



Safety Element

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Chapter 6

Safety Element

Introduction

One of the fundamental values of the Vision for Riverside County highlights the importance of safety to the people of Riverside:

“We acknowledge security of person and property as one of the most basic community needs and commit to designing our communities so that vulnerability to natural and man made hazards, as well as criminal activities, is anticipated and kept to a minimum.”

This “value” underlies the policy direction of the Safety Element and is further defined by the following Vision statement:

“Considerable protection from natural hazards such as earthquakes, fire, flooding, slope failure, and other hazardous conditions is now built into the pattern of development authorized by the General Plan.”

Based on the direction provided by the Vision, and in compliance with state law, the primary objective of the Safety Element is to “reduce death, injuries, property damage, and economic and social impact from hazards”.

The Safety Element serves the following functions:

- Develops a framework by which safety considerations are introduced into the land use planning process;
- Facilitates the identification and mitigation of hazards for new development, and thus strengthens existing codes, project review, and permitting processes;
- Presents policies directed at identifying and reducing hazards in existing development; and
- Strengthens earthquake, flood, inundation, and wildland fire preparedness planning and post-disaster reconstruction policies.

Relation to Other Documents

Technical Background Report

The Safety Element represents an extensive effort to reduce the impacts of future disasters in Riverside County. The Safety Element Technical Background Report (Appendix H), is a comprehensive, up-to-date assessment of natural and man-made hazards in the county, including, but not limited to: earthquakes, landslides, subsidence/settlement, floods, inundation, and wildland fire. The report serves as the foundation for the Safety

Element and includes detailed Geographic Information System (GIS) hazard mapping and analyses. This Safety Element incorporates by reference the County Fire Code, the County Abatement of Hazardous Vegetation Ordinance, and the Zoning Ordinance as well as the County Fire Department's Fire Protection Plan, and EMS Strategic Master Plan.

The following sections of the Safety Element summarize mitigation goals, specific policies, and key topics identified in the Technical Background Report. Issues and policies are organized by the following topics:

- Seismic Hazards;
- Slope and Soil Instability Hazards;
- Flood and Inundation Hazards;
- Fire Hazards;
- Hazardous Waste and Materials; and
- Disaster Preparedness, Response, and Recovery

Other General Plan Elements

The Safety Element is only one of several components of the General Plan. Other social, economic, political and aesthetic factors must be considered and balanced with safety needs. Rather than compete with the policies of related elements, the Safety Element provides policy direction and designs safety improvements that complement the intent and policies of other General Plan elements.

Crucial relationships exist between the Safety Element and the other General Plan elements. How land uses are determined in areas prone to natural hazards, what regulations limit development in these areas, and how hazards are mitigated for existing development, are all issues that tie the elements together. For instance, Land Use Element diagrams and policies must consider the potential for various hazards identified in the Safety Element and must be consistent with the policies to address those hazards. The Multipurpose Open Space Element is also closely tied to the Safety Element. Floodplains, for example, are not only hazard areas, but also often serve as sensitive habitat for threatened or endangered species, or provide recreation or passive open space opportunities for residents and visitors. As such, flood and inundation policies balance the need to protect public health and safety with the need to protect habitat and open space. Safety Element policies, especially those concerning evacuation routes and critical facilities, must also be consistent with those of the Circulation Element. The County's Circulation Plan routes are considered the backbone routes for evacuation purposes.

Area Plans

Together, the Safety Element and Technical Background Report provide a comprehensive set of hazard maps and policies that cover all unincorporated areas of Riverside County. The 19 area plans described in the General Plan, Chapter 1 Introduction, provide additional policy direction, as appropriate, as well as depict major hazards on more detailed maps than the countywide maps can provide. They show more precisely where hazard areas are, providing a more visible link between geography, land use, and policies. For additional policy guidance in specific areas, please refer to the applicable area plan.

Setting

Historically, Riverside County has had the second highest number of state and federally-declared disasters in California. Which hazard poses the greatest risk? Which threat renders Riverside County most vulnerable? How bad will it get, how often? These deceptively simple questions lie at the heart of risk management.

For example, Riverside County has suffered six fire disasters since 1970. Much of Riverside County is at risk from wildland fire, which is a severe and growing problem. Meanwhile, throughout the 20th century, floods caused by storms have been the number one natural disaster in the United States, for lives lost and property damage. Since 1975, Riverside County has suffered fourteen floods severe enough to merit Gubernatorial or Presidential declarations of disaster. Inundation due to dam failure, while unlikely, would have even more devastating consequences. Failure of unstable ground, whether due to collapsing or expanding soil, or slope failures such as landslides, debris flows and rockfalls, can cause localized but expensive damage. Areas prone to unstable soil and slopes can generally be predicted, but, absent mitigation and maintenance, such failures can be frequent and recurring.

All of these hazards are costly and potentially life-threatening and affect significant portions of Riverside County. Some hazards must be avoided entirely, while the potential impacts of others can be mitigated by special building techniques. In still other cases, safety-oriented organizations, such as Fire Safe, can provide assistance in educating the public and promoting practices that contribute to improved public safety. With existing development in areas prone to these disasters, an aggressive program is needed to persuade property owners to mitigate, or to sell the property to the County of Riverside or other entity, or to modify use of the property.

Major earthquakes will cause disasters less frequently than other hazards, yet they have the most serious life, safety, and economic consequences. A mere tens of seconds of strong ground shaking can devastate large areas of Riverside County and overwhelm the County's ability to respond. Economic consequences could last for years. A large earthquake can also trigger occurrences of most of the other disasters considered in this Safety Element.

Because major earthquakes are such high-consequence events, because relatively easy land use mitigation efforts do not considerably reduce earthquake hazards, and because earthquakes have far-reaching consequences outside of damaged areas, much legislation has been written to reduce society's vulnerability to such hazards. For the same reasons, many of the Safety Element policies address earthquake hazards.

Issues and Policies

The following issues and policies are organized under the headings of “General” - those that apply to all natural hazards and “Hazard Specific” - those that only apply to a specific hazard type (i.e., flood or seismic). Those policies that are “General” are subcategorized by types of policies: code conformance, special development regulations, or hazard reduction. Following the general policies are those that are categorized by specific hazard types. Additional safety policies that only apply to a specific geographical area of Riverside County may be found in any of the General Plan’s 19 area plans.

