the true intent of the vision will be carried out long after the original authors are no longer involved in the process.

MARKETING AND PROMOTION

It is not enough to merely attract users to Community Centers in the preliminary development stages. Existing businesses as well as future business candidates for the Community Center need to be courted and informed of the benefits of locating within a Community Center project. Emphasis needs to be placed on the Community Center as hub of activity that is pedestrian friendly and will be conducive to a steady stream of business traffic. Programs established through agencies such as Economic Development Departments or Chambers of Commerce can introduce potential candidates to the benefits of the Community Center from a business owner's perspective. Market the Community Center well so that public will take pride in their community and also take responsibility for implementing the Community Center. Continual promotion of activities occurring within the Community Center core keeps the concept in motion.

Appendix K-1:
Implementation Program

Appendix K: Implementation Program

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Appendix K-*1*: Implementation Program

Introduction

The Riverside County General Plan is the product of a unique planning process known as the Riverside County Integrated Project (RCIP). The RCIP involves three major planning components; a major overhaul of the County General Plan, a major transportation corridor analysis (CETAP), and the multiple species habitat conservation plan (MSHCP) for Western Riverside County. These components of the project intersect in numerous land use/transportation/open space combinations.

The General Plan contains the mandated array of elements specified in the California Government Code, as well as an optional Air Quality Element. Each of these elements provides overall direction to a series of more detailed area plans covering portions of the County in which some level of development is anticipated in the next 20 years.

Because of the scale and complexity of the living environments that make up unincorporated Riverside County, it is essential to have a clear sense of priorities in deciding what steps to take in carrying out this newly established policy direction. A basic consideration is the limited existing and future institutional and financial resources that can reasonably be devoted to General Plan implementation. Focus will be required to get the most of whatever resources are available.

The primary mechanism for allocating resources to implementation activities is the annual budget process. Thus, it is essential to translate initiatives identified in this program into funded budget actions as soon as practicable.

This appendix is divided into several sections that further delineate the commitment to General Plan implementation. A Purpose section outlines what the Implementation Program seeks to accomplish. A further section describes in summary fashion how the Implementation Program is related to the Riverside County Vision. Key implementation issues are described as a means of understanding the challenges this program faces. The final section defines the program scope.

Three points are important to understand regarding the scope. The first is that there is not necessarily a one-to-one relationship between actions and policies. Many General Plan policies do not require special initiatives in this Program; they are implemented through existing processes, such as development project review procedures. Conversely, some actions implement more than one policy; sometimes an entire cluster of policies related to a particular subject area. Finally, some actions are not the result of policy; they relate instead to administrative procedures and requirements of the General Plan, primarily from Chapter ~~10~~*11*, Administration *Element*.

A second point is that the five-year action plan that is mandated as part of the Housing Element appears in this appendix and in the Housing Element as well. Because of the unique nature of the Housing Element, the format of this material differs from the rest of the Implementation Program. An expanded description of the Initial Implementation Program is also provided, along with a matrix summarizing a number of candidate implementation initiatives organized by General Plan Element.

PURPOSE

The main purposes for this Implementation Program include:

- Sustain the momentum achieved by the RCIP;
- Support the Riverside County Vision;
- Focus resources where they can most advance the General Plan;
- Rapidly satisfy legal requirements as specified in the Government Code;
- Provide robust support for private sector and public sector commitments to the Plan;
- Provide leverage for other dependent actions; and
- Respond to the most critical issues in as timely a manner as possible.

These purposes are served largely through two types of implementation initiatives. The first is the processing of development projects and public facility projects. Most, but not all, of the General Plan policies are carried out through the project review process.

The second type of initiative is a dedicated action that must be designed and taken. It may involve creating a new ordinance, making an organizational change, obtaining new funding, updating current processing procedures or technical standards, or seeking desired legislative changes. These and other initiatives are simply aimed at strengthening the County's capabilities to implement the General Plan.

ACHIEVING THE VISION

The General Plan is based on a comprehensive Vision statement (See Chapter 2, A Vision for Riverside County). The Implementation Program is especially critical to certain aspects of the Vision, as it reflects certain values expressed in the Vision, and through its commitment to selected Vision concepts. Some examples are noted below.

Values

The Implementation Program focuses especially on the following values:

- Communication and information that enables the public to understand how the General Plan affects its interests;
- Quality management that enables the County to achieve quality results from implementing the General Plan;
- Sustaining desirable qualities in the living environment over time;
- Cost containment to achieve the General Plan at minimum cost; and
- Intergovernmental coordination to facilitate collaboration with other governmental entities where that offers mutual benefits.

Vision Concepts

The Implementation Program reflects a commitment to making several critical concepts real:

- Creation of flexible tools that offer the ability to respond to a variety of physical conditions and circumstances;
- Availability of public facilities and services when they are needed;
- Integration of open space into the fabric of community development as well as in larger concentrations and corridors;
- Building distinctive communities with their own identities and characteristics in response to local conditions;
- Applying quality development standards that ensure continued value of private and public improvements;
- Integrating land uses and circulation systems so that multiple modes of transportation are available wherever possible; and
- Establishing partnerships with other public, quasi-public and private interests where joint action is more effective than independent action.

IMPLEMENTATION ISSUES

Institutional Resources

The County must make sufficient resources available to accomplish the Implementation Program. Riverside County is a vast and complex environment that is expected to undergo substantial growth pressures for the foreseeable future. Because County funds will also continue to be limited, the pressures on County departments–particularly the Transportation and Land Management Agency–will likewise continue. Organizational efficiencies, clear procedures and improved technical tools will be necessary if the potential of the General Plan is to be achieved.

Priorities

The Administration Activities/Programs section of the Implementation Program is the first priority for the County act upon. The Initial Implementation Program–actions that should be initiated immediately upon adoption of the Plan–is heavily oriented toward creating the institutional capabilities needed by the County. A particular focus is on expanding the County's capability to administer provisions of the Plan through the project review process.

Continuity

Elected officials, staff members, legislation, and conditions all change over time. Yet, it is important to provide continuity in administering the provisions of the Implementation Program. The commitment to implementing the action items within this document can be sustained over time through new procedures, tools and training efforts so that an "institutional memory" is created that will transcend these changes. This will require long-term commitment on the part of the County and its agencies to fully implement the General Plan.

Cooperation/Collaboration

Many aspects of the Plan, especially regarding transportation and open space/conservation actions, require multi-jurisdictional collaboration. The negotiation of land use projects within city spheres of influence is a form of collaboration that would contribute to optimum development patterns. The intent is to expand the County's commitment to resolving growth and development through collaboration.

Clarity

One of the major characteristics of the General Plan is its focus on clear land use direction. Numerous policies influence the results of that direction. The County needs to establish clear and unambiguous documentation of how actions, ordinances and procedures are to be applied and interpreted. This will entail a highly organized land use administration system.

PROGRAM SCOPE

The overall program consists of Action Items that will lead to a series of annual revisions that evolve over time. Numerous candidate actions are identified for later consideration. This consists mainly of organization and tool-building initiatives. An Administration Activities/Programs section consists of *12* ~~13~~ activities that incorporate the General Plan into County Government operations and decision making. These include technical and procedural activities related to the General Plan Elements. The remainder of the Action Items have been placed in the Element Activities/Program section because, while all of them are important, they have to be accomplished over time because there aren't enough resources to accomplish all of them at once.

The Initial Implementation Program will get underway as part of the budgeting cycle at the time of General Plan adoption, with updates to occur in each annual cycle. As actions are completed, they can be dropped from the Program and replaced by other actions requiring attention. In this manner the Administration Activities/Programs section will constantly evolve as an integral part of the County's budget cycle.

Key to Matrix Organization

AI:	*Implementation Program Action Item*
AQ:	*General Plan Air Quality Element*
C:	*General Plan Circulation Element*
CAP;	*Riverside County Climate Action Plan*
EDA:	*County of Riverside Economic Development Agency*
EPD:	*County of Riverside Environmental Programs Department, Division of Planning Department*
LU:	*General Plan Land Use Element*
N:	*General Plan Noise Element*
OES:	*Office of Emergency Services*
OS:	*General Plan Multi-purpose Open Space Element*
RCFCWCD:	*Riverside County Flood Control and Water Conservation District*
RCIT:	*Riverside County Information Technology*
TLMA-BS:	*Transportation and Land Management Agency-Building and Safety*
TLMA-CDR:	*Transportation and Land Management Agency- Center for Demographic Research*
TLMA-CE:	*Transportation and Land Management Agency-Code Enforcement*
TLMA-PD:	*Transportation and Land Management Agency-Planning Department*
TLMA-TD:	*Transportation and Land Management Agency- Transportation Department*
TLMA:	*County of Riverside Transportation and Land Management Agency*
S:	*General Plan Safety Element*

INITIAL IMPLEMENTATION PROGRAM

Action Item #. ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe* Target ~~Date Funding Source~~	*Status*
AI 1	~~Prepare a~~ *Ensure the* County *Zoning Ordinance* ~~Development Code~~ *is* ~~consistent that is~~ consistent and compatible with the County of Riverside General Plan and Land Use Map. *The major tool for implementing the policies of the General Plan is through a Zoning Ordinance* ~~*or development code. Currently, Riverside County's zoning code is inconsistent with the General Plan because the code has not been recently updated to reflect changes in the General Plan. A County Development Code is more than a zoning code. It is a single source of regulations affecting development, codified into an integrated document. It would contain specialized sections that are unique to Riverside County, as well as the zoning code, subdivision ordinances, and countywide design guidelines.*~~ *The Zoning Ordinance* ~~*Riverside County Development Code*~~ *should be a coherent, streamlined, and well organized tool for use by the County and others who play a role in implementing the General Plan.*	AQ 8.7, LU 1.9, LU 2.1, LU 3.1, LU 4.1, LU 4.3, LU ~~4.4~~ *4.5*, ~~LU 6.1~~, ~~LU 6.2~~, *LU 7.1, LU 9.4,* LU 11.1, *LU 12.1,* ~~LU 15.1, LU 15.2, LU 16.10, LU 16.11,~~ *LU 20.11, LU 21.7, LU 22.7,* ~~LU 23.2~~, ~~LU 24.6~~, ~~LU 26.12~~, ~~LU 27.1~~, *LU 29.2, LU 30.1, LU 30.6, LU 31.1,* ~~LU 28.7,~~ *LU 32.12, LU 33.1* OS 7.5	~~T~~*TLMA-PD*		*2-4 years*	*Ordinance 348 Comprehensive Review- Underway*
AI 2	Complete the design, initiation, and operation of the General Plan Monitoring System. *The General Plan Monitoring System would be used to ensure proper administration of the General Plan. It should be designed to yield the following information and should be keyed to the parcel or parcels involved in any proposed land use designation change:* *1. Case Number* *2. Location* *3. Area in acres* *4. Current Use(s)* *5. Foundation Component(s)* *6. Current Land Use Designation(s)* *7. Proposed Land Use Designation(s)* *8. Change in acreage allocations by designation* *9. Number of net additional dwelling units by density type* *10. Dwelling unit allocations according to affordability levels in the Housing Element* *11. Amount of square footage of non-residential use by designation type* *12. Revised applicable Area Plan statistical table, incorporating change(s)* *13. Comments regarding special considerations: geotechnical constraints, traffic constraints, mitigation measures, other policy requirements, fiscal implications, or any other noteworthy factors that would clarify important considerations regarding the project.* *This information should be developed as part of the staff report on proposed general plan amendments, with the final content added to the General Plan database upon adoption of the amendment. In addition, these statistics can provide direct input to the annual report required by Government Code. Please see the Administration Chapter for more information.*	C 7.1 ~~LU 27.3,~~*LU 29.1,LU 30.1, LU 33.3*	~~T~~*TLMA-PD*	~~GPAC~~	*2-4 years*	*Underway*

Action Item # ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe* Target ~~Date~~ ~~Funding Source~~	*Status*
AI 3	~~Develop a~~ *Periodically update* project review checklist to ensure that all development projects are reviewed for their impacts on resources on-site and on immediate surroundings. ~~*This*~~ *The comprehensive checklist should include, but not be limited to type of use, size, location, economic and fiscal viability, trips generated, infrastructure and service demands, land use compatibility, non-mitigated environmental impacts, aesthetics, impacts on agriculture and open space, buffer zones, and property management. All discretionary projects should include reviews by all relevant County Departments and public agencies that provide infrastructure, facilities or services. Compliance with National Pollutant Discharge Elimination System Permits and legislative mandates should also be considered when updating project review checklists.* ~~*Specific attention should be given to compliance with new water-related legislation:*~~ *including, but not limited to. the following:* *SB610 (Water Assessment)* ~~*and*~~ *SB221(Verification of Sufficient Water Supply)* *AB 32 (California Global Warming Solutions Act of 2006)* *SB 375 (Sustainable Communities and Climate Protection Act of 2008)* *AB 1358 (Complete Street)* *SB 1468 (General plans: military facilities)* *SB 1462 (notify the military of certain local planning proposals and development permit applications)*	C 2.1, C 2.2, C 2.3, C 4.6, C 6.3, C 7.2, C 11.1, *C16.1, C16.4,*~~C 14.1, C 16.6,~~ C 16.7, *C16.8* LU 2.1, LU 3.1, LU 4.1, LU 5.1, LU 5.2, LU 5.3, LU 5.4, ~~LU 6.1, LU 6.2, LU 6.3, LU 6.4, LU 6.5, LU 6.6, LU 6.7,~~ *LU 7.1, LU 7.3, LU 7.4, LU 7.5, LU 7.6,* ~~LU 8.2, LU 8.5, LU 9.1,~~ LU 9.2, *LU 9.5, LU 10.1,* LU 10.2, LU 11.2, ~~LU 12.6, LU 12.7, LU 13.3, LU 13.4, LU 13.5,~~ LU 13.6, LU 13.7, ~~LU 13.8, LU 14.2,~~ LU 14.3 *LU 14.4, LU 14.5, LU 14.6, LU 14.7, LU 14.8*, ~~LU 14.9, LU 15.1-15.13,~~ *LU 15.2, LU 15.3, LU 15.3, LU 15.4, LU 15.7, LU 15.8, LU 15.9, LU 16.1,* LU 16.2, *LU 16.3, LU 16.4, LU 16.5, LU 16.6, LU 16.7, LU 16.8, LU 16.9, LU 16.10, LU 16.11, LU 16.12, LU 16.13* ~~, LU 17.2, LU 17.3, LU 18.1~~, ~~LU 19.4, LU 19.5,~~ LU *20.2* ~~20.1~~, ~~LU 20.3, LU 20.4,~~ LU 21.2, *LU 21.3, LU 22.2, LU 22.3,* ~~LU 22.3, LU 22.6, LU 22.10,~~ *LU 23.2,* ~~LU 24.3, LU 24.7, LU 24.8, LU 25.2-25.6~~, *LU 25.4,* LU26.2, *LU 26.3,* ~~26.12,~~ *LU 27.2, LU 28.3,* ~~LU 28.4~~, *LU 28.6, LU 28.10, LU 28.11, LU 29.3, LU 29.4, LU 29.5, LU 29.6, LU 29.7, LU 29.8, LU 29.9, LU 30.3,LU 30.7, LU 30.8, LU 31.2, LU 31.3, LU 31.4, LU 31.5, LU 31.6, LU 32.3, LU 32.5-32.12, LU 34.3,* OS 1.1, *OS 1.4, OS 2.1,* ~~OS 2.3,~~ OS 3.3, *OS 3.4*, OS 4.3, OS 4.4, OS 6.1, OS 7.3, OS 8.1, OS 9.3, OS 9.4, ~~OS 19.2,~~OS 20.5, OS 20.6, OS 22.1, OS 22.4, OS 22.5	*TLMA-PD*		*Ongoing*	

Action Item # ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe* Target ~~Date~~ ~~Funding Source~~	*Status*
AI 4	~~Establish procedures to c~~ Coordinate and work with other jurisdictions and appropriate agencies regarding land use decisions. *Coordination with incorporated cities, adjacent counties, Indian nations, State and Federal agencies, WRCOG, CVAG, LAFCO, and other appropriate agencies' plans and programs would ensure land use and policy compatibility between Riverside County and other jurisdictions, resulting in a coordinated and successful regional planning effort. Compatibility between jurisdictions and agencies would also enable the County to work with these groups to develop collaborative growth forecasts and participate in a regional growth visioning process as well as address any unresolved issues arising out of the completion of any adopted MSHCPs and CETAP.*	C 1.6, ~~C 7.6~~ *C 7.8* LU 1.3, LU 1.5, LU 1.6, LU 1.8, LU 3.5, LU 5.1, LU 5.2, ~~LU 7.5,~~ *LU 8.5* ~~LU 32.1~~ OS 1.3, *OS 1.4, OS 2.3* *S 3.9, S 5.14, S 7.11*	~~T~~*TLMA-PD*		*Ongoing*	
AI 5	~~Initiate~~ *Provide* training programs for existing and new employees to ensure the proper implementation of the General Plan. *These training services would be used to maintain and expand in-house expertise to adequately review and enforce land use, environmental, design, and safety provisions. Training could include sessions on Land Use Designation Interpretation; Specific Plans; Community Centers; Element, Area Plan and Policy Interpretation; use of Design Guidelines, Implementation, Zoning Regulations and Consistency; and others.*	LU 2.1, LU 4.2	~~T~~*TLMA-PD*		*Ongoing*	
AI 6	Initiate a program *to facilitate* ~~for~~ the preparation of Specific Plans for Community Centers designated in the General Plan. *Community Centers are designated in key locations throughout the County to indicate areas set aside for more compact and mixed-use development. In order to appropriately develop all of the parcels within the Community Center creatively and to achieve the land's full potential, a single Specific Plan must be prepared. The Specific Plan would serve as a guide for the coordinated development of a multiplicity of individual properties. The Plan should contain provisions outlined in the Community Centers Guidelines in Appendix J.*	LU 4.1, *LU 29.1, LU 30.1, LU 31.1*	~~T~~*TLMA-PD*		*4-8 years*	
AI 7	Prepare a General Plan Status Report annually as required by California Government Code. *The County must provide an annual report to the California Office of Planning and Research and the Department of Housing and Community Development on the status of the General Plan and progress in the Plan's implementation. The annual report should include the progress that the County has made in meeting its share of housing needs as well as confirm the General Plan's role as an effective guide for orderly growth and development, preservation and conservation of open-space land and natural resources, and the efficient expenditure of public funds relating to the subjects addressed in the General Plan. This is an opportunity to sustain attention to the General Plan and integrate it into the budget process.*	LU 1.7	*TLMA-PD*		*Ongoing - Annually*	

Action Item # ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe* Target ~~Date Funding Source~~	*Status*
AI 8	*Monitor conversion of agriculture lands, plan for each Agriculture Foundation Amendment Cycle and advise Agricultural Task Force for each of the areas identified in the Administration Element:* *1) The area covered by the Palo Verde and Desert Center Area Plans and the Eastern Desert Land Use Plan;* *2) The area covered by the Eastern Coachella Valley and Western Coachella Valley Area Plans; and,* *3) The area covered by all other Area Plans.* ~~Create a General Plan Amendment Team.~~ ~~*The General Plan Amendment Team should consist of a group of senior level County officials and possibly representatives from the Board of Supervisors and/or the Planning Commission. The team would review proposed development applications for their consistency with the Riverside County Vision and General Plan. The Amendment Team would then define the issues that need clarification as well as provide guidance on completion of the application. The team would subsequently advise the applicant of the parts of the amendment that veer from or do not adhere to either the General Plan or the Riverside County Vision. Finally, the Amendment team would declare a finding and provide supplemental documentation for support. Please see the Administration Chapter for more information.*~~	~~LU 16.6~~ *LU 20.6*	~~T~~*TLMA-PD*		*Ongoing*	
AI 9	~~Refine and~~ Adopt the General Plan Incentives Program. *An Incentives Program should be ~~is being~~ created that aims to increase the density of some community development land to promote the conservation of multipurpose open space and assist in infrastructure improvements. This program may serve to further facilitate ~~liven~~ the proposed Community Centers as well. ~~At the time of adoption, the Incentives Program has not been finalized, and is still undergoing revisions. At such time as the Program has been completed, reviewed by senior level County officials, and is determined to be a strong catalyst for implementing the Riverside County Vision and General Plan, the Incentives Program may be adopted. That action may also require concurrent refinements to the General Plan.~~*	C 11.4, LU 2.1, LU 3.1, LU 3.4, LU *8.6* ~~7.6, LU 8.3,~~ *LU 9.3, LU 9.4,* ~~LU 17.6,~~ *LU 21.6, LU 22.6* ~~LU 20.6,~~ *LU 26.5* ~~OS 4.7,~~ OS 18.2	~~GPAC~~ *TLMA-PD*		*2-8 years*	
AI 10	*Ensure that* ~~Complete~~ the *General Plan remains consistent with the* MSHCP(s) and CETAP ~~and ensure integration and consistency with the General Plan~~. *The General Plan is one piece of a larger puzzle that is shaping the future land uses for Riverside County. The MSHCPs for both Western Riverside County and the Coachella Valley and CETAP planning processes are the other critical parts of the puzzle. The three parts of the Riverside County Integrated Program rely heavily upon each other to justify land use and policy decisions. ~~At the time of adoption, neither the MSHCP(s) the CETAP processes have been completed.~~ It is imperative to constantly strive to integrate the circulation and habitat plans and any future amendments with the land use plan for the County. ~~Upon completion of t~~The MSHCP(s) and CETAP documents, policies, and maps~~; their results~~ must be folded into the County of Riverside General Plan as well as any city General Plans. In order to properly implement the MSHCPs and CETAP, collaboration between*	C 7.2, ~~LU 2.1,~~ LU 3.1, ~~LU 8.1, LU 8.2,~~ *LU 9.1, LU 9.2,* ~~LU 18.2,~~ *LU 24.1* OS 17.1, OS 17.2, OS 17.3, OS 18.1	~~T~~*TLMA-PD*	*TLMA-TD*	*Ongoing*	

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	jurisdictions and the County must occur.					
AI 11	~~Create a General Plan database, as part of the GIS system that contains statistical analyses of parcels within the County.~~ *Maintain statistical information on the County and provide recommendations for updates to the General Plan data when necessary.* *~~This~~ Maintain County's statistical information* database*s. This includes ~~should include~~ information such as average dwelling units, square feet of nonresidential buildings, revised statistical tables for the Area Plans, updated resource mapping (e.g. agricultural lands, vegetation, mineral and water resources, etc.), new hazards, and others. These numbers can and should be aggregated in any General Plan Amendment package that encompasses several amendment proposals to facilitate an understanding of their cumulative effect. The County will need to prepare appropriate procedural materials to enable the proper information to be developed in conjunction with General Plan amendment applications.*	OS 1.2, OS 7.1, OS 9.1, OS 9.2, OS 14.3	~~T~~ *TLMA-PD*	~~GPAC~~ *TLMA- TD RCIT*	*Ongoing*	
AI 12	Plan, schedule and conduct ~~the first~~ technical amendment*s* to the General Plan *to address any issues concerning its implementation*. *~~Since General Plans and land uses are not static entities, a series of proposed and technical changes have been accumulating since before adoption of the General Plan. These changes were not incorporated before adoption because the EIR must reflect exactly what is portrayed in the General Plan. These~~ The technical changes would not affect the overall intent of the General Plan or Land Use Map, but would update them to reflect the current accurate state of the policies, statistics, and land uses. Some of the items considered in this technical amendment could include, but not be limited to; ~~the incorporation of any Specific Plan approved by the Planning Commission since the beginning of the General Plan Process,~~ mapping errors, statistical errors, a change of community boundary, a change in community designation (Community of Interest, Unincorporated Community, etc.).*	*Administration Element: Amendment Cycles "General Plan Review Cycle"*	~~T~~ *TLMA-PD*		*Ongoing*	*Through General Plan Review Cycle*
~~AI 13~~	~~Implement the Housing Element of the General Plan.~~ ~~*Please see the Housing Element Section of the Implementation Program for more information.*~~		~~T~~			

EXPANDED IMPLEMENTATION PROGRAM

Action Item #. ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe-* Target ~~Date Funding Source~~	*Status*
	Land Use					
	Community Centers Implementation					
AI 14	Adopt *Implement* the Community *Center* Design Guidelines as policy to guide the preparation of all Community Center Specific Plans.	AQ 8.4, AQ 8.5, AQ 8.6, LU 3.3, LU 4.1, *LU 32.2*	~~T~~ *TLMA-PD*		*Ongoing*	
AI 15	Target one community center per year for development and *facilitate* initiate the preparation of a Specific Plan for that area.	*LU 32.2*	~~T~~ *TLMA-PD*		*Ongoing*	
	Population Assumption Review					
AI 16	~~Initiate a coordinated process to r~~ *R*egularly review and adjust population assumptions and forecasts in conjunction with the Department of Finance, SCAG, WRCOG, and CVAG. This must involve cities and the County in a collaborative process.	LU 1.5	~~T~~ *TLMA-PD*	*RCIT*	*Ongoing*	
	Economic Development Tools					
AI 17	*Promote economic development strategies, such as* ~~Designate~~ redevelopment ~~project~~ areas, enterprise zones, ~~and~~ empowerment zones*, and fast track program*, as a means of stimulating economic development and assembling land parcels to facilitate more competitive business development projects.	~~LU 7.4~~ *LU 8.2, LU 8.4, LU 8.6, LU 8.7, LU 8.8, LU 8.11, LU 11.1*	~~T~~ *TLMA-PD*	*EDA*	*Ongoing*	
~~AI 18~~	~~Prepare an economic development strategy for the County.~~	~~AQ 7.1, AQ 7.2, AQ 7.3, AQ 7.4, AQ 7.5, AQ 7.6, AQ 7.7, AQ 8.1, AQ 8.2, AQ 8.3, AQ 9.1,~~ ~~LU 7.1, LU 7.2, LU 7.5, LU 7.6, LU 7.7, LU 7.8, LU 7.11, *LU 8.1-8.2, LU 8.5-8.8, LU 8.11,* LU 10.1, *LU 11.1*~~	~~T~~			
AI 19	Target three (3) project areas for revitalization each year to stimulate the local economy and further revitalization, create a sense of place, and enhance transit feasibility.	~~LU 7.4~~ *LU 8.4, LU 8.8*	~~T~~ *TLMA-PD*	*EDA*		
	Fiscal Impact Analyses					
AI 20	Update the Fiscal Impact Model concurrent with the ~~5~~*8*-year General Plan review*, if necessary*.	*LU 8.1*	~~T~~ *TLMA-PD*		*8-years*	
	Spheres of Influence					
AI 21	~~Initiate a formal program to w~~ *W*ork closely with cities and LAFCO on 5-year plans for Spheres of Influence that ensure urban development near existing urban centers is consistent with transportation, habitat, and open space goals.	LU 1.3	~~T~~ *TLMA*		*Ongoing*	*Board Policy A-59*
AI 22	Document the status of Unincorporated Communities and Communities of Interest at the time of each technical amendment to the General Plan to ensure their accurate reference and subsequent designation. If a change in status is appropriate, review the General Plan for possible revisions.		~~T~~			
	Grading Ordinance					

Action Item # ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe* Target ~~Date Funding Source~~	*Status*
AI 23	Develop a grading ordinance that establishes appropriate grading standards for each General Plan land use category.	LU 4.1, LU ~~11.1~~ *12.1,* LU ~~17.1~~ *21.1, LU 22.1*, LU ~~20.2~~ *26.1*	~~T~~ *TLMA-PD*	*TLMA-BS*	*5-8 years*	*Ord. 457*
AI 24	Prepare an ordinance that provides density/intensity standards for hillsides and ridgelines, and standards for construction, landscaping, and grading techniques.	LU 4.1, LU ~~11.1~~ *12.1, LU 13.4*	*TLMA-PD*	*TLMA-BS*	*5-8 years*	
	Watercourse Setback Regulations					
AI 25	*Coordinate flood control and planning efforts to ensure implementation of the General Plan does not hinder watercourses and floodways or jeopardize safety.* Prepare and implement a watercourse management system that identifies the functional roles of each water course (e.g., flood control, water recharge, habitat, etc.) and provides appropriate setbacks and permitted uses adjacent to and within designated watercourses and floodways, including incentives to landowners.	LU 3.2~~, LU 29.1~~ OS 5.1, OS 5.2, OS 5.4, OS 5.5, S 4.1, S 4.2, S 4.3, S 4.4, S 4.6, S4.7, S 4.8, ~~S 4.11,~~ S 4.12, S 4.13, S 4.16, S 4.21	*TLMA-PD*	*RCWCFCD*	*5-8 years*	
	Mobility					
AI 26	~~Develop standards that guide development in areas in close proximity to transit facilities.~~ *Utilize design elements that are provided in the Community Center Guidelines* ~~Provide standards~~ that *integrate* transit *connectivity* ~~achieve integration of~~ into ~~the~~ land use fabric ~~through the use of transit village plans~~.	AQ 8.8, AQ 8.9, AQ 9.2, *AQ 18.2, AQ 18.5, AQ 20.9* C 1.3, C 4.3, *C 12.2* LU ~~12.4~~ *13.4*	~~T~~ *TLMA-PD*	*TLMA-TD, Regional/local Transit Agencies, RCTC*	*5-8 years*	
	Infill Assistance					
AI 27	Prepare a comprehensive survey of vacant and underutilized lands within Community Development areas to identify and direct potential developers to infill opportunities.	LU 2.1	~~T~~ *TLMA*	*RC-EDA, RCIT*	*2-4 years*	
AI 28	~~Create an urban space task force to~~ *During development review* examine ways to allow publicly-owned vacant parcels to convert to interim, passive use parks and community gardens within urbanized areas.	LU ~~8.3~~ *9.3*	~~T~~ *TLMA-PD*	*Riverside County Regional Park & Open-S0pace District*	*5-8 years*	
	Rural Lot Consolidation					
AI 29	Develop a system of programs and incentives that encourages the consolidation of rural lots.	LU 2.1, LU ~~17.5~~ *21.5*, *LU 22.5*, ~~LU 20.5~~, *LU 26.4*	*TLMA-PD*		*5-8 years*	
	Rural Village Implementation					
AI 30	~~Prepare a program for Rural Villages~~ *Prepare Rural Village Design Guidelines and implement the policies for Rural Village Overlays* to allow and/or encourage transfer of density and/or lot consolidation.	LU 2.1, LU 3.3, LU 3.4, LU ~~17.6~~ *21.6, LU 22.6,* LU ~~28.5~~*34.4*	~~T~~*TLMA-PD*		*2-4 years*	
	Farmworker Housing					
AI 31	Create standards for farmworker housing.	LU ~~16.3~~ *20.3*	~~T~~ *TLMA-PD*		*5-8 years*	