In addition to this Safety Element, land use and development in Riverside County are regulated by the other elements and area plans of the General Plan, County Building and Grading Ordinances, the California Environmental Quality Act (CEQA), and specific resolutions adopted by the Riverside County Board of Supervisors.

General Issues and Policies

Code Conformance and Development Regulations



The General Plan policy and implementation item reference system:

LU 1.3: Identifies which element contains the Policy, in this case the Land Use Element, and the sequential number.

AI 1 and AI 4: Reference to the relevant Action Items contained in the Implementation Program found in Appendix K.

The Riverside County Department of Building and Safety provides technical expertise in reviewing and enforcing the County Building and Fire Codes. These codes establish site-specific investigation requirements, construction standards, and inspection procedures to ensure that development does not pose a threat to the health, safety and welfare of the public. Every three years, the County's Building and Fire Codes are adapted from the Uniform Building and Fire Codes. They contain baseline minimum standards to guard against unsafe development. As discussed in the Technical Background Report, project variables may modify the implementation of a particular standard.

At a minimum, it is imperative to enforce the most recently adopted regulatory codes for new development and significant redevelopment, including the County's Zoning Ordinance, Land Use Ordinance and Land Division Ordinance, which support the Building and Fire Codes. The California Environmental Quality Act (CEQA) adds another level of safety review, requiring that environmental constraints be considered prior to approval of significant projects. Additional guidelines and standards are introduced through the Safety Element. Table S-1, Multi-Hazard Safety Actions, identifies the relationship between these various regulatory and planning tools and the hazards that they address.

Special development regulations can reinforce and augment existing code standards by raising the level of hazard-conscious project design and mitigation engineering. Examples include additional geologic/geotechnical investigation and additional reinforcement of foundations in areas of potential ground failure. While foundation investigations are required by Riverside County's Building Code, it is important to emphasize expected levels of investigation and protection. Furthermore, some requirements that may only apply to critical facilities, such as detailed seismic analyses, could be expanded to include other structures and lifelines. Where engineering methods cannot mitigate the hazards, avoidance of the hazard is appropriate, such as where ground rupture along active or potentially active fault traces are identified during project investigation. Special minimum setbacks away from active faults, which are already required for critical facilities, can also be defined for other structures and lifelines.

Through Ordinance 457 and Board of Supervisors Policy F-6, Riverside County prohibits grading without permits, levies penalties for illegal grading, and requires the restoration of illegally graded land to prevent off-site drainage and slope erosion. The penalties for illegal grading include fines and 5-year abeyances on the issuance of building permits and land use approvals involving subject properties. Larger fines may be levied for illegal grading where it can be shown that violations have occurred in regard to federal and state laws that permit the larger fines.

**Table S-1
Multi-Hazard Safety Actions**

Hazards	Risk			Scope of Risk*	Code Conformance and Hazard Management#				
	Low	Moderate	High		Building	Fire	Special Development	Hazard Reduction	
EARTHQUAKE DAMAGE	Strong Ground Motion			X	Countywide/Regional	X	X	X	X
	Fault Rupture			X	Local			X	X
	Liquefaction		X	X	Local			X	X
	Settlement/Subsidence		X		Local	X		X	X
	Landslide		X		Local	X		X	X
	Dam/Reservoir Inundation	X			Local			X	X
	Building Damage		X	X	Countywide/Regional	X	X	X	X
Infrastructure/ Utilities Damage		X	X	Countywide/Regional	X	X	X	X	
SLOPE AND FOUNDATION STABILITY	Deep-Seated Landslide	X			Local	X		X	X
	Soil Slumps		X		Local	X		X	X
	Settlement/Subsidence		X		Local	X		X	X
INUNDATION	Stream Flooding			X	Local			X	X
	Dam/Reservoir Inundation	X			Local			X	X
FIRE	Wildland Fire			X	Local/Countywide	X	X	X	X
	Industrial Fire		X		Local	X	X	X	
	Residential Fire		X		Local	X	X		

*Scope of Risk:

Local - Hazard impacts localized or site-specific portion of County.

Local/Countywide - Hazard impacts a significant portion or all of County.

Countywide/Regional - Hazard affects large multi-jurisdictional area.

#Code Conformance and Hazard Management Options:

Special Development Regulations reinforce and augment existing codes.

Hazard Reduction Programs are designed to improve the safety of existing development.

Special Development Regulations and Hazard Reduction policies exceed current code requirements and are implemented by this Safety Element.

Policies:

- S 1.1 Mitigate hazard impacts through adoption and strict enforcement of current building codes, which will be amended as necessary when local deficiencies are identified.
- S 1.2 Enforce state laws aimed at identification, inventory, and retrofit of existing vulnerable structures.
- S 1.3 Continue to enforce penalties against grading without permits, and ensure the restoration of land thus damaged. Continue to educate the public about the benefits of grading with permits and the penalties for grading without them. If the penalties are later determined to not be effective, explore whether the levying of greater penalties would be more effective in deterring illegal grading and ensuring the proper restoration of damaged lands.
- S 1.4 Implement the County of Riverside Multi-Jurisdictional Hazard Mitigation Plan.

Hazard Reduction

Lessons learned from recent earthquakes and extensive scientific research conducted as part of the National Earthquake Hazard Reduction Program (NEHRP) have led to significant improvements in building codes.

Adopted by the County of Riverside in July 1999, the 1997 Uniform Building Code (UBC) is a prime example of an effort to reduce hazard risks in response to recent earthquakes. Seismic codes will continue to improve under the International Building Code, which replaced the UBC in the year 2000.

Hazard reduction programs are designed to improve the safety of existing development. For example, older structures, built to superseded code standards, may need seismic upgrading. Owners of older structures may voluntarily upgrade, be strongly persuaded to upgrade, or be required to do so. Additional examples of hazard reduction programs include:

- Strengthening pipelines and developing emergency back-up capability by public utilities serving the County of Riverside;
- Collaborating with water purveyors to ensure adequate fire flow and enact preventative measures;
- Encouraging the construction of auxiliary water systems to supplement existing water lines. This will help ensure adequate water flow for fire suppression even if main water lines are damaged. Gravity-fed or generator-operated pumps for swimming pools and water storage tanks can also supplement flow;
- Planning for emergency response at the government and individual level to reduce the risk to the public from hazards; and
- Identifying unsafe structures and posting public notices.