Action Item #. ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe-* Target ~~Date Funding Source~~	*Status*
	Day Care Facilities					
AI 126	*Collaborate with appropriate public, private and non-profit agencies (e.g. local, regional and state agencies, such as the Riverside County Child Care Consortium, First-5 Riverside, ABCD Task Force, Department of Public Social Services, Local Planning Council, Office of Aging and Adult Protective Services) to study the development of day care programs, fill service gaps, increase programs' effectiveness, improve service accessibility, and maximize all available resources in the community.*	*LU 6.1*	*TLMA-PD*		*Ongoing*	
AI 127	*Incorporate provisions for day care facilities in future density transfer programs.*	*LU 6.1*	*TLMA-PD*		*Ongoing*	
AI 128	*Develop a standard operating procedure for determining when projects should provide day care facilities that incorporates the following guidelines:* *i) Determine the level of need for additional day care facilities, and whether the day care facilities could be feasibly located either on the project-site, or on another site in the vicinity;* *ii) To more effectively identify the level of need, utilized the Geographic Information System (GIS) to illustrate the location, type, and magnitude of growth anticipated in the County;* *iii)Consider whether a neighborhood park, school, community center, or other community facility exists or is proposed on or in the vicinity of the project-site;* *iv) Consider whether there is interest by a day care provider in working with the project developer in a private, voluntary arrangement between those parties.*	*LU 6.1*	*TLMA-PD*		*2-4 years*	
	Circulation					
	Utilities					
AI 32	Develop a program and priority list (including funding, location and timing) to underground utility structures where feasible.	C 25.2, LU 5.1, LU 5.2, LU ~~13.1~~ *14.1*, LU ~~13.3~~ *14.3*, LU ~~13.5~~ *14.5*	~~T~~*TLMA-TD*		*Ongoing*	*Underground Utility Conversion Program (Rule 20-A)*
	Multi-purpose Trails and Bikeways Acquisition					
AI 33	*When feasible, ~~A~~a*cquire trail easements through subdivisions and development approvals in compliance with the County's trail system Master Plan.	C 16.1, C 16.4, C 18.1 LU ~~13.2~~ *14.2*	~~T~~*TLMA-PD*	*Riverside County Regional Park & Open-Space District*	*Ongoing*	*Through development proposal review*
AI 34	~~Create~~ *Maintain* an inventory of all trail easements and Class I bikeways that have been dedicated and acquired, either unimproved or improved, throughout the County.	*C 16.5,* C 17.1~~, C 17.2~~	~~T~~ *TLMA-PD*	*Riverside County Regional Park & Open-Space District*	*2-4 years*	
AI 35	Identify gaps in the trail and bikeway systems and prioritize location and timing of improvements to complete trail segments.	C 16.2, C 16.6	~~T~~*TLMA-PD*	*Riverside County Trails Committee*	*2-4 years*	

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AI 36	Acquire funding and grants to implement trails that have been designated but never constructed as well as gaps within the trails and bikeways system.	C 15.2, C 16.6, *C16.7,* C 18.3	~~T~~*TLMA-PD*	*Riverside County Regional Park & Open-Space District*	*Ongoing*	
AI 37	Pursue funding sources, including public/private partnerships, that encourage the development of linear parks and greenways that would include multi-use trails.	C 18.3	~~T~~*TLMA-PD*	*Riverside County Regional Park & Open-Space District*	*Ongoing*	
AI 38	Study the feasibility of establishing a system for acquiring open space easements from private landowners for trail corridors in return for tax incentives in accordance with the California Land Conservation Act of 1965.	C ~~16.6~~ *16.7*	~~T~~*TLMA-PD*	*Riverside County Regional Park & Open-Space District, Riverside County Trails Commission*	*Ongoing*	
AI 39	Establish standards for and acquire multi-purpose trail easements that provide enough width to include vegetation, paving, fencing, and equestrian components.	C ~~16.6~~ *16.7* LU ~~13.3~~ *14.3*	~~T~~*TLMA-PD*	*Riverside County Trails Committee*	*2-4 years*	
AI 40	Consult the *Riverside County Regional Park and Open-Space District's Trail Development Standard, General Plan Trails and Bikeway maps,* ~~Public Access map~~ and MSHCP for *development standards and* restrictions on trail use when any trail segment is being considered for development, construction, or use.	C ~~16.6~~ *16.7* LU 3.2	~~T~~*TLMA-PD*		*Ongoing*	*Through development review process*
AI 41	Consult the County Regional Parks and Open Space District *and the Riverside County Trails Committee* as part of the development review process regarding any development proposals that are adjacent to an existing or proposed trail segment.	C 1.6, ~~C 16.6,~~ C 16.7, C 17.1 LU 2.1, *LU 4.1,* ~~LU 4.2,~~ LU ~~12.4,~~ *13.4,* LU ~~13.2~~ *14.2*	~~T~~*TLMA-PD*	*Riverside County Regional Park & Open-Space District*	*Ongoing*	*Through development review process*
AI 42	Incorporate converted railroad trails into Riverside County components of a statewide bicycle trail plan ~~that is mandated by the Intermodal Surface Transportation Efficiency Act (ISTEA)~~.	C 16.6, *C 16.7*	~~T~~*TLMA-PD*	*Riverside County Trails Committee*	*Ongoing*	
	Transportation					
AI 43	~~Implement a study of truck movements in the County to determine truck lanes.~~ *Coordinate with RCTC and SCAG to develop a truck lane plan.*	AQ 17.7, C 23.1, C ~~23.9~~*23.8*, ~~C 23.10~~ LU ~~24.2~~ *30.2*	~~T~~*TLMA-TD*		*2-8 years*	
~~AI 44~~	~~Initiate a program of establishing precise centerline alignments and right-of-way reserves for proposed arterial highways for which rights-of-way do not exist.~~	~~C 3.17, C 3.19~~	~~T~~			
AI 45	Develop locational standards and criteria to ensure the proximity of new County facilities to transit corridors and existing and planned bicycle commuting routes.	C 4.3, C ~~4.9~~ *4.8*	~~T~~*TLMA-PD*	*EDA-Facilities Management*	*2-4 years*	
AI 46	Cooperatively work with local transit agencies regarding new bus service to any new government facility that is not located along or within 1/8 mile of a transit corridor.	C 1.6	~~T~~*TLMA-PD*		*Ongoing*	*Through project development review*

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	TDM/Carpool/Rideshare					
AI 47	~~Develop~~ *Continue to promote* carpool and rideshare programs that reinforce the County's Transportation Demand Management (TDM) Guidelines	AQ 10.1, AQ 10.2, *AQ 19.4, AQ 20.1, AQ 20.2, AQ 20.3, AQ 20.4, AQ 20.5, AQ 20.7* C 22.1, C 22.2	~~T~~*County of Riverside Human Resources*		*Ongoing*	*Board Policy K1, K2 and K3* *Ord. 348 Section 18.12 e: "Off Street Vehicle Parking- Alternative Programs for Parking"*
AI 48	Create and provide parking incentives for carpooling.	AQ 10.3, C 22.2	~~T~~*TLMA-PD*		*Ongoing*	*Ord. 348 Section 18.12 e: "Off Street Vehicle Parking- Alternative Programs for Parking"*
	Local Agency and Property Owner Coordination					
AI 49	~~Every five years,~~ *Through the update of the County General Plan,* conduct a review of the status of city and County Circulation Plans, as well as those of adjacent counties, and the impacts that new development and proposed development will have on the County's Circulation System.	C 1.1, C 1.5, C 3.27, C ~~4.10~~ *4.9*, C 7.1, C 7.3	~~T~~*TLMA- TD*	*TLMA-PD*	*Ongoing*	
AI 50	Convene a task force consisting of County staff, local cities, WRCOG, and CVAG to coordinate circulation standards, CETAP corridors, and circulation planning.	*C1.6,* C 7.1, C 7.3, C 7.4, C 7.5, *C7.8, C7.9,* C 10.1, C 12.1	~~T~~*TLMA- TD*	*TLMA-PD*	*Ongoing*	
AI 51	Develop a process to coordinate with Caltrans to identify ultimate freeway ROW's, prioritize ROW acquisition, and work with property owners to acquire the entire, or necessary portions of, the property.	C 3.17, C 3.18, C 3.19, C 7.3	~~T~~*TLMA- TD*		*Ongoing*	
AI 52	Develop a process to obtain the ROW needed from private property owners to implement transportation corridors or public transit.	C 3.17, C 7.2, C 11.1	~~T~~*TLMA- TD*		*Ongoing*	*Ord. 669, Board Policy G-4, Ord. 460, Ord. 461*
AI 53	Identify phasing of and funding sources available to establish transportation corridors.	AQ 14.4, *AQ 20.1, AQ 20.2, AQ 20.3, AQ 20.5, AQ 20.7* C 7.1, C 8.1, C 8.8	~~T~~*TLMA- TD*		*Ongoing*	*Transportation Improvement Program*
AI 54	Develop a proactive community outreach program to educate property owners about the current status of transportation corridor alignments and the possibility of future dedications and potential impacts to their properties.	C 7.2	~~T~~*TLMA- TD*		*Ongoing*	

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	Multi-purpose Open Space					
	Hydrological Programs					
AI 55	Establish and maintain a centralized water resource database that incorporates surface and groundwater data and provide for the public dissemination of water resource information.	OS 1.2, OS 1.3	~~T~~*TLMA-PD*	*RCWCFCD*	*Ongoing*	
AI 56	Develop and maintain an inventory of sites within the County that are suitable for groundwater recharge. The sites should be incorporated into the County GIS and included in the water resource database.	OS 4.1, OS 4.2, OS 4.3, OS 6.3	~~T~~*TLMA-PD*	*RCWCFCD*	*Ongoing*	
AI 57	*Coordinate with Riverside County Flood Control and Water Conservation District to d*~~D~~design and initiate conservation and recharge programs to increase the supply of potable water in the County.	*OS 1.4,* OS 2.1, OS 2.2, ~~OS 2.3,~~ OS 2.5, *OS 3.7,* OS 4.1, OS 4.2, OS 4.3, ~~OS 4.5,~~ OS 4.6, *OS 4.8*	~~T~~*TLMA-PD*	*RCWCFCD*	*Ongoing*	
AI 58	Develop and implement public educational outreach designed to increase public participation in water conservation and water quality awareness.	OS 1.3, *OS 2.1,OS 2.3,* OS 2.4	~~T~~*TLMA-PD*	*RCWCFCD*	*Ongoing*	
AI 130	*Establish a Landscape Review Division within the Planning Department to review development proposals and ensure the implementation of the County's Water Efficient Landscape Ordinance No. 859.*	*OS 1.4, OS 2.1*	*TLMA-PD*		*Ongoing*	*Ord. 859*
AI 131	*Work with water districts to develop data base that identifies current and future recycled water facilities and develop policies that ensure that requisite purple pipe components are installed as part of the landscape review process. Coordinate County's water-efficiency policies and programs with water service providers.*	*OS 1.4, OS 2.3*	*TLMA-PD*		*Ongoing*	
AI 132	*To manage storm water and urban runoff incorporate design elements, such as:* *(1) Incorporation of permeable paving for parking surfaces, driveways, sidewalks and other surfaces requiring hard materials;* *(2) narrower streets and less pavement;* *(3) street parkways with vegetated bio-swales;* *(4) multi-functional open drainage systems in lieu of more conventional curb-and-gutter systems such as a curb and swale system, concave street medians that capture water, and cul-de-sac circles that provide a concave, landscaped circle to capture water; and* *(5) home lots and public area design that incorporates water capture, biofiltration, and other measures.*	*OS 4.7*	*TLMA-PD*		*Ongoing*	*Through development review process*
	Floodplain and Riparian Management					
AI 59	*Coordinate with Riverside County Flood Control and Water Conservation District to* ~~C~~*c*reate a hierarchy of waterways within the county by establishing a system for defining and graphically delineating the floodplains, watercourses, streams, wetlands, and buffer zones. *When necessary update data and maps in the General Plan and the Riverside County Land Information System.*	OS 5.1, OS 5.2, OS 5.3, OS 5.4, S 4.19, S 4.20, S 4.22	~~T~~*TLMA-PD*	*RCWCFCD*	*4-8 years*	

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AI 60	*Coordinate with Riverside County Flood Control and Water Conservation District to* ~~D~~*develop* a set of guidelines for floodway, floodplain, floodplain fringe, and wetland preservation and management that includes incentives for limiting development in and around these designated areas.	C 20.3, *C 20.4, C 20.5* LU 2.1, LU 3.2, ~~LU 29.1~~ OS 5.1, OS 5.2, OS 5.3, OS 5.4, OS 5.5, OS 5.6, OS 5.7 S 4.4, S 4.5, S 4.7, S 4.8, S 4.9, S 4.19	~~T~~*TLMA-PD*	~~GPAC~~ *RCWCFCD*	*4-8 years*	
AI 61	Develop guidelines for establishing wetland buffer zones in conjunction with floodway setbacks addressing both their form and delineation and methods for their implementation, including incentives to landowners.	LU 3.2, OS 5.6, OS 6.2, S 4.5, S 4.20	~~T~~*TLMA-PD*	~~GPAC~~ *RCWCFCD*	*4-8 years*	
AI 133	*Develop a model for determining minimum setbacks from floodway boundaries.*	*OS 5.3*	*TLMA-PD*			
AI 134	*Develop an educational outreach program for the agricultural community through the Agricultural Commissioner's office, Farm Bureau, and University Agricultural Extension regarding the many benefits of locating crops outside watercourses and floodplains.*	*OS 5.7*	*TLMA-PD*	*Riverside County Agricultural Commissioner's Office*	*4-8 years*	
AI 135	*The county will refine the Blueline Stream data (Figure OS-1) as appropriate with new datasets such as the National Hydrography Dataset (NHD) prepared by the USGS that shows different types of watercourses.*	*OS 5.7*	*TLMA-PD*		*2-4 years*	
	Energy Resource Efficiency and Conservation					
AI 62	Establish an Innovative Buildings Review Committee, empowered by the County Building Official and comprised of professionals with specific expertise in sustainable, energy-efficient building, to review development and building proposals for more efficient consumption of resources.	AQ 5.2, LU 4.1, OS 2.1, OS 2.2, ~~OS 2.3,~~ *OS 3.7,* OS 11.1, OS 11.3, OS 16.1, OS 16.9, OS 16.10	~~T~~*TLMA-PD, TLMA-BS*	~~GPAC~~		*CAP*
AI 63	Work with public utilities, University of California, K-12 schools, community colleges, adult education, county departments, cities and others that have existing outreach programs to organize a coordinated program for promoting energy conservation.	OS 11.2, OS 11.3, OS 16.5, OS 16.9	*TLMA*		*Ongoing*	*CAP*
AI 64	Work with public utilities and the private sector to develop outreach programs designed to inform small businesses about the cost and benefits of energy efficiency, including technical options, funding, and incentive programs.	OS 11.2, OS 11.3, OS 16.5, OS 16.9	*TLMA-PD*		*Ongoing*	*CAP*
AI 65	Develop and distribute an informational brochure that describes passive solar designs (e.g, orientation of buildings, vegetative shading, light colored roofs, day lighting, etc.) and other energy-efficiency features.	OS 11.1, OS 16.9	~~T~~*TLMA-PD, TLMA-BS*	~~GPAC~~	*Ongoing*	*CAP*
AI 66	Prepare and implement incentives for the use of solar energy systems for heating swimming pools.	OS 11.1	~~T~~*TLMA-PD, TLMA-BS*	~~GPAC~~		

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AI 67	Distribute and periodically update guidelines to factor the costs and benefits of energy-efficient equipment into purchasing decisions.		~~T~~ *County of Riverside Purchasing Department*	~~GPAC~~	*Ongoing*	*Board Policy A-64*
AI 68	Require County specifications for bids on major energy-using devices to contain energy-saving estimates.	OS 16.2, OS 16.7	~~T~~ *County of Riverside Purchasing Department*	~~GPAC~~	*Ongoing*	
AI 69	Consult with the appropriate utility company to take advantage of cost-saving opportunities related to purchasing energy-efficient items through utility rebates.	OS 16.7	~~T~~ *EDA-Facilities Management*	~~GPAC~~	*Ongoing*	
AI 70	Include in the Development Code provisions for passive and active solar devices and state of the art energy conservation measures in development projects.	OS 11.1, *OS 11.4,* OS 16.2, OS 16.9, OS 16.10	~~T~~ *TLMA-PD*	~~GPAC~~	*Ongoing*	*CAP*
AI 71	Create a geothermal and biomass resources team to research the feasibility of implementing the use of renewable energy sources on a countywide basis.	OS 12.1, OS 13.1	~~T~~ *TLMA-PD*		*Ongoing*	*CAP*
AI 72	Develop a regulatory review process to initiate changes in County ordinances that stem from the Wind Implementation Monitoring Program (WIMP).	OS 10.2	*TLMA-PD*		*Ongoing*	*CAP*
AI 73	Create an energy conservation and planning program that addresses present shortcomings and future possible shortages or needs as well as present consumption. Create a supporting energy database.		~~T~~ *TLMA-PD*	~~GPAC~~	*2-4 years*	
	Infrastructure					
AI 74	Review infrastructure plans submitted as part of development applications to prevent services and utilities designated for urban uses from being installed or expanded in open-space areas.	LU 5.1, LU 5.2, OS 20.2, OS 20.3	~~T~~ *TLMA-PD*	~~GPAC~~	*Ongoing*	*Through development review process*
	Interagency Coordination					
AI 144	Develop a cultural resources program in consultation with Tribes and the professional cultural resources consulting community.	OS 19.2	TLMA-PD		~~Fall 2011~~ *2-4 years*	
AI 145	To the extent feasible, allocate resources and/or tax credits to prioritize the protection of cultural resources preserved in place or left in an undisturbed state.	OS 19.4	TLMA-PD		Ongoing	
	Natural Resource Management					
AI 77	Continue to enforce the County's Guidelines for properties with Oak Tree Resources.	*OS 9.4*	*TLMA-PD*		*Ongoing*	
AI 78	Monitor the conversion of vacant or agricultural land and native vegetation into vineyards and evaluate land for potential or existing Oak Tree Woodlands.	OS 7.2, OS 7.3, OS 9.4	*TLMA-PD*		*Ongoing*	
AI 79	Develop a public process for identifying, defining, mapping, and protecting County scenic resources, scenic vistas, scenic corridors, viewsheds, and natural landmarks.	C 19.1 LU ~~13.1~~*14.1, LU 14.6*	~~T~~ *TLMA-PD*	~~GPAC~~	*2-8 years*	

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		OS 9.3, OS 21.1				
	Safety					
	Hazard Data/Information Maintenance					
AI 80	Develop a program to maintain and modify the fault and study zone maps as new data is generated.	S 2.1	~~T~~*TLMA-PD*	*RCIT*	*Ongoing*	
AI 81	Identify potentially hazardous structures and inventory them in a GIS database. Conduct follow-up structural surveys of high-vulnerability structures identified in the inventory.	S ~~1.3~~ *1.4*, S 2.2	~~T~~*Fire Department, OES*	*TLMA-PD TLMA-BS, TLMA-CE*	*Ongoing*	
AI 82	Conduct periodic loss estimations (scenarios) based on inventory and geologic conditions, to track the County's exposure to disaster, and to quantify cost-benefit ratios of mitigation activities.	S 7.5	~~T~~*Fire Department, OES*	*RCIT*	*Ongoing*	
AI 83	Update dam inundation GIS data ~~for Diamond Valley Lake and Prado Dam~~ when *new* information becomes available from the California Office of Emergency Services.	S 4.17, S 4.19~~, S 2.1~~	~~T~~*TLMA-PD*	*RCIT*	*Ongoing*	*Through General Plan Review Cycle*
AI 84	Request a vulnerability study from CalTrans to facilitate emergency response planning.	S 7.15	~~T~~*Fire Department, OES*		*Ongoing*	
AI 85	~~Appoint or contract a liaison with Southern California earthquake scientists to e~~ *E*nact and employ a short-term hazard notification system based on foreshock probabilities.	S 7.13	~~T~~*Fire Department, OES*		*2-8 years*	
AI 86	Compile all disaster incidences into the GIS database.	S 7.6	~~T~~*Fire Department, OES*	*RCIT*	*Ongoing*	
AI 87	Electronically archive all geotechnical reports and other data relevant to hazard mitigation.		~~T~~*TLMA-PD*		*2-4 years*	
AI 88	Create a countywide Safety Guidelines manual that outlines proper protocol for assessing unsafe buildings, creating emergency response and recovery plans, and updating flood and geotechnical information.	S ~~1.3~~ *1.4*, S 4.17, S 4.19, *S 5.14, S 5.9,* S 7.14, S 7.15	~~T~~*TLMA, Fire Department, OES*		*2-8 years*	*OES- Response Plan and Multi-Jurisdictional Local Hazard Mitigation Plan, OES-Water And Dam Emergency Response, Ord. 839*
	Public Notification/Education					
AI 89	Require tagging of seismically vulnerable buildings to inform occupants that the building could be unsafe in the event of an earthquake.	S ~~1.3~~ *1.4*	~~T~~*TLMA-CE*		*Ongoing*	*Ord. 839*
AI 90	Post visible notices or plaques on buildings that are considered unsafe in an earthquake or commending property owners who have completed mitigation efforts.	S ~~1.3~~*1.4*	~~T~~*TLMA-CE*		*Ongoing*	
AI 91	Utilize the GIS hazard mapping database to attach environmental constraints data to each property title and make the data publicly available on the ~~hazard mitigation~~	LU 2.1,	~~T~~*RCIT*		*Ongoing*	

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	Riverside County Land Information System (RCLIS) web site.	S 2.1				
AI 92	Develop a hazard notification program that requires property owners to sign a notice confirming their awareness and acceptance of unmitigated risk identified in engineering geologic/geotechnical investigation reports. The notice should be made part of the deed and passed on to future buyers, users, or residents.	S 3.12	~~T~~*TLMA*			
AI 93	Develop a series of educational seminars that can be given to homeowners, schools, or civic groups and promote their availability. *Through* • *Increasing awareness through Safety Fairs, Open Houses, Places of Worship, Community Centers and School Visits and Curriculum Presentations.* • *Disseminating informational brochures on topics such as residential Fire Sprinkler Maintenance, commercial design and construction standards, development and construction requirements in the fire hazard areas.* • *Disseminating information on established evacuation routes and plans in high fire hazard zones.* • *Providing training and training resources (audio-visual and digital) that includes specific instruction on fire protection planning or engineering, fire hazard reduction techniques that ensure effective fire prevention inspection compliance.*	*S 3.14, S 5.21,* S 7.19	~~T~~*Fire Department, OES*			
AI 94	Develop a hazard mitigation web site and regularly advertise its existence.	S 7.22, S 7.23	~~T~~*Fire Department, OES*			
AI 95	Develop a photographic database of "typical" hazard situations for use in conveying hazard awareness to the public.	S 7.23	~~T~~*Fire Department, OES*			
AI 96	Make available pamphlets, brochures, and in-house expertise to educate homeowners on each natural hazard and home mitigation strategies.	S *5.11,* ~~5.4,~~ S 7.19	~~T~~*Fire Department, OES*		*Ongoing*	
AI 97	Provide incentives for County employees to make outreach appearances at schools, businesses, and community groups to promote public safety.	*S 3.14,* S 7.2	~~T~~*County of Riverside Human Resources*		*Ongoing*	
AI 98	Coordinate community volunteerism and involvement in hazard mitigation *and disaster preparedness*.	*S 3.14,* S 6.1	~~T~~*Fire Department, OES*		*Ongoing*	*Citizen Corps, Community Emergency Response Team (CERT), California Disaster Corps, Radio Amateur Civil Emergency Service (RACES)*

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AI 99	Build redundancy into the County web site host to reduce its vulnerability in a disaster.	S 7.22, S 7.23	~~T~~ *RCIT*		*Ongoing*	
	~~***New Policy/Regulation/Mitigation Measures***~~					
AI 100	Develop a mandatory retrofit ordinance covering unsafe buildings. Create follow-up procedures to ensure that required building retrofits are completed.	S ~~1.3~~ *1.4*, S 3.7	~~T~~ *TLMA-BS*		*Ongoing*	*Ord. 839*
AI 101	Develop an ordinance to require correction of nonstructural hazards in privately owned commercial and industrial facilities, especially for critical facilities.	S 4.12, S 4.14, S 7.9	~~T~~ *County of Riverside*		*5-8 years*	
AI 102	Investigate the feasibility of forming assessment districts or geologic hazard abatement districts to encourage cost-effective and tax-reduced measures to mitigate existing seismic, landslide, erosion, or subsidence hazards.		~~T~~ *County of Riverside*		*5-8 years*	
AI 103	Prepare a disaster recovery and reconstruction ordinance.	S 7.18	~~T~~ *County of Riverside*		*5-8 years*	*OES- Response Plan and Multi-Jurisdictional Local Hazard Mitigation Plan*
	Staffing					
AI 104	Engage a qualified specialist to regularly review available technology suitable for hazard reduction, mitigation, or emergency response and recovery.	S 2.8, S 3.1	~~T~~ *Fire Department, OES*		*Ongoing*	
	Noise					
AI 105	~~Create a Noise Ordinance to p~~ Prohibit or mitigate harmful or unnecessary noise within the County.	C 6.7, C 9.4 N 1.3, N 1.5, N 2.1, N 2.2, N 2.3, N 3.1, N 3.2, N 4.1, N 4.2, N 4.3, N 4.4, N 4.5, N 4.6, N 5.2, N 6.3, N 6.4, ~~N7.3, N8.2, N8.4,~~ *N 9.2, N 9.4, N 9.5,* ~~N12.1, N12.2, N12.4,~~ *N 13.1, N 13.2, N 13.4,* ~~N 13.6, N 13.7, N 14.2, N 14.3,~~ *N 14.6, N 14.7,* ~~N 15.1,~~ *N 15.2, N 15.3,N 16.1,* ~~N 17.1,~~ *N 18.1*	~~T~~ *TLMA-PD, TLMA-CE*		*Ongoing*	*Ord. 847*
AI 106	Examine the existing and projected future noise environment when considering any new development, and when considering amendments to the circulation element.	N 1.4, N 1.5, N 1.7, N 3.4, N 4.3, N 4.7, N 4.8, ~~N 8.3, N 8.5, N 8.6, N 8.7,~~ *N 9.3, N 9.6, N 9.7,* ~~N 10.1, N 10.2, N 10.3, N 10.5,~~ *N 11.1, N 11.2, N 11.3,N 11.5,* ~~N 13.3, N 13.5, N 14.1,~~ *N 14.3, N 14.5, N 15.1,* ~~N 17.4, N 17.6, N17.7,~~ N 18.4, *N 18.6 N 18.7, N 19.5*	*TLMA-PD, TLMA-TD*		*Ongoing*	*Ord. 847*
AI 107	Review proposed zone changes to ensure consistency between zoning and the affected noise environment.	C ~~20.6~~ *20.8* N 1.1, N 1.2, N 1.6, N 1.7, N 2.2, N 3.1, N 3.3, N 3.6, N 3.7, N 4.5, N 4.7, N 4.8, N 6.3, ~~N 7.4, N 12.3,~~ *N*	*TLMA-PD*		*Ongoing*	

Action Item # ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe-* Target ~~Date Funding Source~~	*Status*
		13.3, ~~N 13.5, N 14.1, N 14.3,~~ N 14.5, N 15.1, N 15.3, ~~N 17.6, N 17.7, N 18.4,~~ N 18.6, N 18.7, N 19.5				
AI 108	Establish a Noise Abatement Program	N 1.5, N 1.8, N 6.1, N 6.2, N 6.4, ~~N 9.1, N 9.2, N 9.4,~~ *N 10.1, N 10.2,* N 10.4, ~~N 11.1, N 11.2,~~ *N 11.4,* N 12.1, N 12.2, ~~N 12.4,~~ *N 13.1,* N 13.2, N 13.4, ~~N 13.6, N 13.7, N 14.1,~~ *N 14.2, N 14.4, N 14.6, N 14.7, N 15.1,* ~~N 18.2,~~ *N 19.2*	~~T~~*TLMA-PD*		*Ongoing*	*Ord. 847,*
AI 109	Accurately produce existing and future noise contours for major noise sources within the County including rail, street, manufacturing facilities, helipads, airports, and heliports.	N 1.4, N 3.5, N 4.3, ~~N 7.3, N 7.4 N 7.5, N 10.1, N 10.2, N 10.3, N 10.5,~~ *N 11.1, N 11.2, N 11.3, N 11.5,* ~~N 16.1, N 16.2, N 16.3,~~ *N 17.1, N 17.2,* N 17.3, ~~N 17.6, N 17.7, N 17.8, N 18.1,~~ N 18.3,*N 18.6, N 18.7, N 18.8, N 19.1, N 19.3*	~~T~~*TLMA-PD*		*Ongoing*	*Through General Plan Review Cycle*
	Air Quality					
	Regional Air Management					
AI 110	Participate in the development and update of the regional air quality management plans required under Federal and State law.	AQ 1.3, *AQ 19.1, AQ 22.1* C ~~20.11~~ *20.13*	*TLMA-PD*		*Ongoing*	
AI 111	Develop Air Quality policies for the South Coast, Salton Sea, and Mojave Air Basins. (Coordinate policy efforts with the following agencies; Environmental Protection Agency (EPA), South Coast Air Quality Management District (SCAQMD), Southern California Association of Governments (SCAG), Western Riverside Council of Governments (WRCOG), Coachella Valley Association of Governments (CVAG), and the Mojave Desert Air Quality Management District (MDAQMD).	AQ 1.1, AQ 1.2, AQ 1.4, AQ 1.5, AQ 1.10, AQ 4.10, AQ 17.4, *AQ 19.1, AQ 22.1, AQ 20.25*	*TLMA-PD*		*2-4 years*	
~~AI 112~~	~~Participate in the conformity review process outlined in the South Coast Air Quality Management District's Air Quality Management Plan.~~					
	Legislation					
AI 113	Collaborate with State and federal elected officials to develop legislative proposals which: Promote cleaner industry, clean fuel vehicles and more efficient burning engines and fuels. Permit the County to promote creative air quality programs, which otherwise could not be implemented. Require stricter control measures for bias belted tires, smoking vehicles and vehicles that spill debris on our streets and highways, to better control particulate matter.	AQ 1.7, AQ 1.8, AQ 1.9, AQ 16.2, *AQ 19.1*	~~T~~*TLMA*		*Ongoing*	*CAP*
	Sensitive Receptors					
AI 114	Create an Urban Tree Planting Program. The program should focus especially on	AQ 2.1, AQ 2.2, AQ 2.3, AQ 2.4,	*County of*	~~County Staff~~	*5-8 years*	