To reduce hazards in areas mapped as hazard zones, the County of Riverside uses a combination of methods:

- Special investigation and reporting requirements;
- Land use planning;
- Real-estate disclosure;

- Incentives to encourage mitigation;
- Public education; and
- Disincentives including fines and fees for those who choose to take the risk of that hazard.

Policies:

- S 1.4 Require structural and nonstructural assessment and, when necessary, mitigation, of other types of potentially hazardous buildings that: 1) are undergoing substantial repair or improvements resulting in more than half of the assessed property value, or 2) are considered an element of blight in a redevelopment district. Potential implementation measures could include: (AI 81, 88, 89, 90, 100)
- a. Use of variances, tax rebates fee waivers, credits, or public recognition as incentives.
 - b. Inventory and structural assessment of potentially hazardous buildings based on screening methods developed by the Federal Emergency Management Agency.
 - c. Development of a mandatory retrofit program for hazardous, high occupancy, essential, dependent or high-risk facilities.
 - d. Development of a mandatory program requiring public posting of seismically vulnerable buildings.

Hazard Specific Issues and Policies

Seismic Hazards

While Riverside County 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 in the Safety Element Technical Background Report, Appendix H. Earthquakes can also cause human-made hazards such as urban fires, dam failures, and toxic chemical releases.

Earthquake risk is very high in the most heavily populated western portion of the county and the Coachella Valley, due to the presence of two of California's most active faults, the San Andreas and San Jacinto. Risk is moderate in the eastern portion of the county beyond the Coachella Valley.

Most of the loss of life and injuries from earthquakes are due to damage and collapse of buildings and structures. Building codes have generally been made more stringent following damaging earthquakes. However, in the County of



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.

Riverside, structures built prior to improved building codes have generally not been upgraded to current standards, and are vulnerable in earthquakes.

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.

The intent of these policies is to minimize the impact of earthquakes on Riverside County's citizens, property, and economy.

Fault Rupture

Primary ground damage due to earthquake fault rupture typically results in a relatively small percentage of the total damage in an earthquake, but proximity 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; that is, they are unlikely to generate further earthquakes. Other faults are known to be active. Such faults have either generated earthquakes in historical times (within the last 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 (Figure S-1).

The State Alquist-Priolo Earthquake Fault Zoning Act (A-P Act) was passed in 1972 to mitigate the hazard of surface faulting. Surface rupture is the most easily avoided seismic hazard. The main purpose of the A-P Act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The A-P Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. 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.



Critical Facilities:
Facilities housing or serving many people, which 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.

Within the rapidly growing county, State A-P mapping has not kept pace with development. The County of Riverside has zoned fault systems and required similar special studies prior to development. These are referred to as County Earthquake Fault Study Zones on Figure S-2 and in the Technical Background Report. They generally represent zones that have been identified from groundwater studies, and should be viewed as doubtful. However, until solid field evidence is generated to prove or disprove their existence, they should continue to be considered a hazard.

Within State A-P and Riverside County Fault Zones, proposed tracts of four or more dwelling units must 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.

As there are many active faults in Riverside County, with new fault strands being continually discovered, all proposed structures designed for human occupancy should be required to investigate the potential for and setback from

ground rupture. Also of concern are structures, not for human occupancy, that can cause harm if damaged by an earthquake, such as utility, communications, and transportation lifelines.

The County of Riverside regulates most development projects within earthquake fault zones (Figure S-2). Projects include all land divisions and most structures for human occupancy. Exempted projects include single-family, wood-frame and steel-frame dwellings that are one or two stories, are not part of a development of four units or more, and are not located within 50 feet of a fault.

Before a project can be permitted within a State A-P Earthquake Fault Zone, Riverside County Fault Zone, or within 150 feet of any other potentially active or active fault mapped in published United States Geological Survey (USGS) or California Division of Mining and Geology (CDMG) reports, a geologic investigation must demonstrate that proposed buildings will not be constructed across active faults. A site-specific evaluation and written report must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy must be set back 50 feet from the fault, unless adequate evidence, as determined and accepted by the Riverside County Engineering Geologist, is presented to support a different setback.

Policies:

S 2.1 Minimize fault rupture hazards through enforcement of Alquist-Priolo Earthquake Fault Zoning Act provisions and the following policies: (AI 80, 91)

- a. Require geologic studies or analyses for critical structures, and lifeline, high-occupancy, schools, and high-risk structures, within 0.5 miles of all Quaternary to historic faults shown on the Earthquake Fault Studies Zones map.
- b. Require geologic trenching studies within all designated Earthquake Fault Studies Zones, unless adequate evidence, as determined and accepted by the Riverside County Engineering Geologist, is presented. The County of Riverside may require geologic trenching of non-zoned faults for especially critical or vulnerable structures or lifelines.
- c. Require that lifelines be designed to resist, without failure, their crossing of a fault, should fault rupture occur.
- d. Support efforts by the California Department of Conservation, California Geological Survey to develop geologic and engineering solutions in areas of ground deformation due to faulting and seismic activity, in those areas where a through-going fault cannot be reliably located.
- e. Encourage and support efforts by the geologic research community to define better the locations and risks of Riverside County faults. Such efforts could include data sharing and database development with regional entities, other local governments, private organizations, utility agencies or companies, and local universities.



An example of an area of **ground deformation** is the Newport- Inglewood Fault through the northern part of Long Beach, California, where young river sediments bury the fault faster than the fault can reassert itself every thousand years or so with an earthquake. Potential examples in Riverside County could include several locations along the Elsinore Fault, the northern San Jacinto Fault, some of the faults in the Temecula area, and some of the secondary strands of the San Andreas Fault in Indio.

Seismically-Induced Liquefaction, Landslides, and Rock Falls



As demonstrated by past earthquakes, seismic settlement is primarily damaging in areas subject to differential settlement. These can include cut/fill transition lots built 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.