Action Item # ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe-* Target ~~Date Funding Source~~	*Status*
	protecting sensitive receptors from air quality impacts associated with existing and future development. A mitigation fee should be established to fund the program.	~~AQ 17.12~~	*Riverside*			
	Overall Vehicular Emissions Reduction					
AI 115	Create Transportation Management Associations (TMAs) to reduce vehicular emissions.	AQ 3.3, *AQ 20.8*	*County of Riverside*		*2-4 years*	
AI 116	Prepare an ordinance requiring major outdoor events to provide remote parking and shuttle services as well as discounted parking incentives for carpoolers.	AQ 11.1, AQ 11.2, AQ 11.3, AQ 11.4	*TLMA-PD*		*5-8 years*	
AI 117	Implement traffic synchronization programs to improve traffic flow.	AQ 12.1, AQ 12.2, AQ 12.3, *AQ 20.7, AQ 20.8,* C ~~21.5~~*21.4*, C ~~21.9~~*21.7*, C 24.1	*TLMA-TD*	*TLMA-PD*	*Ongoing*	
AI 118	Establish a program to convert County-owned vehicles to alternative fuels.	AQ 13.1, *AQ 20.27,* C ~~20.12~~ *20.14*	*County of Riverside Purchasing Department*			*Board Policy D-2 and A-64*
AI 119	Locate, map, inventory, and develop priorities for all at-grade railroad crossings where transit interrupts the flow of traffic and initiate Public Utilities Commission requests for grade separations.	AQ 12.4 C 13.5, C 23.4, C 23.5	*TLMA-TD*		*Ongoing*	
	Particulate Matter					
AI 120	Develop stricter control measures for the length of time commercial trucks may be idled, in collaboration with the EPA, SCAQMD and MDAQMD.	AQ 16.3, AQ 17.9, *AQ 22.1*	*TLMA-PD*	~~County Staff~~	*Ongoing*	*Through development review*
AI 121	Create a plan to identify and meet State and federal guidelines for diesel emissions.	AQ 16.4, AQ 17.8	*TLMA-PD*	~~County Staff~~	*0-2 years*	*CAP*
AI 122	Create a mitigation program to minimize impacts of projects that divert water from the Salton Sea. Thereafter, create an air quality monitoring program in the Coachella Valley designed to measure the impacts of these projects and amend the Air Quality Element as needed to meet state and federal air quality standards.	*OS 1.3*	~~T~~*TLMA-PD*		*Ongoing*	
AI 123	Identify and encourage alternative farming practices that farmers will find acceptable yet will reduce the impacts of particulate matter in the air.	AQ 17.1, AQ 17.5	~~T~~*TLMA-PD*	*County of Riverside Agriculture Commissioner's Office*	*Ongoing*	
	Greenhouse Gas Emission Reduction Strategy					
AI 146	*Adopt and implement a Climate Action Plan (CAP) and incorporate the included Implementation Measures (IMs) into the General Plan as an Appendix. The CAP includes a variety of IMs set forth by the Federal and State governments (known as Reduction Measures, A.K.A. "R-measures") Reduction Measures required by Federal and State law are shown as "R-1" Measures and are already required of all development applications and municipal operations. The CAP expands further on this practice and incorporates local Reduction Measures or R-2 Measures. The list of R2 measures divided into eight major categories, which are transportation, land use, energy use, water and biota use, waste generation, municipal (i.e., County) operations and existing uses not otherwise covered. efficiency the County can*	*AQ 17.10, AQ 18.3, AQ 19.2, AQ 20.1, AQ 20.2, AQ 20.3, AQ 20.4, AQ 20.5, AQ 20.7, AQ 20.8, AQ 20.20, AQ 20.24, AQ 20.25, AQ 20.27, AQ 20.28, AQ 20.29, AQ 20.30, AQ 21.4, AQ 22.1, AQ 24.1, AQ 25.1, AQ 25.3, AQ 26.1, AQ 27.1, AQ 27.2, AQ 28.2, AQ 29.1, AQ 29.2, AQ 29.3*	*TLMA-PD*			

Action Item # ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe-* Target ~~Date Funding Source~~	*Status*
	incorporate into the new development projects are to achieve an AB 32 compliant reduction target of 15% below existing emissions levels by the year 2020.					
AI 147	*Adopt, implement, and update a set of community protocol implementation and design measures to aid in the reduction of GHG emissions from new development authorized under the Land Use Element of the General Plan. The CAP includes Appendix F (Screening Tables) which incorporates the R-1, R-2, and the voluntary R-3 Reduction Measures from the CAP along with standardized reduction values (or points) that are associated with each set of reduction measures. In order for new development projects to achieve compliance with the County's CAP and \therefore with the County's General Plan, each project must achieve a minimum of 100 points for their project or provide an independent GHG emissions reduction analysis with equivalent reductions in GHG emissions.*	*AQ 17.10, AQ 18.4, AQ 18.5, AQ 19.3, AQ 19.4, AQ 20.10, AQ 20.11, AQ 20.12, AQ 20.13, AQ 20.18, AQ 20.19, AQ 20.21, AQ 20.23, AQ 20.26, AQ 21.1, AQ 21.2, AQ 22.1, AQ 23.1, AQ 23.2, AQ 26.1, AQ 26.2, AQ 27.1, AQ 28.1,*	*TLMA-PD*			
	Housing (action plan summary provided below)					
AI 124	Implement the ~~5~~ *8*-year Action Plan of the Housing Element in the General Plan. The ~~5~~ *8*-year Action Plan is located both in the Housing Element and at the end of this appendix.	AQ 6.1	*TLMA-PD*	*RC-EDA*	*Ongoing*	*General Plan Review Cycle*
AI 125	Ensure consistency with the Housing Element and the adopted General Plan.	*LU 3.1*	*TLMA-PD*	*RC-EDA*	*Ongoing*	*General Plan Review Cycle*
	Healthy Communities					
	Overall Health					
AI 136	*Regularly update the Riverside County Department of Public Health Strategic Plan to respond changes in health concerns related to the built environment and to reflect the policies in the General Plan.*	*HC 1.1, HC 1.2*	*DOPH*	*TLMA-PD*	2-4 years	
	Land Use and Community Design					
AI 137	*Implement a program to evaluate the impacts of new development on public health outcomes. Such a program might include a Health Impact Assessments or other tools. Once created, the tool should be used as part of the evaluation and approval process for development proposals.*	*HC 2.1, HC 3.1, HC 4.1, HC 4.2, HC 5.1*	*DOPH*	*TLMA-PD*	*0-2 years*	
	Healthy Transportation System					
AI 138	*Regularly analyze and map the location of cyclist and pedestrian injuries and develop a plan to mitigate problem locations.*	*HC 5.1, HC 5.2,HC 5.6,HC 9.1*	*DOPH*	*TLMA-PD*	*Ongoing*	
	Access to Healthy Foods and Nutrition					
AI 139	*Continue to implement and periodically update County programs to improve nutritional intake, such as the County Nutrition Action Plan, Women, Infants and Children (WIC) program and Food Stamps, and Champions for Change.*	*HC 2.2 HC 11.1,HC 11.2*	*DOPH*	*TLMA-PD*	*Ongoing*	
AI 140	*Conduct a study of county areas lacking full-service grocery stores and develop an economic development strategy to attract stores to deficient areas.*	*HC 2.2, HC 11.1, HC 11.2*	*DOPH*	*TLMA-PD*	*Ongoing*	
AI 141	*Develop and implement an educational campaign around nutrition and physical activity. Activities could include: presentations to school children, health fairs, checklists of healthy and unhealthy foods, etc.*	*HC 11.1, HC 11.2*	*DOPH*	*TLMA-PD*	*Ongoing*	
AI 142	*Implement a "safe routes to school" program for Community Development Areas in the county.*	*HC 3.3, HC 5.1, HC 5.2, HC 5.4, HC 5.6, HC 9.1, HC 9.5*	*DOPH*	*TLMA-PD*	*Ongoing*	

Action Item #. ~~Type~~	Administration Activities/Programs	*General Plan* Policy # Reference	Primary Resp. ~~*Consultant Rec*~~	Support Resp. ~~Source~~	*Timeframe-* Target ~~Date Funding Source~~	*Status*
AI 143	*Identify areas around schools with a high incidence of accidents, particularly those involving pedestrians and cyclists.*	*HC 5.1, HC 5.2, HC 5.6, HC 9.1*	*DOPH*	*TLMA-PD*	*Ongoing*	

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
GOAL 1: TO ASSIST IN THE DEVELOPMENT OF ADEQUATE HOUSING TO MEET THE COUNTY'S FAIR SHARE OF THE REGION'S HOUSING NEEDS FOR ALL ECONOMIC SEGMENTS OF THE POPULATION, WITH AN EMPHASIS ON LOWER INCOME HOUSEHOLDS AND HOUSEHOLDS WITH SPECIAL NEEDS.					
Policy 1.1: Encourage housing developers to produce affordable units by providing assistance and incentives for projects that include new affordable units available to lower/moderate income households or special needs housing.	1.1a: Use, to the greatest extent possible, all funding available for the production and subsidization of low and moderate income housing. Utilize public financing tools when available, including but not limited to: multi-family revenue bonds, the CDBG Housing Loan Fund, HOME funds, RDA Set-Aside funds to provide low interest loans, and where feasible, leverage other state and federal financing obtained by the developer (e.g. Low Income Housing Tax Credits [LIHTC], CHFA multi-family housing assistance programs, HCD Multi-family Housing Loans), and other financing available. All projects receiving public assistance will be required to remain affordable in compliance with the requirements of the program in which they participate.	Review and revise, if necessary, the County's Fast Track Policies. Develop an affordability ordinance that provides direction and incentives to the development community to encourage areas and opportunities for affordable housing developments	See Implementing Resources summary table	EDA/RDA/ Housing Authority	2014 for implementation
	1.1b: Continue utilization of tax exempt revenue bonds for the financing of new multi-family construction.	Tax Exempt Private Activity Bond Program	County tax allocation bonds; California Debt Limit Allocation	Housing Authority	Continue program through planning period -2014
	1.1c: Continue to utilize federal and state funding programs to assist prospective owners and renters of mobile homes in funding the purchase and/or installment of mobile home units.	Agricultural Housing Assistance Loan Fund, Mobile Home Tenant Assistance Loan Program, HCD Mobilehome Park Resident Ownership Program, HCD CalHOME Program, HCD Joe Serna Jr. Farmworker Housing Grant Program (FWHG)	RDA Set-Aside Funds, USDA Rural Development, HCD	EDA	Annually, or in response to the Notice of Funding Availability (NOFA)

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	1.1d: Continue to offer fast track/priority processing, gap financing options, density bonus and fee subsidies to developers of County-assisted projects proposing new housing, mixed-use or infill projects affordable to lower income households, farmworkers, seniors, and other special needs groups.	CDBG Housing Loan Fund, State Density Bonus Program Review programs annually and revise is necessary	CDBG, General Fund HOME, RDA Set Aside	EDA/RDA/ TLMA	Review annually through end of planning period
	1.1e: In addition to waiving Ordinance 659 development fees to proponents of mobile homes on non-permanent foundations, second units, and publicly subsidized projects for low income households, consider waiving selected fees for projects proposing units affordable to households with incomes below 80% of the County median in all planning areas.	Ordinance No. 659- fees are waived for second units, publicly-subsidized projects for low income households, and projects with affordable housing components.	General Fund	TLMA/EDA	Continue wavier policy
	1.1f: Where feasible and/or necessary, the County shall offer assistance with land acquisition, off-site infrastructure improvements, and other up-front costs, as well as assistance in securing federal or state housing financing resources for projects which reserve a proportion of units affordable to households with incomes below 80 percent of the County median.		RDA Set-Aside, HOME, CDBG	EDA, TLMA	Review resources on an annual basis through 2014
	1.1g: Consider adopting a special density bonus provision, or other incentives to promote the construction of rental housing with three or more bedrooms.		General Fund	TLMA	Develop an affordable housing incentives provision or ordinance to be adopted as part of 2013 General Plan update.
	1.1h: Give priority to permit processing for non-County assisted projects providing affordable housing when requested. Expand application of processing priority to projects providing housing for seniors and other special needs groups.		General Fund	TLMA	Additional policies and procedures should be adopted with the new zoning ordinance that would prioritize affordable housing projects.
	1.1i: Promote the continued use of density bonus provisions on a case by case basis to provide affordable housing, particularly in high density, mixed-use and infill areas.	Develop an affordability ordinance that provides direction and incentives to the development community to encourage areas and opportunities for affordable housing developments that	General Fund, (RDA Set-Aside, HOME and CDBG funds to support financial incentives)	TLMA/EDA	2014 for implementation

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
		also implements State law			
	1.1j: Review State Density Bonus provisions and adopt ordinance as part of the Comprehensive General Plan Update to ensure consistency with state law.	General Plan Incentives Program	General Fund	TLMA	Consider adopting affordable housing incentives program, including density bonuses where appropriate, as part of the 2013 General Plan Update.
	1.1k Develop fee assistance program where the amount and type of fees waived is predicated in the number of affordable units proposed. (As number of affordable units increases, the amount of fee subsidy or waiver increases)			TLMA	Consider as part of affordable housing incentive program.
	1.1l: Expand recruitment of Community Housing Development Organizations (CHDOs) under the HOME program.	Review program and if necessary, increase staffing levels and resources to assist in outreach	HOME	EDA	Review annually through planning period.
	1.1m: Continue to exempt publicly subsidized projects for low income households per Ordinance 659.	Ordinance No. 659. Implement a tracking mechanism to review performance.		TLMA	Review exemptions on a quarterly basis.
	1.1n: Work with public or private sponsors to make applications to State and Federal housing programs for new construction of rental housing for seniors and other special needs, and take all actions necessary to expedite processing and approval of such projects.	See Implementing Resources Matrix for other special needs housing funding(Table H-58)	HUD, State	EDA	Continue policy.
	1.1o: The County will encourage the development of housing for extremely low-income households through a variety of activities such as outreach to housing developers on an annual basis, providing financial assistance (when feasible) or in-kind technical assistance or land writedowns, providing expedited processing, identifying grant and funding opportunities, applying for or supporting applications for funding on an ongoing basis, reviewing and prioritizing local funding at least twice in the planning period, and/or offering additional incentives beyond the density bonus.		General Fund	EDA	Ongoing, as projects are processed, and annual outreach with local developers
Policy 1.2: Ensure the availability of suitable sites for the development of affordable housing to meet the needs of	1.2a: Utilize HOME and Redevelopment Set-aside funds to write down land costs of acquiring sites and CDBG funds for off-site improvements for	Annual review projects assisted.	HOME, CDBG, RDA Set-Aside	EDA/RDA	56 projects were assisted from 2006-2008. Make all attempts to keep on par with

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
all household income levels, including farmworkers and other special needs populations.	projects for lower income households where feasible.				new projects provided funding constraints.
	1.2b: Work with public or private sponsors to identify candidate sites for new construction of rental housing for seniors and other special needs, and take all actions necessary to expedite processing and approval of such projects.			EDA/TLMA	Set a goal of 10 private projects for next planning period.
	1.2c: Continue to allow the development of affordable housing in the R-6 zone, or similar zoning concepts. Utilize incentives for development within this zone as established in Ordinance No. 348, or as provided in the General Plan.	Ordinance No. 348 Develop an affordable housing ordinance that will augment the R-6 zoning and offer new opportunities to private developers		TLMA	2014 for implementation
	1.2d: Identify areas of the County with adequate infrastructure and limited environmental constraints that are most suited to the construction of housing, particularly housing affordable to low/moderate income households, and high density product types.	Riverside County Housing Element 2006-2014 Site Inventory		TLMA/GIS Section	Following adoption of General Plan update - 2002.
	1.2e: As part of the General Plan update process, establish a Land Use Inventory which provides the mechanism to monitor acreage and location, by General Plan designation, of vacant and underutilized land, as well as buildout of approved projects, utilizing the County's GIS system and supported by mapping. Update the Land Use Inventory on an annual basis. (Also see Policy 4.2, Action 4.2b.)			TLMA/GIS Section	Sites have been identified through site inventory. Program complete.
	1.2f: Utilize the County GIS system to facilitate preliminary strategic planning studies to identify vacant or underutilized commercial properties for infill construction or adaptive reuse in high density areas.	County GIS/County General Plan Update		EDA/TLMA/ GIS Section	Implementation shall take place through 2013 General Plan Update
	1.2g: Where feasible, the County shall work with non-profits in the development of County owned sites in planning areas where affordable housing is needed. Combine provision of sites with other subsidy/assistance programs.	County GIS/County General Plan Update	HOME, RDA Set-Aside, CDBG, other federal and state funding sources	EDA/RDA	Concurrent with Comprehensive Plan update for 2013
	1.2h: Identify areas of the County where urban infill is appropriate based on General Plan land use			TLMA/EDA/GIS	Establish targets for number of housing units to be

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	policy and Area Plan designations, and encourage infill development through the use of incentives.				provided.
	1.2i: As part of the General Plan update, designate residential land use districts in the unincorporated County within close proximity to major transportation corridors and transit nodes with more intensive uses and mixed-use development. Designate less intensive uses in more rural areas.		General Fund	TLMA	Concurrent with Comprehensive General Plan update for 2013.
	1.2j: Ensure that redevelopment revitalization plans include provisions for new affordable housing for projects within established redevelopment and target areas.	RDA Sub-area plans	RDA Set-Aside	RDA	Annually review RDA Sub-area plans to ensure through the planning period.
	1.2k: Maintain an inventory of County owned lands with potential for low and moderate income housing.			TLMA/ EDA	Estimate how many affordable units might be created through this approach
	1.2l: The Housing Authority shall continue to develop new affordable very low income rental housing units under the HUD Public Housing Development Program and State tax exempt private activity bond financing.	HUD Public Housing Development Program, Tax Exempt Private Activity Bond Program	HUD, CDLAC	Housing Authority	86 units quantified for assisted under the Housing Authority's HUD public housing development program.
	1.2m: Encourage potential developers to identify candidate vacant sites and underutilized properties by referring them to the County's Land Use Inventory.			EDA/TLMA/ GIS Section	Land Use Inventory is available for developers to identify candidate sites.
	1.2n: Consider land-swapping of County land and other incentives for the provision of affordable housing projects.		HOME, RDA Set-Aside, CDBG	EDA	Continue policy. EDA will consider land swapped for development of affordable housing.
	1.2o Prepare a land inventory of sites suitable for farmworker housing in the Coachella Valley as a priority.			TLMA	Concurrent with Land Use Element Update (2013)
	1.2p Identify appropriately zoned land transferred to the new Cities of Wildomar and Menifee to determine their fair share of the County of Riverside's RHNA housing target for the current planning period.		Transfer agreements to be negotiated with newly-incorporated cities.	TLMA, RCEO	Prepare agreement and have in place with cities by 2010.
	1.2q The County will continue to allow for reduced parking requirements for senior and affordable housing projects as well as pursue the following revisions to the County's parking standards to more		General Fund	TLMA	Review alternative parking options and revise as necessary by December 2013

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	easily accommodate higher densities on multi-family and mixed use sites. Further study of these revisions shall be conducted before changes to the Zoning Ordinance are made: • Reductions in the number of spaces required for affordable or senior housing projects, if it can be demonstrated that the expected tenants will own fewer cars than the regular standards anticipate – or if spaces will not be "pre-assigned" to specific units in the project. • Allowances for some of the spaces to be tandem or uncovered, provided that none of the spaces extend into the front yard setback. • Standards for "shared parking" when uses with different peaking characteristics (such as offices and apartments) are combined in a single structure. • Reductions to the space requirements for studio and one-bedroom apartments (presently 2 spaces per unit) • In addition, the County should explore the feasibility of an ordinance which would prohibit the long-term storage of cars in designated parking spaces in multi-family complexes, thereby ensuring that the spaces may remain available for tenant use. The County will also evaluate the associated costs with the current parking requirements to ensure they are not a constraint on development.				
	1.2r The County will provide for the inclusion of mixed-income housing in future new growth areas of the county through development agreements and other mechanisms. To facilitate the development of affordable housing on smaller parcels (50 to 150 units in size), the County will routinely coordinate with property owners and give high priority to processing subdivision maps that include rezoned R-4 sites or affordable housing units. Also, an expedited review process will be available for the subdivision of larger sites into buildable lots where the development application can be found consistent with the General Plan and applicable		General Fund	TLMA	Ongoing, as projects are processed.

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	Specific Plan.				
	1.2s The County will amend its Zoning Ordinance to comply with Government Code Section 65852.2 (AB1866) and remove the one acre min lot size requirement for second units.		General Fund	TLMA	Amend the Zoning Ordinance by December 2013
	1.2t. To ensure the County has enough land to meets its Regional Housing Needs Allocation (RHNA), the County will amend the Land Use Map of this General Plan to add a minimum of 595 acres to the Highest Density Residential designation (HHDR). The County has identified several possible sites to redesignate (see Appendix B). All rezoned sites will permit owner-occupied and rental multi-family developments by right and will not require a conditional use permit, a planned unit development permit, or any other discretionary review. All sites will accommodate a minimum of 20 units per acre and at least 16 units per site, per state law requirements. Although density is not determined by the zoning, to ensure multi-family development is permitted, the County will also rezone the sites to the R-4 zone permitting owner-occupied and rental multi-family development by right.		General Fund	TLMA	Amend the Land Use Map and rezone sites by October 2013.
Policy 1.3: Assist in the development of new farmworker housing.	1.3a: Continue to provide funding resources through the Federal HOME program, the County Housing Loan Fund (CDBG) and Redevelopment Agency 20% Set-aside funds to non-profit organizations for the development of farmworker housing.	CDBG Housing Loan Fund, Agricultural Housing Assistance Fund Program	HOME, RDA Set-Aside, CDBG	EDA	4,603 units quantified for construction between 2006 – 2014
	1.3b: Prepare a Countywide Gaps Analysis and Farmworker Housing Plan to be integrated into the Department of Community Action's Annual Local Plan			CRLA, Dept. of Community Action	2009
	1.3c: Continue to work with non-profit organizations such as CVHC and Habitat for Humanity in the production of self-help housing for ownership and multi-family farmworker housing opportunities.			EDA, non-profit organizations	888 units quantified for construction between 2006 – 2014
	1.3d: Develop incentives for the set-aside of agricultural land for farmworker housing.			EDA/TLMA	Continue policy and study feasibility of using Williamson Act land.

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	1.3 e The County will amend the Zoning Ordinance, to comply with Health and Safety Code Sections 17021.5 and 17021.6. For the purpose of all local ordinances, employee housing shall not be deemed a use that implies that the employee housing is an activity that differs in any other way from an agricultural use. No conditional use permit, zoning variance, or other zoning clearance shall be required of this employee housing that is not required of any other agricultural activity in the same zone. The permitted occupancy in employee housing in an agricultural zone shall include agricultural employees who do not work on the property where the employee housing is located.		General Fund	TLMA	Amend the Zoning Ordinance by December 2013.
Policy 1.4: Assist in the development of additional housing for the mentally disabled.	1.4a: Recruit and train a Mental Health Housing Coordinator or services coordination by a non-profit organization			Department of Mental Health	Continue
	1.4b: Support current legislation to block grant Supportive Housing Program and Shelter Plus Care Program Funds	Supportive Housing Program, Shelter Plus Care	HUD	Department of Public Social Services	Meet quarterly with County Legislative Advocates to address implications of new legislation
	1.4c: Develop design criteria for housing suitable for the mentally disabled for use by affordable housing developers	Develop an affordability ordinance that will include design criteria and build upon current fee exemptions and fast track authority that currently provides assistance for affordable housing units for the mentally disabled.		Department of Mental Health in conjunction with EDA	Implement by 2014
	1.4d: Update the 1993 "Assessment of the Status and Problems of Homeless Mentally ill Persons in Riverside County"			Department of Mental Health	2010
	1.4e: Promote the integration of special needs housing into affordable housing communities as disabled development projects maximize community opposition, add to development financing difficulties and segregate persons with mental health disorders, promoting stigma.	Special needs housing will be integrated into proposed affordable housing ordinance		Department of Mental Health	Implement by 2014
	1.4f: Continue the Shelter Plus Care Program through addition of permanent housing facilities for the mentally disabled, as funding is available, and implement a new program to provide safe havens to	Shelter Plus Care Program Safe Haven for the Mentally Ill Program	HUD	Department of Public Social Services	268 beds were established during 1995 – 2008. Goal to meet or to exceed previous amount.

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	the mentally ill.				
Policy 1.5: Assist in the development of additional emergency, transitional and permanent supportive housing for homeless persons and families.	1.5a: Support current legislation to block grant Supportive Housing program and Shelter Plus Care Funds and modify the current fair share funding ratio to allow for multiple continuums.			Department of Public Social Services	Ongoing.
	1.5b: Ensure that the Local Emergency Shelter Strategy includes provisions for new construction of special needs permanent housing			Department of Public Social Services	Annually.
	1.5c: Ensure that evaluation criteria for Supportive Housing applications include provisions for new construction of units, not merely numbers of beds.			Department of Public Social Services	2009
	1.5d: Continue to participate in the Continuum of Care Supportive Housing Program and Shelter Plus Care Program. (See also 1.4f)	Supportive Housing Program/Shelter Plus Care program	HUD	Department of Public Social Services	See item 1.4 f
	1.5e: Develop transitional housing facilities in established regions of the County where transitional housing shelters are needed, in cooperation with non-profits and local jurisdictions.	Supportive Housing Program	HUD	Department of Public Social Services	Maintain current funding. Utilize the County's 10-Year Plan to End Homelessness and the POLIS Project to site facilities.
	1.5f: Expand the number of emergency shelters in identified areas of Riverside County in cooperation with non-profit organizations and local jurisdictions	Emergency Housing Assistance Program, Emergency Shelter Grants, FEMA	HCD	Department of Public Social Services	Ensure the emergency shelter needs of mentally ill and domestic violence victims are addressed.
	1.5g: Amend Ordinance 348 to include use and occupancy requirements for transitional and emergency shelters as follows: a. Allow for emergency shelter in the I-P zone by right without discretionary review Add the current definition of transitional housing and supportive housing and to permit transitional and supportive housing types as residential uses and subject only to those restrictions that apply to other residential uses of the same type in the same zone.	Ordinance 348	General Fund	TLMA	Amend the Zoning Ordinance by December 2013
Policy 1.6: Support Self Help Housing programs (e.g. Habitat for Humanity and CVHC)	1.6a: Identify and recruit Habitat for Humanity chapters within Riverside County as Community Housing Development Organizations (CHDOs) under the HOME Program.		HOME	EDA	Establish a quarterly meeting schedule with Habitat for Humanity to provide policy direction.
	1.6b: Continue to work with Habitat for Humanity and Coachella Valley Housing Coalition in providing homeownership opportunities through the Rural Development Self Help program and other	Rural Development Self Help Program (refer to Implementing Resources matrix for	HOME, HUD, Redevelopment Set-Aside	EDA	See objective in 1.6a

Housing Element Five-year Action Plan Summary					
POLICIES	**ACTIONS**	**IMPLEMENTING PROGRAMS**	**IMPLEMENTING RESOURCES**	**RESPONSIBLE AGENCY**	**QUANTIFIED OBJECTIVE AND/OR TIME FRAME**
	self-help construction programs.	additional programs/funding (Table H-58))			
Policy 1.7: Encourage innovative housing, site plan design and construction techniques to promote new affordable housing by the private sector.	1.7a: Continue to provide for greater flexibility in the design of single family development through the processing of PDs, Specific Plans, and Area Plans, and application of density bonus provisions, when requested, to allow for varying lot sizes and development standards than normally required in residential districts.	Develop an affordable housing ordinance that will implement State Housing Law and Density Bonus provisions. Update Ordinance 348 to provide for greater flexibility for high density development. Update County's General Plan to provide additional policies that compliment affordable housing development from private developments.		TLMA/Building and Safety	Implement by 2014
	1.7b: Maintain those provisions of Ordinance No. 348 providing opportunities for the lawful establishment of second units.			TLMA/Building and Safety	Provisions have been established
	1.7c: Continue to allow mobile homes in single family residential zones "by right," and mobile home parks subject to a CUP, and encourage construction of new mobile home parks and manufactured housing to increase the supply of affordable dwelling units. Continue to waive the fees associated with Ordinance No. 659 as an incentive.			TLMA/Building and Safety	Provisions have been established including Fast track Authorization for any affordable housing/farm worker housing mobile home park
	1.7d: Encourage new large scale development proposals to provide a range of housing types and densities for all income levels through the use of creative planning concepts such as specific plans and mixed-use development.	Update Ordinance 348 to establish design standards and specific criteria to encourage such developments. Provide for an affordability ordinance to regulate/mandate affordable housing development in Specific Plans. Continue use of Fast Track process.		TLMA	Implemented by 2014
	1.7e: Encourage multi-family housing developers to designate accessible and/or adaptable units already required by law to be affordable to persons with disabilities or persons with special needs.	See Program 1.7d		EDA/County Counsel	Implemented by 2014

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	1.7f: Evaluate existing specific plans with affordability restrictions and develop minimal affordability thresholds and criteria			EDA/TLMA	Adopt countywide provisions, thresholds or criteria for affordability to be used in the design of Specific Plans following adoption of General Plan update in 2008.
	1.7g: Encourage "universal design" features such as level entries, larger bathrooms, and lower kitchen countertops to accommodate persons with disabilities.		General Fund	TLMA	Continue to enforce regulations and requirements.
GOAL 2: TO CONSERVE AND IMPROVE THE CONDITION OF THE HOUSING STOCK, PARTICULARLY AFFORDABLE HOUSING.					
Policy 2.1: Continue to pursue all available federal, state and local funds to assist housing rehabilitation.	2.1a: Advertise and promote the availability of funds for the rehabilitation of single family and mobile home dwelling units through the CDBG Minor and Enhanced Senior Home Repair Program and the two components of the Housing Rehabilitation Program: the RDA Set-Aside funded RHRP in unincorporated County and the CDBG funded CHRP in incorporated cities. Continue to distribute informational materials throughout redevelopment target areas.	Housing Rehabilitation Program (RHRP and CHRP), Minor and Enhanced Senior Home Repair Program	CDBG in participating jurisdictions, RDA Set-Aside in Unincorporated Area	EDA/RDA	Procedures are established and will continue
	2.1b: Advertise and promote the availability of funds administered by the County for the rehabilitation of multi-family units using HOME, CDBG Housing Loan Fund, and Redevelopment Set-Aside funds, as well as the HCD Multifamily Housing Loan Program available to developers through the State. Continue to distribute informational materials throughout redevelopment target areas.	HOME, CDBG Housing Loan Fund, HCD Multifamily Housing Loan Program	HUD, CDBG, HCD, RDA Set-Aside, HOME	EDA/RDA	Procedures are established and will continue
	2.1c: Continue to utilize the Mobile Home Park Assistance Loan Fund and Mobile Home Tenant Assistance Loan programs for the rehabilitation of mobile homes in the Coachella Valley, as well as the Agricultural Housing Loan Fund.	Mobile Home Park Assistance Loan Fund, Mobile Home Tenant Assistance Loan Program, Agricultural Housing Loan Program	RDA Set-Aside	EDA	888 units were quantified for construction during the planning period.
	2.1d: The Housing Authority, to the extent feasible, will pursue all available federal and state funds to modernize all public housing units affordable to very low and low income households		HUD Capital Funds	Housing Authority	Meet or exceed the quantified objectives from last planning period utilizing this funding.
	2.1e: Continue utilization of tax exempt private		Tax Exempt Private	EDA/Housing	424 multi-family units were

Housing Element Five-year Action Plan Summary

POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	activity bonds for the financing of multi-family housing rehabilitation.		Activity Bonds	Authority	rehabilitated during previous period. Meet or exceed through current period.
	2.1f: Research funding for historic preservation of structures, such as adoption of a Mills Act ordinance which would give property tax relief for rehabilitation of historic property, as well as grants for the identification of historic structures.	Inner Cities Venture Fund, National Preservation Loan Fund	National Trust for Historic Preservation	EDA	Continue the pursuit of funding and grant opportunities.
	2.1g: Continue to provide funding from the Redevelopment Agency and CDBG funded Housing Rehabilitation Program to retrofit units to meet accessibility standards.		RDA Set-Aside, CDBG	EDA/Building and Safety Department	509 special needs units were quantified for assistance/ construction during the planning period.
	2.1h: Consider the adaptive reuse of small older motels to transitional housing facilities, emergency shelters or Single Resident Occupancy (SROS) in conjunction with qualified non-profit organizations. (Also see Policy 3.5, Action 3.5c.) In addition, the County will amend the Zoning Ordinance to define single-room occupancy units (SROs) and allow them to be permitted in the General Commercial Zone (C-1/C-P) with a conditional use permit.	Supportive Housing Program, Emergency Housing Assistance Program, HUD SRO Moderate Rehabilitation Program	HUD, HCD	DPSS, TLMA, non-profits, EDA	No cases have resulted; however, program should continue and research should be continued. Amend the Zoning Ordinance by December 2013.
	2.1i: Department of Community Action (DCA) shall continue to implement the Home Weatherization program to conserve existing single family housing through weatherization and/or rehabilitation.	County HOME Weatherization Program, County Low Income Home Efficiency Assistance Program	Department of Energy, Southern California Gas, California Conservation Corp.	DCA	As part of an ongoing program, target 1,600 households in the incorporated portion of the County and 800 households in the unincorporated County.
Policy 2.2: Enhance the quality of existing residential neighborhoods by including adequate maintenance of public facilities in the County's capital improvement program and requiring residents and landlords to maintain their properties in good condition.	2.2a: Continue to utilize RDA Set-Aside funding to eliminate conditions of blight, rehabilitate affordable units within the project areas, expand housing opportunities for low and moderate income households, and expand employment opportunities in selected target areas.		RDA Set-Aside Funds	EDA/RDA	Quantified objectives are included herein from RDA Set-Asides. 115 single-family units and 1,170 multi-family units are planned for construction.
	2.2b: Action: Ensure that currently sound housing is maintained through code enforcement activities.	Code Enforcement Ordinance No. 457		Building and Safety	Code Enforcement procedures, including a new