Portions of the County of Riverside are susceptible to liquefaction and landslides or rockfall, which are very destructive secondary effects of strong seismic shaking. This section addresses these hazards as they relate specifically to seismic events. General slope and soil instability hazards, which can occur in the absence of seismic shaking, are addressed separately in following sections of the Safety Element.

Liquefaction occurs primarily in saturated, loose, fine- to medium-grained soils in areas where the groundwater table is within approximately 50 feet of the surface. Shaking causes 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. 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 specific liquefaction potential of a site; however, a determination of general risk potential can be provided based on soil type and depth of groundwater. Areas identified as susceptible to liquefaction are identified in Figure S-3.

Seismically-induced landslides and rock falls should be expected throughout the county in a major earthquake. Field investigation enables identification of slide-prone slopes before an earthquake occurs. Landslides and rock falls occur most often on steep or compromised slopes. Factors controlling the stability of slopes include: 1) slope height and steepness; 2) engineering characteristics of the earth materials comprising the slope; and 3) intensity of ground shaking. Figure S-4 maps areas with varying levels of earthquake-induced slope instability.

The Seismic Hazard Zone Maps are issued by the State of California and they address the seismic hazards of liquefaction and earthquake-induced landslides pursuant to the Seismic Hazards Mapping Act (SHMA). The SHMA requires the State Geologist to compile and issue maps identifying seismic hazard zones, also referred to as Zones of Required Investigation (ZORI). The purpose of these zones is to delineate areas within which soil conditions, topography and the likelihood of future ground shaking indicate sufficient hazard potential to justify a site-specific geotechnical investigation. The Murrieta Quadrangle Seismic Hazard Zone Map area is shown on Figure S-3 and Figure S-4 and it is the first official Seismic Hazard Zone Map within Riverside County released by the California Geological Survey through its Seismic Hazards Zonation Program.

This Seismic Hazards Zonation Program will ultimately map the principal and major growth areas in seismically active areas of California. Each quadrangle map covers an area of approximately 60 square miles. There are sixteen other planned quadrangles within western Riverside County that will be incorporated into the Safety Element as they become available.

The following policies apply to Riverside County and California State identified liquefaction and slope instability hazardous zones:

Policies:

- S 2.2 Require geological and geotechnical investigations in areas with potential for earthquake-induced liquefaction, landsliding or settlement, for any building proposed for human occupancy and any structure whose damage would cause harm, except for accessory buildings. (AI 81)
- S 2.3 Require that a state-licensed professional investigate the potential for liquefaction in areas designated as underlain by “Susceptible Sediments” and “Shallow Ground Water” for all general construction projects, except for accessory buildings (Figure S-3).
- S 2.4 Require that a State-licensed professional investigate the potential for liquefaction in areas identified as underlain by “Susceptible Sediments” for all proposed critical facilities (Figure S-3).
- S 2.5 Require that engineered slopes be designed to resist seismically- induced failure. For lower-risk projects, slope design could be based on pseudo-static stability analyses using soil engineering parameters that are established on a site-specific basis. For higher-risk projects, the stability analyses should factor in the intensity of expected ground shaking, using a Newmark-type deformation analysis.
- S 2.6 Require that cut and fill transition lots be over-excavated to mitigate the potential of seismically-induced differential settlement.
- S 2.7 Require a 100% maximum variation of fill depths beneath structures to mitigate the potential of seismically-induced differential settlement.
- S 2.8 Encourage research into new foundation design systems that better resist Riverside County’s climatic, geotechnical, and geological conditions. (AI 104)



Pseudo-static stability analyses requires detailed geotechnical investigations, including subsurface soil sampling and laboratory testing.

Slope and Soil Instability Hazards

Covering approximately 7,310 square miles and spanning from the Colorado River at the Arizona border to within ten miles of the Pacific Ocean, Riverside County contains a variety of topographical and geological conditions that pose various slope and soil instability hazards. Mass wasting, which includes landslides, rockfalls, and debris flow, is associated with the mountainous regions primarily composed of igneous and metamorphic rock, while subsidence and hydroconsolidation are concentrated in valleys filled with sediments.

The intent of these policies is to reduce the occurrence and costs of slope and soil instability hazards, and eliminate human contribution to their occurrence.



In a typical year in the United States, mass wasting causes 25 to 50 deaths and over \$1.5 billion in damages.



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.

Landslides, Rockfalls, and Debris Flows

Landslides, rockfalls, and debris flows occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, often with disastrous results. As human populations expand over more of the land surface, these processes become an increasing concern.

There are predictable relationships between local geology and landslides, rockfalls and debris flows. Knowledge of these relationships can improve planning and reduce vulnerability. Slope stability is dependent on many factors and their interrelationships, including rock type, pore water pressure, slope steepness, and natural or man-made undercutting. Slope and geologic conditions are identified in Figures S-4 and S-5, respectively.