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	Continue to administer the Code Enforcement Program per Ordinance No. 457 to eliminate substandard conditions in residential units and continue inspections and permitting for the maintenance, use and occupancy of mobile home parks.	Code Enforcement prioritizes safe and sound housing opportunities and maintenance of the County's existing housing stock. Priority permitting, including by not limited to, Fast Track Authorization is offered to residential code actions.		Department/ Department of Environmental Health	case tracking system, has been upgraded and is on-line since 2009.
	2.2c: Maintain and improve community facilities, and infrastructure in sound condition utilizing available CDBG and RDA Set-Aside funds.	Redevelopment 5-Year Implementation Plan, Consolidated Plan	CDBG, RDA Set-Aside	EDA/RDA	328 beds within community facilities have been established with associated upgrades. Meet or exceed previous objectives.
	2.2d: Continue and enhance outreach efforts to educate and inform communities about available rehabilitation programs through: presentations at community service organizations (PTA, Kiwanis); brochures, as well as presentations at community facilities such as medical facilities, county government offices and one-stop processing centers within participating jurisdictions.	Outreach is coordinated through RDA staff.		EDA/DCA	Establish quarterly meetings with service organizations to evaluate and revise, if necessary, outreach policies.
	2.2e: EDA shall continue to work with each cooperating city so that each city can assume its fair share responsibility for rehabilitation of existing housing.	EDA Staff meets regularly with Cities as they update their Housing Element		EDA	Establish an annual reporting of fair share contributions.
	2.2f: Environmental Health shall continue to respond to household sanitation complaints in respect to Ordinance No. 650 and No. 657.	Ordinance No. 650 and No. 657 are implemented by Environmental Health Staff on a case-by-case basis		Environmental Health Department	Programs are successful and will continue.
	2.2g: HCD shall continue to implement the employee housing (farm labor camp) enforcement program.	HCD Employee Housing Enforcement Program		HCD	Ongoing.
Policy 2.3 Facilitate rehabilitation and preservation of farmworker housing.	2.3a: Conserve existing affordable mobile home housing stock, utilizing the Mobile Home Park Loan Fund and Mobile Home Tenant Assistance Loan programs funded by CDBG, as well as the Agricultural Housing Assistance Fund which provides financial aid in the form of an at or below market interest rate loan up to $75,000 to bring	Mobile Home Tenant Assistance Program, Mobile Home Park Assistance Loan Program, Agricultural Housing Assistance Loan Fund	RDA Set-Aside Funds, CDBG	EDA/RDA	See Policy 2.1.C

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	existing agricultural facilities up to code.				
	2.3b: Consolidate the Mobile Home Tenant Assistance Grant program with the Mobile Home Tenant Assistance Loan program and increase the maximum loan amount to $35,000 per unit to accommodate replacement of existing substandard units.	Mobile Home Tenant Assistance Loan program	RDA Set-Aside	EDA	500 units were rehabilitated during the previous planning period. 357 units are programmed for current period.
	2.3c: Organize bilingual outreach materials and activities to educate and inform the farmworker community about available rehabilitation programs and resources.	Bilingual outreach programs are in process and coordinated by RDA staff with assistance from non-profits, service organizations, and community volunteers		EDA	Establish annual reporting on policy with quarterly meeting schedule of stakeholders.
Policy 2.4: Preserve the affordability of federal, state and county subsidized units at risk of conversion to market rate, or other affordable housing resources.	2.4a: Ensure that affordable housing assisted with public funds remains affordable for the required time period through maintenance of an inventory of assisted units with monitoring of expiration dates on an annual basis.	Public and private projects, utilizing such public funds, are required to record covenants on property title for a period of 55-years.		EDA/Housing Authority/RDA	Establish an annual review of existing covenants and update as necessary.
	2.4b: Place a priority on providing financial assistance, where feasible, to preserve federal or state assisted, bond financed, density bonus, RDA assisted or other types of affordable units at risk of conversion to market rate during the planning period through purchase of the units by a non-profit organization, assisting with low or no interest loans for rehabilitation, bond refinancing, and referral to other federal or local sources of below market financing.		RDA Set-Aside funds, HOME, CDBG and other federal and local funding resources	EDA	No projects or units have been found at-risk. Monitoring will continue.
	2.4c: Assist non-profit and for profit organizations with the acquisition and preservation of assisted single family and multi-family units affordable to low and moderate income households.		RDA Set-Aside funds, HOME, CDBG and other federal and local funding resources	EDA/RDA	1,681 units were preserved during previous period. Meet or exceed previous goal.
	2.4d: The County Housing Authority shall continue to work with HUD, private management companies, non-profit organizations, and participating cities, as applicable, to maintain subsidized projects.		LIHPRA and other resources available for acquisition/ rehabilitation and rental subsidy. Refer to	Housing Authority/EDA	268 beds were created during the previous period. Annual reporting of all facilities is in place and maintenance occurs as needed.

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
			Implementing Resources Matrix. (Table H-58)		
	2.4e: Continue to require maintenance of newly provided affordable housing projects through affordability covenants with the project proponent and the RDA, EDA or Housing Authority.	See Implementing Program for Policy 2.4a		RDA/EDA/ Housing Authority	Condition of approval provide for the establishment of these requirements. In the case of public projects, covenants are recorded on the subject title.
	2.4f: Develop strategies to maintain affordability of 63 identified at-risk units scheduled to expire in 2018.	All practical and legitimate programs for maintaining affordability should be examined.		EDA	Have strategies identified and in place by 2014 to be included in next Housing Element update.
GOAL 3: TO PROMOTE EQUAL HOUSING OPPORTUNITIES FOR ALL PERSONS REGARDLESS OF RACE, AGE, SEXUAL ORIENTATION, RELIGION, SEX,					
Policy 3.1: Continue to support fair housing laws and organizations that provide fair housing information and enforcement.	3.1a: Continue to utilize the services of the Fair Housing Council of Riverside County to implement a number of programs, including: 1. Audits of lending institutions and rental establishments 2. Education and training of County staff 3. Education and outreach to apartment owners, associations, management companies, lending institutions, building industry associations, homebuyers and residents in emergency shelters and transitional housing facilities.	The Fair Housing Council provides services to both Cities and Counties.	CDBG	Fair Housing Council/EDA/ Housing Authority	EDA staff coordinates with the Fair Housing Council and monitors their work program. Funding is proposed to continue to establish existing efforts.
	3.1b: Update the 2003 Fair Housing Impediments Study			EDA/Fair Housing Council	2011.
	3.1c: Ensure that actions to remove fair housing impediments identified in the 2003 Study will be reflected in the General Plan Update cycle.			TLMA/EDA	Covered in Housing Element update.
	3.1d: Provide financial assistance from CDBG to fair housing (See also 3.2b).	CDBG Funds are transferred via EDA/RDA staff	CDBG	EDA	EDA/RDA Staff regularly coordinates and monitors work programs of the Fair Housing Council, including, but not limited to First Time Home Buying programs.
Policy 3.2: Provide housing information and counseling to low-income households and households with special	3.2a: EDA shall continue to provide education and training for mortgage lenders applying for certification or re-certification to participate in the	First Time Homebuyers Down Payment Assistance	RDA Set-Aside	EDA	EDA staff regularly reports graduates of training programs. No specific target

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
housing needs.	First Time Home Buyers Down Payment Assistance Program.	Program			has been established.
	3.2b: Continue to use the services of the Fair Housing Council to provide education and outreach services to the public in both Spanish and English (See also 3.1d).	First Time Homebuyers Down Payment Assistance Program		Fair Housing Council/EDA	EDA/RDA Staff regularly coordinates and monitors work programs of the Fair Housing Council, including, but not limited to First Time Home Buying programs.
Policy 3.3: Provide housing services to persons with special needs, including child care, and the homeless.	3.3a: Continue to facilitate coordination between the County, participating jurisdictions, non-profit agencies and community groups to implement food programs, emergency shelters and homeless assistance programs, including the Supportive Housing Program, the Shelter Plus Care Program and the Emergency Housing Assistance Program.	Supportive Housing Program, Shelter Plus Care, Emergency Housing Assistance Program	HUD, ESG, FEMA, HCD, HOME	DPSS	Coordination continues to occur between EDA/RDA staff and community groups. Units produced have been detailed within the Housing Element.
	3.3b: Ensure that persons with disabilities have increased access/placement in residential units rehabilitated or constructed through County programs. Continue to cooperate with non-profit agencies that provide placement or referral services for persons with disabilities. The County will develop and formalize a general process that a person with disabilities will need to go through in order to make a reasonable accommodation request.	SHARE Program The provision of an affordable housing ordinance will establish standards for special needs.		Shared Housing, a Riverside Experience (SHARE), Housing Authority, Non-profits and Community Access Center, DPSS	Implement ordinance by 2014. Develop a reasonable accommodation procedure by December 2013.
	3.3c: Increase housing choice for persons with disabilities through retrofit of existing housing and the continued enforcement of ADA requirements.	Through the establishment of a new affordability ordinance coupled with a GIS analysis to establish the best location for special need housing choices		Community Access/ Building and Safety	Provide information to Community Access and County staff for dissemination and public outreach.
	3.3d: The Housing Authority shall continue to work in cooperation with local organizations that provide referral and support services to persons with disabilities.	The Housing Authority continues to coordinate and outreach with special need communities.		Housing Authority, DPSS	Establish quarterly reporting by the Housing Authority in their coordination and outreach to special needs communities.
	3.3e: Continue to provide rental certificates to persons with disabilities (Housing Choice Voucher Program previously known as Section 8 Rental Assistance Program).	Mainstream Housing Opportunities for Persons with Disabilities program/Housing Choice Voucher Program (previously	HUD	Housing Authority	Establish a reporting mechanism to track rental certificates.

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
		known as Section 8 Rental Assistance Program)			
~~3.3f: Continue to refer eligible participants to the SHARE program.~~	*3.3f: Continue to refer eligible participants to the SHARE program.* ~~SHARE Program~~	The Department of Public Social Services provides education and management of the SHARE Program.	Shared Housing a Riverside Experience (SHARE), DPSS	DPSS	870 units have been provided under this program under the previous period. Set goal to meet or exceed program through DPSS
	3.3g: The Department of Public Social Services will continue to administer homeless programs and services, and seek provision of additional emergency shelter, transitional and permanent supportive housing facilities in cooperation with non-profit organizations and homeless service providers. (See also 1.5e and 1.5f) ~~Supportive Housing Program, Shelter Plus Care, Emergency Housing Assistance Program, FEMA~~	The Department of Public Social Services provides Supportive Housing Program, Shelter Plus Care, Emergency Housing Assistance Program and FEMA programs.	HUD, HCD, FEMA, ESG, HOME	DPSS	Continue. DPSS will focus on development of permanent supportive housing units
~~3.3h: Continue to utilize the following programs to assist special needs households:~~ ~~1. Housing Choice (Section 8 Certificates)~~ ~~2. Family Unification Program~~ ~~3. Family Self Sufficiency Program~~ ~~4. Housing Opportunities for Persons with AIDS (HOPWA)~~ ~~5. Veteran's Affairs Supportive Housing Program (VASH~~ ~~6. Foster Care Youth Program~~ ~~7. Tenant Based Rental Assistance Program.~~	*3.3h: Continue to utilize the following programs to assist special needs households:* *1. Housing Choice (Section 8 Certificates)* *2. Family Unification Program* *3. Family Self Sufficiency Program* *4. Housing Opportunities for Persons with AIDS (HOPWA)* *5. Veteran's Affairs Supportive Housing Program (VASH* *6. Foster Care Youth Program* *7. Tenant Based Rental Assistance Program.* ~~HUD Housing Choice Voucher Program (Section 8 Rental Assistance)/ Family Unification Program/Family Self-Sufficiency Program /HOPWA /VASH/ Foster Care Youth Program/TBRA~~	*HUD Housing Choice Voucher Program (Section 8 Rental Assistance)/ Family Unification Program/Family Self-Sufficiency Program / HOPWA /VASH/ Foster Care Youth Program/TBRA*	HUD	Housing Authority, EDA, DPSS	7,255 Section 8 vouchers were issued on an annual basis between 1998 – 2005 within incorporated cities and 570 annually within the unincorporated county. Program will continue as funding is obtained.

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
~~3.3i: The Housing Authority shall continue its collaborative agreement with Riverside County Department of Mental Health to administer Shelter Plus Care housing assistance for mentally ill homeless persons in eastern Riverside County, as funding is awarded. Services should be expanded to include western Riverside County during the planning period.~~	*3.3i: The Housing Authority shall continue its collaborative agreement with Riverside County Department of Mental Health to administer Shelter Plus Care housing assistance for mentally ill homeless persons in eastern Riverside County, as funding is awarded. Services should be expanded to include western Riverside County during the planning period.* ~~Shelter Plus Care~~	HUD *Shelter Plus Care*	Housing Authority/ DPSS	Continue	268 beds were provided as part of the Shelter Plus Care program during the last planning period (1998 – 2005). Current Planning period quantified objectives would be to meet or exceed this goal.
	3.3j: Maintain 469 public housing units and assist 8,499 extremely low and very low income recipients per year with Housing Choice Vouchers (Section 8 rental assistance vouchers).	Housing Choice Voucher Program (formerly, Section 8 Rental Housing Assistance)	HUD	Housing Authority	Program has been quantified within the Housing Element and will be maintained.
	3.3k: DPSS shall continue to work with non-profit organizations and participating cities, as applicable, on programs to prevent homelessness, including rental mortgage assistance.	Supportive Housing Program, Emergency Shelter Program, and Shelter Plus Care			In March 2011, the County adopted Emergency Shelter provisions as part of Ordinance 348 in compliance with SB 2. As a result, a tracking mechanism will be established to report emergency shelter facilities constructed under these provisions.
	3.3l: Support legislation for block grant entitlement of Supportive Housing Program and Shelter Plus Care Program funds.	Supportive Housing program, Shelter Plus Care	HUD	DPSS	2009.
	3.3m: The County will continue to administer the Mobile Home Rent Stabilization Ordinance No. 760, limiting rent increases to correspond to the increase in the consumer price index (CPI).	Mobile Home Rent Stabilization Ordinance No. 760		County Executive Office	As the last amendment of Ord. 760 was 9/17/1996, during the Planning period, review the effectiveness of Ord. 760 and proposed amendments is necessary.
Policy 3.4: Support programs that offer low and moderate income households the opportunity for home ownership.					
	3.4b: Continue to implement the Mortgage Credit Certificate Program (MCC) for low to moderate income homeowners.	MCC Program	CDLAC	EDA	750 units were assisted through the MCC. Set goal to meet or exceed this previous planning objective.