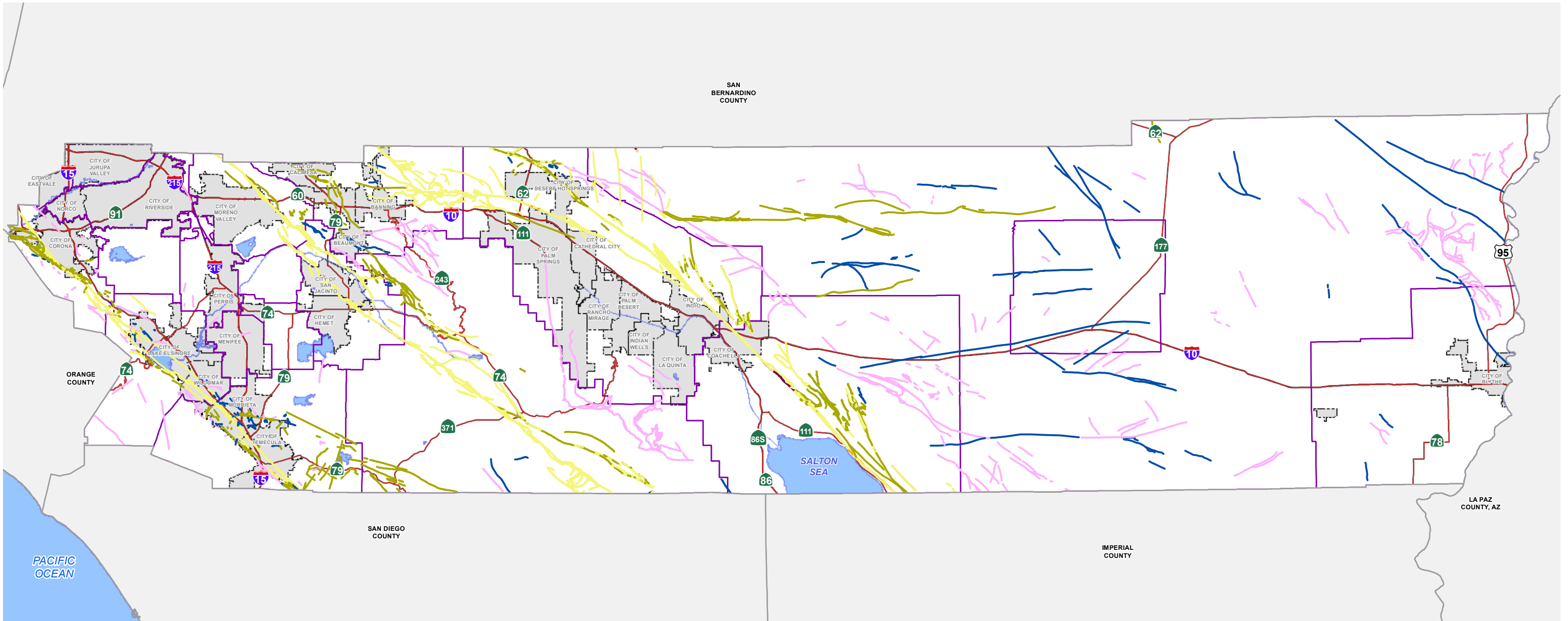
For new development, the Riverside County Building and Safety Department enforces current building codes. Building codes establish specific site investigation requirements and define various standards by which hillside projects are assessed.

Landslide Management Zones (LMZs) identify regions susceptible to slope instability. This instability can include deep-seated landslides, rockfalls, soil slumps, and debris flows. Without the presence of extensive flood control devices, including large debris basins, the areas outlined by an LMZ may be subject to debris flow inundation. Most often, debris flow inundation results in roadways and improvements blocked by boulders. Rarely do debris-flow-generating storms affect the entire county.

Most of the area within Landslide Potential Management Zones of the County of Riverside, as shown on Figure S-6, are designated for open space or rural development. Investigations and stability evaluations should be conducted prior to any proposed grading, if conditional use permits or variances are granted. Within a Landslide Potential Management Zone, mitigation of existing and/or potential slope problems can be required when substantial improvements are proposed.

Policies:

- S 3.1 Require the following in landslide potential hazard management zones, or when deemed necessary by the California Environmental Quality Act: (AI 104)
- a. Preliminary geotechnical and geologic investigations.
 - b. Evaluations of site stability, including any possible impact on adjacent properties, before final project design is approved.
 - c. Consultant reports, investigations, and design recommendations required for grading permits, building permits, and subdivision applications be prepared by state-licensed professionals.
- S 3.2 Require that stabilized landslides be provided with redundant drainage systems. Provisions for the maintenance of subdrains must be designed into the system.
- S 3.3 Before issuance of building permits, require certification regarding the stability of the site against adverse effects of rain, earthquakes, and subsidence.



Data Source: County Geology (2013)/California Geological Survey (2008)

- Faults Activity**
- Historic
 - Historic (Creep)
 - Holocene
 - Late Quaternary
 - Quaternary
 - Pre-Quaternary
 - Highways
 - Area Plan Boundary
 - City Boundary
 - Waterbodies

Figure S-1

December 8, 2015
 Miles

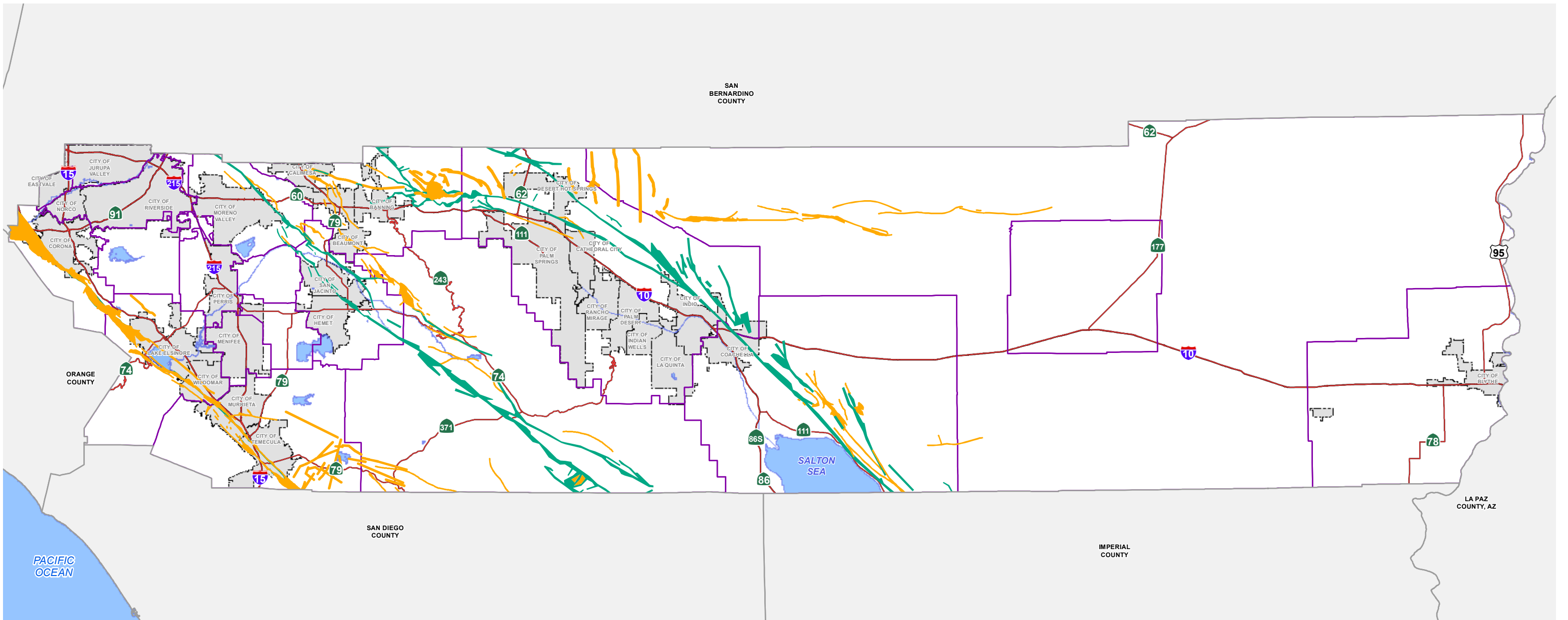
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MAPPED FAULTING IN RIVERSIDE COUNTY