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	3.4d: Continue to provide down payment assistance and closing cost assistance to low income first time homebuyers through the First Time Homebuyers Program.	First Time Homebuyers program	HOME/RDA Set-Aside Funds	EDA	500 units were assisted during the previous planning period. 81 units were assisted from 2006 – 2008. Set goal to meet or exceed previous periods results
	3.4e: Continue to participate as an associate member of the Riverside-San Bernardino Housing and Finance Agency Lease Purchase Program.	Finance Agency Lease Purchase Program	Bond funds	EDA	25 units were assisted during the last period (1998 – 2005). Set goal to meet or exceed previous periods results
	3.4f: Investigate the feasibility of acquiring foreclosure homes and offering them to residents at prices affordable to low and moderate income households.		HOME, RDA Set-Aside	EDA	Implement program approved by the Board of Supervisors on November 25, 2008.
	3.4g: The Housing Authority implemented the Mortgage Voucher Assistance Program in April 2008. This program enables low income households to use Section 8 vouchers for home purchase.	Housing Choice Voucher Program	Section 8	Housing Authority	The Housing Authority will continue to market and find current Section 8 households who are renters and work with them to transition to homeownership until the program reaches capacity.
Policy 3.5: Expand the availability of affordable and/or special needs housing through acquisition or conversion.	3.5a: Work with public or private sponsors to encourage acquisition/ rehabilitation of existing multi-family units to be converted to senior housing with a portion of the units required to be reserved for households with incomes below 80 percent of the County median.	HUD Assisted Living Conversion Program for Eligible MF Projects	HOME, RDA Set-Aside, CDBG, HUD	EDA/RDA	243 multi-family, senior restricted units, were produced during the last planning period (1998 – 2005). 503 multi-family, senior, units are programmed for the current planning period.
	3.5b: Assist eligible non-profit buyers in acquiring market rate apartments in exchange for reservation of a portion of the units to be made available at rents affordable to low and moderate income households.		HOME, RDA Set-Aside, CDBG	EDA/RDA	20,356, market-rate units, were provided under the previous planning period. Set goal to meet or exceed previous period's results.
	3.5c: Consider the conversion of small older hotels to transitional housing facilities, emergency shelters or SROs in conjunction with qualified non-profit organizations. The Department of Social Services shall work with participating jurisdictions when requested. (Also see Policy 2.1, Action 2.1h.)	Supportive Housing Program, HUD SRO Moderate Rehabilitation Program	HUD, HCD	DPSS, Non-profits	No projects reported during previous planning period. Program will continue with additional research and outreach.
GOAL 4: ESTABLISH ADEQUATE PLANNING, ADMINISTRATIVE AND FISCAL TOOLS TO IMPLEMENT HOUSING POLICIES					
POLICY 4.1: Evaluate the County's	4.1a: Revise Countywide Development Mitigation	Ordinance No. 659.9	General Fund	County	Ordinance No. 659 is

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
planning policies, codes, development review procedures and fees as part of the Housing Element update cycle to ensure that they do not represent unjustified constraints to the development of housing. (Note: Other elements of the General Plan address various components of residential neighborhoods that could add to the cost of housing (e.g. Safety Element or Circulation Element, but are considered essential ingredients of balanced communities.)	Fees.			Counsel/TLMA/	reviewed on an annual basis with the last amendment approved on 08/10/10. Updates are provided as needed. Development Mitigation Fees provide exemptions for special needs and publicly subsidized affordable housing projects. Annual reviews will continue to analyze and evaluate the effectiveness of this ordinance.
Policy 4.2: Establish and maintain accurate planning and demographic data using GIS (Geographic Information Systems)	4.2a: Maintain an inventory of County owned lands with potential for low and moderate income housing.	County GIS and Facilities Management		TLMA/GIS Section	Establish an annual review of all County owned sites and evaluate with EDA/RDA staff for potential scoring for affordable housing siting. To date, so existing, non-affordable housing sites have been converted to such uses.
	4.2b: Update the land use inventory on a continual basis	Housing Element Maintenance	General Fund	TLMA/GIS Section	Annually
	4.2c: Identify and map areas of the County where urban infill is appropriate	Housing Element Maintenance	General Fund	TLMA/GIS Section	Annually
	4.2d: Encourage the developer to provide current market analysis to determine supply and demand for special needs affordable housing projects as part of the application for County assistance.	The establishment of an affordable housing ordinance will provide additional incentives that will complement the County's R-6 zone, State Law, and Density Bonus provisions		EDA	Implement by 2014
	4.2e: Develop program for tracking and categorizing affordable units provided through the County's development review process. Maintain data base of new affordable housing provided.	Development review process		TLMA	Develop tracking program and have in place by 2013
	4.2f: Evaluate the affordability via interest rates, underwriting issues, cost per unit			EDA	By 2002, following the adoption of the General Plan update.
	4.2g. Determine strategies for specified needs:	Housing Element	RDA Set-Asides	EDA/RDA/TLMA	These policies include provisions that have been

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	• Dispersed (County-wide) versus target areas • Level of assistance (RDA induced or developer induced) • Non-profit versus for profit-developers • Competitive application/RFP process first come, first served • Types of housing - seniors, farm workers, special needs, assisted living, multi-family, single family, mixed-use, transit oriented developments, etc • Market group - small family, large family, persons with disabilities, farm workers, etc. • Type of program - rehabilitation, new construction, rental housing, owner- occupied, acquisition of existing housing, etc. • Fee reductions, waivers or other incentives • Services such as child care	Maintenance			previously quantified. The establishment of strategies for specific needs will be completed by the completion of the current planning period (2014).
	4.2h: Map the location of affordable projects developed by the County.	Program will be implemented as part of policy 4.2B and 4.2C		EDA/TLMA	Maps will be completed by end of planning period (2014) and updated annually.
Policy 4.3: Assure that administrative functions are consistent with housing policies and goals	4.3a: Ensure that redevelopment revitalization plans include provisions for new affordable housing, where feasible	*Redevelopment Sub-Area Master Plans*	RDA Set-Aside funds	EDA/RDA	RDA Sub-Area plans are reviewed and updated in accordance with State Law. The inclusionary aspects of new affordable housing are currently included in the work effort
	4.3b: Identify and summarize housing requirements and obligations annually (e.g. RDA inclusionary and replacement housing, implementation plans, housing production plans, new regulations and legislative mandates)	Redevelopment Sub-Area Master Plans	RDA Set-Aside funds	RDA/EDA	Annual review is currently included in RDA work programs and updated in accordance with State Law.
	4.3c: Identify programs of greatest use based on community needs, potential funding, available resources; prioritize programs based on funding sources such as grants, deferred/amortized loans, land write downs, loan guarantees, rental assistance, etc.	Redevelopment Sub-Area Master Plans	RDA Set-Aside funds	RDA/EDA	These policies include provisions that have been previously quantified. The establishment of community needs, potential funding, and available resources will be completed by the completion of the current planning period (2014).

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	4.3d: Propose and advocate legislative efforts to promote jobs/housing balance. Participate in subregional (WRCOG and CVAG) and regional (SCAG) agency meetings to establish housing goals beyond County lines and ensure that regional plans are consistent with County policies and goals. Prepare legislative proposals as necessary.	Supportive Housing Program	RDA Set-Aside funds	RDA/EDA/ County Counsel	Establish a quarterly meeting schedule with County's legislative advocates to ascertain the impact existing and proposed legislation, including, but not limited to SB 375. EDA and Planning Staff shall provide a report on the County's legislative platform with respect to affordable housing and Housing Element legislation.
	4.3e: Implement the County's new economic development strategy which utilizes both public and private sector financing to stimulate economic development utilizing CDBG funding.	EDA Workforce Development Program	CDBG	EDA	The County's economic development strategy will be refined and implementation will be completed by 2014.
	4.3f: Train *County* staff to implement programs, perform assessments, provide housing counseling and technical service and referral services.	*Housing Element Maintenance*	*General Fund*	EDA	The County will establish training modules to provide training for outreach and implementation of Housing Element policies by the end of the Planning period.
	4.3g: Direct and assist regional and local agencies, private developers and non-profit agencies to facilitate the attainment of County housing goals.	Housing Element Maintenance	CDBG, RDA Set-Aside	TLMA/EDA	County staff will establish outreach materials; include training on affordable housing incentives for private and non-profit agencies.
	4.3h: Seek changes in state policy to encourage the production of affordable housing such as construction defect litigation reform and additional low income tax credits.	Supportive Housing Program	General Fund	EDA	See Policy 4.3d
	4.3i: Require management plans for special needs affordable housing projects to reduce potential opposition.	Housing Element Maintenance	General Fund	EDA/RDA/ TLMA Planning	As part of the establishment of an affordable housing and rezoning program, design standards for special need communities will be established. Implementation will occur within the

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
					planning period (2014)
	4.3j: Maintain adequate staffing levels to correspond to size and complexity of housing projects	Development Review Procedures for private projects.	General Fund	All County Departments	Staffing levels to correspond to work load is a constant assessment of County staff. This program is ongoing through the planning period and will continue to the next planning period.
	4.3k: Seek changes in State policy to revise the 1986 Tax Reform Act, which removed private incentives to construct and own rental housing and therefore contributed to the decline of multi-family construction.	Housing Element Maintenance	General Fund	EDA	See Policy 4.3d
	4.3l: Continue the Housing Review Committee Advisory Council to continue to develop solutions for farmworker housing and services	Housing Authority	RDA Set-Asides/CDBG	EDA/4th District Supervisor	The Housing Review Committee Advisory Council provides regular reporting on its work programs. Farm worker housing and services are established through a number of programs and policies. In addition, an affordable housing ordinance will be implemented as previously referenced and additional zones will be modified to authorize farm worker housing projects.
	4.3m: Establish reasonable numeric targets for housing production annually, by region, income category and type. Ensure that numeric targets are consistent between the HUD 5-Year Consolidated Plan, Housing Element, AB315 Housing Production Plan and RDA Implementation Plans.	Housing Element Maintenance	General Fund	EDA/TLMA	Numeric targets for housing production are established through the Housing Element. By the end of the Planning Period, the County will reconcile the Housing Element quantified goals, HUD 5-year Consolidated

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
					Plan, AB315 Housing Production Plan and RDA Implementation Plans.
	4.3n: Support changes in Redevelopment Law that increase home-ownership eligibility by raising affordability criteria and respective mortgage payment maximums.	Housing Element Maintenance	General Fund	EDA/TLMA	See Policy 4.3d
Policy 4.4: Consistently monitor and review the effectiveness of the Housing Element programs and other County activities in addressing housing need.	4.4a: Develop a standardized system of annually reporting and monitoring housing activities. Information to be standardized should include, but not be limited to: jurisdiction in which the project is located; level of income (based on HUD classifications) household size and type of household (based on HUD classifications); the program(s) utilized for assistance and funding source; the agency or department responsible for the program or project; the total number of units; and other relevant factors to be determined. The standardized system should be used for reporting in association with the Consolidated Annual Performance and Evaluation Report (CAPER), the Redevelopment Annual Housing Report, and the Housing Element Annual Housing Status Report.	Housing Element Maintenance	General Fund	EDA/TLMA	This policy shall be included within the implementation of policy 4.3m.
	4.4b: Monitor the expiration of affordability periods and assess replacement needs annually.	Housing Element Maintenance	General Fund	EDA/ TLMA	This policy shall be included within the implementation of policy 4.3m.
Policy 4.5: Develop sound fiscal management practices to implement housing policies and programs.	4.5.a: Review the current housing and infrastructure expenditures and programs of the various departments and agencies in the County to determine where they are implemented geographically (i.e.: in unincorporated County or within incorporated cities) and develop strategies to target the resources where they will most benefit the County.	Housing Element Maintenance	General Fund	TLMA/EDA	This policy shall be included within the implementation of policy 4.3m.
	4.5b: Identify and evaluate current and projected revenues such as general funds, federal and state entitlement, grants, housing bonds, set-asides, etc.	Housing Element Maintenance	General Fund	RDA/EDA/TLMA	See Policy 4.3d
	4.5c: Evaluate financial resources for leveraging opportunities	Housing Element Maintenance	General Fund	EDA/RDA/TLMA	See Policy 4.3d

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POLICIES	ACTIONS	IMPLEMENTING PROGRAMS	IMPLEMENTING RESOURCES	RESPONSIBLE AGENCY	QUANTIFIED OBJECTIVE AND/OR TIME FRAME
	4.5d: Determine the appropriateness of grants and loans. Develop and adopt grant policies that are consistent with housing goals.	Housing Element Maintenance	General Fund	EDA/RDA/TLMA	Establish a grant and loan policy by the end of the planning period.
	4.5e: Establish a funding plan and timing of activities.	Housing Element Maintenance	General Fund	EDA/RDA/TLMA	See Policy 4.5e
	4.5f: Prioritize financial assistance based on housing needs (e.g. special needs, large families, mixed-use, multi-family, single family, number of units, or cost per unit)	Housing Element Maintenance	General Fund	EDA/RDA/TLMA	See Policy 4.3m
	4.5g: Target future financial resources to meet future housing obligations.	Housing Element Maintenance	Refer to Implementing resources/Program matrix	EDA, Housing Authority	See Policy 4.3m
GOAL #5: REDUCE PER CAPITA RESIDENTIAL ENERGY USE					
Policy 5.1: Encourage the use of energy conservation features in residential construction and remodeling	5.1a: Create incentives for energy conservation above and beyond the requirements of Title 24 by developing a sliding scale Fee Assistance Program. More energy measures = more fees waived.	Climate Action Plan (CAP)	Energy Efficiency Block Grant (EECBG) funded by the Department of Energy (DOE)	EDA/TLMA	Develop a General Plan Energy Element that will include incentives for production of renewable energy resources and greater efficiencies than Title 24.
	5.1b: The Department of Community Action shall continue to operate the LIHEAP and Home Weatherization programs to reduce maintenance and energy costs for households with low incomes and increase efforts to inform the public about available energy conservation programs.	County Home Weatherization Program/County Low Income Home Efficiency Assistance Program, consumer education workshops	California Conservation Corp., Department of Energy, State Department of Community Services and Development, WEEK, Emergency Contingency Funds	DCA	Ongoing.
	5.1c: Pursue grant funds for energy rehab costs and consumer education			DCA	Annually, or in response to NOFAs
	5.1d: Utilize bidding procedures in County rehabilitation programs to incorporate energy conservation measures.	County Housing Rehabilitation Programs (Senior Home Repair, CHRP and RHRP)	CDBG, RDA Set-Aside	EDA	Ongoing.
	5.1e: Promote level pay utility payments for the Housing Choice Voucher Program recipients (Section 8)		HUD	Housing Authority	Ongoing.
	5.1f: Encourage developer incentives for the incorporation of active and passive energy	County Energy Efficiency Programs		Building and	Ongoing.

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POLICIES	**ACTIONS**	**IMPLEMENTING PROGRAMS**	**IMPLEMENTING RESOURCES**	**RESPONSIBLE AGENCY**	**QUANTIFIED OBJECTIVE AND/OR TIME FRAME**
	conservation features in new residential construction.			Safety	
	5.1g: Support changes in Redevelopment law that increase home-ownership eligibility by raising utility allowances and respective mortgage payment maximums.	Housing Element Maintenance	General Fund	EDA/RDA/TLMA	See Policy 4.3d
	5.1j: Annually evaluate and update the Section 8 utility allowances~~.~~ tables to account for increases and or decreases of energy consumption and costs of consumption	Section 8		Housing Authority	Establish an annual reporting mechanism that provides reporting for Section utility allowance tables. Reporting mechanisms shall be established by the end of the planning period.
Note: Refer to Implementing Resources Summary matrix for descriptions Implementing Programs and/or Implementing Resources. It should be noted that not all federal programs are administered by HUD, and not all state programs are administered by HCD.					