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Data Source: Riverside County Geology (2013)/California Geological Survey (2008)

Fault Zones

- Alquist-Priolo
- Riverside County
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Figure S-2

December 8, 2015
 Miles

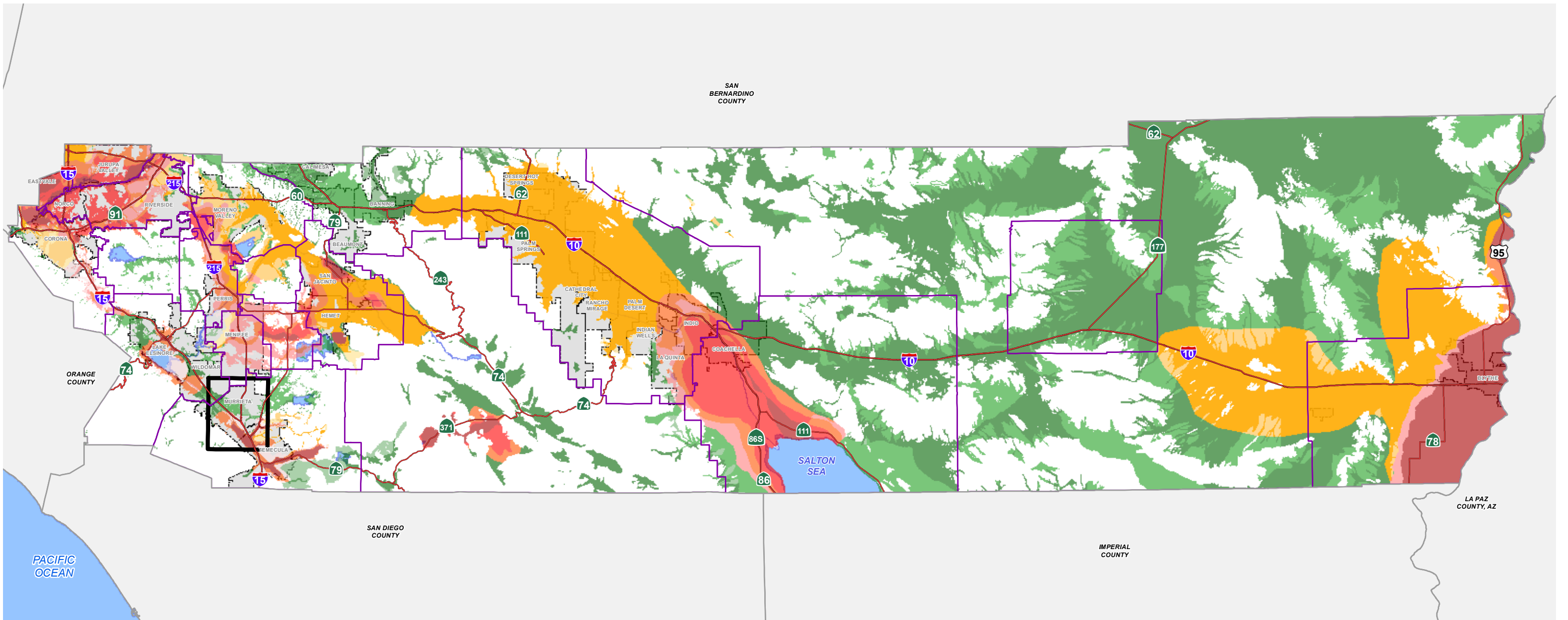
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EARTHQUAKE FAULT STUDY ZONES

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Data Source: Riverside County Geology (2013) /California Geological Survey (2008)

Liquefaction Susceptibility

Shallow Groundwater Susceptible Sediments	Deep Groundwater Susceptible Sediments	No Groundwater Data Susceptible Sediments	Highways	California Geological Survey Seismic Hazard Zones
Very High	Moderate	Moderate	Area Plan Boundary	Murrieta Quad
High	Low	Low	City Boundary	(See detail in Elsinore, Southwest, Sun City / Menifee Valley Area Plans)
Moderate	Very Low	Very Low	Waterbodies	
Low				
Very Low				

Figure S-3

December 8, 2015

0 10 20 Miles

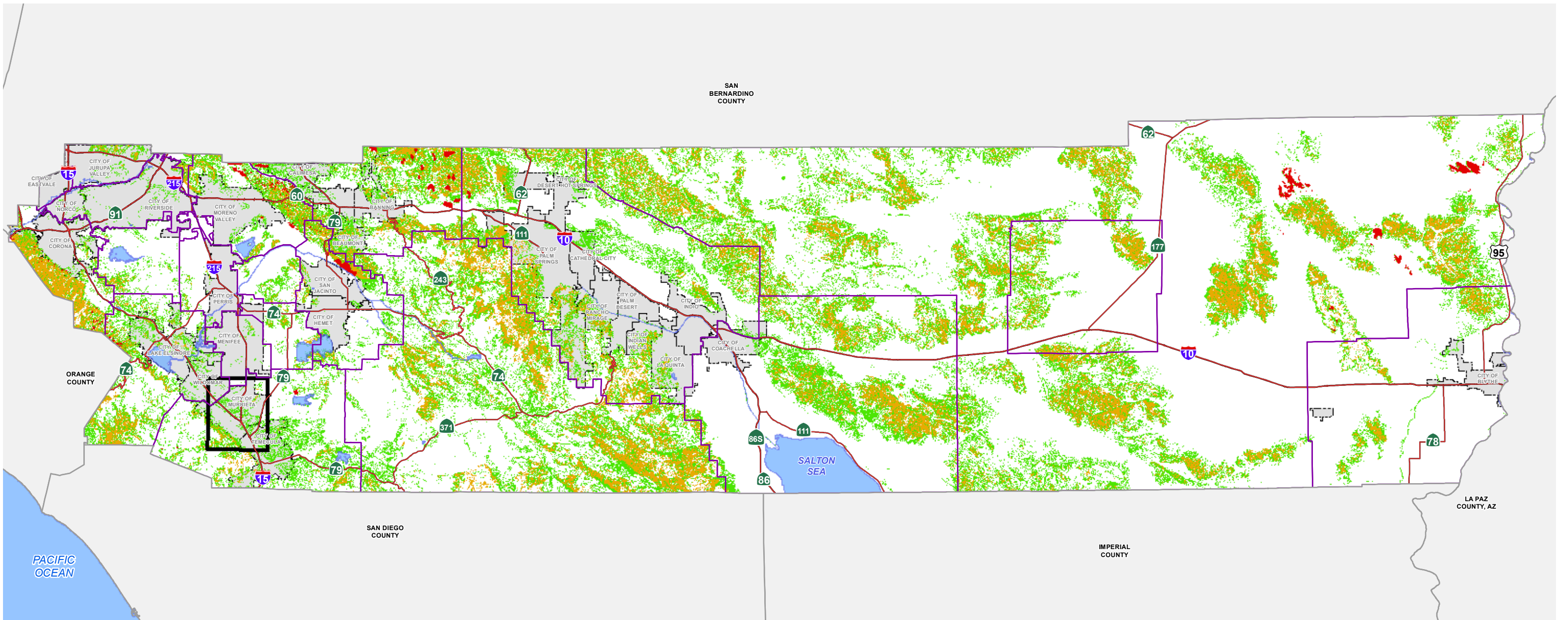
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GENERALIZED LIQUEFACTION

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Data Source: County Geology (2013)/California Geological Survey (2008)

Slope Instability

- Existing Landslides
- High susceptibility to seismically induced landslides and rockfalls.
- Low to locally moderate susceptibility to seismically induced landslides and rockfalls.
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies
- California Geological Survey Seismic Hazard Zones
- Murrieta Quad
(See detail in Elsinore, Southwest, Sun City / Menifee Valley Area Plans)

Figure S-4

December 8, 2015

Miles

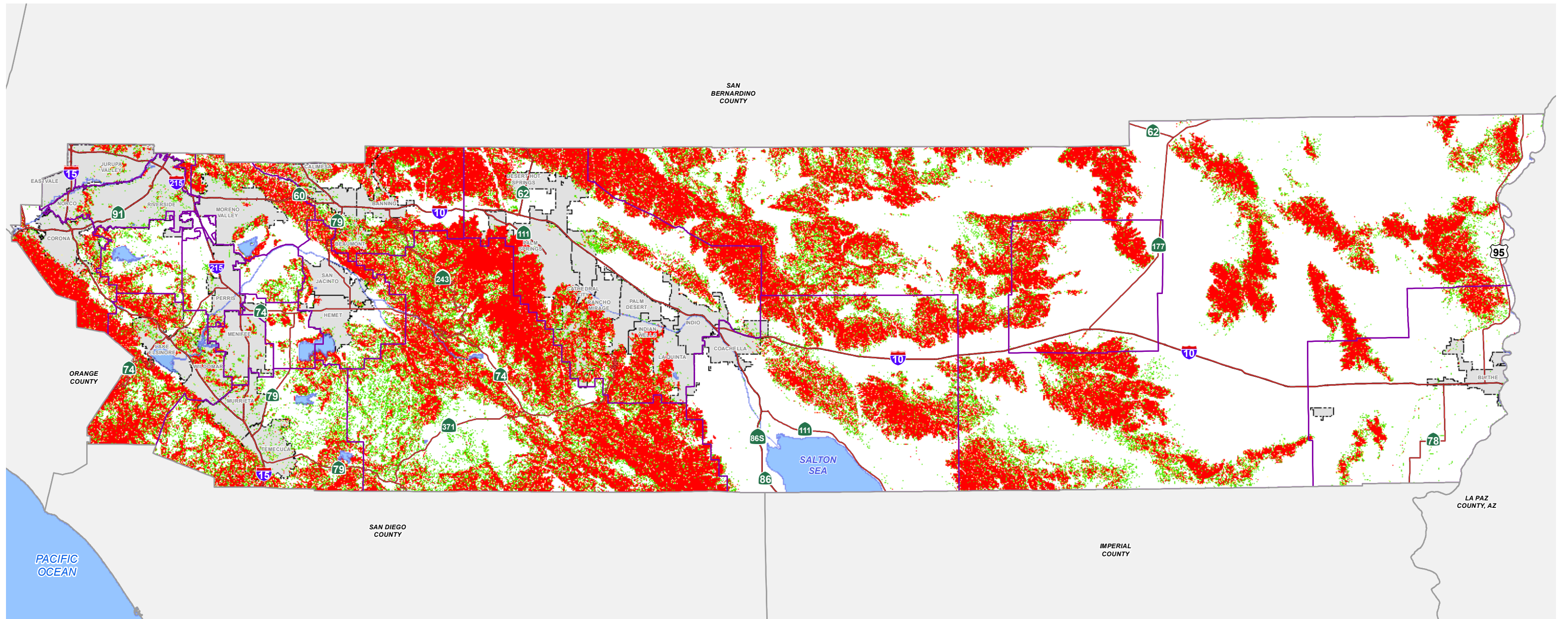
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EARTHQUAKE-INDUCED SLOPE INSTABILITY MAP

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Data Source: Riverside County Contours/Intermap (2007)

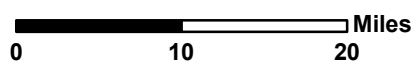
Slope Angle

- Less Than 15%
- 15%-25%
- 25%-30%
- 30% and Greater
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Figure S-5



December 8, 2015



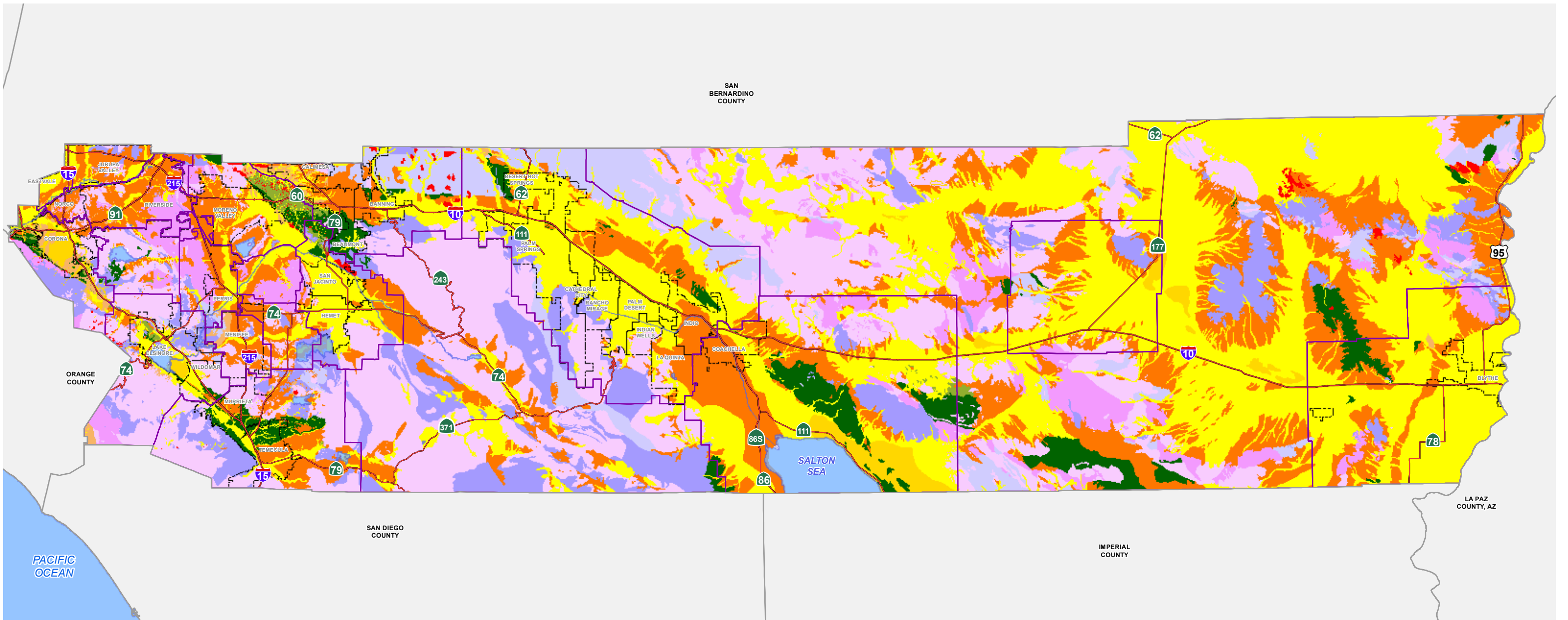
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**REGIONS UNDERLAIN
BY STEEP SLOPES**

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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 lacustrine 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 Undurated 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.

Metamorphic Rocks of Various Ages, including Meta-igneous and Metasedimentary rocks

- Massive igneous rocks.
- Foliated and/or fractured igneous rocks.

Igneous Rocks of Various Ages, both Volcanic and Plutonic

- Massive metamorphic rocks.
- Foliated and/or fractured metamorphic rocks.

Landslides

- Mapped landslides. For additional information, refer to the landslide susceptibility map.

- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Data Source: California Geological Survey (2003)

Figure S-6

December 8, 2015
 Miles

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- S 3.4 Require adequate mitigation of potential impacts from erosion, slope instability, or other hazardous slope conditions, or from loss of aesthetic resources for development occurring on slope and hillside areas.
- S 3.5 During permit review, identify and encourage mitigation of onsite and offsite slope instability, debris flow, and erosion hazards on lots undergoing substantial improvements.
- S 3.6 Require grading plans, environmental assessments, engineering and geologic technical reports, irrigation and landscaping plans, including ecological restoration and revegetation plans, as appropriate, in order to assure the adequate demonstration of a project's ability to mitigate the potential impacts of slope and erosion hazards and loss of native vegetation.
- S 3.7 Support mitigation on existing public and private property located on unstable hillside areas, especially slopes with recurring failures where Riverside County property or public right-of-way is threatened from slope instability, or where considered appropriate and urgent by the Riverside County Engineer, Fire, or Sheriff Department. (AI 100)

Subsidence and Expansive and Collapsible Soils

Subsidence refers to the sudden sinking or gradual downward settling and compaction of soil and other surface material with little or no horizontal motion. It may be caused by a variety of human and natural activities, including earthquakes.

Figure S-7 identifies areas susceptible to subsidence hazards based on geologic and hydrogeologic characteristics that are similar to regions of the county in which subsidence is documented.

Land subsidence and fissuring have been well-documented in Riverside County. Most of the early documented cases of subsidence affected only agricultural land or open space. As urban areas have expanded, so too have the impacts of subsidence on structures for human occupancy. Ground subsidence and associated fissuring in Riverside County have resulted from both falling and rising ground water tables. In addition, many fissures have occurred along active faults that bound the San Jacinto Valley and the Elsinore Trough.

Subsidence typically occurs throughout a susceptible valley. In addition, differential displacement and fissures occur at or near the valley margin, and along faults. In the County of Riverside, the worst damage to structures as a result of regional subsidence may be expected at the valley margins. Alluvial valley regions are especially susceptible.

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. Expansive soils can be widely dispersed and can be found in hillside areas as well as low-lying alluvial basins.

Expansion testing and mitigation are required by 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



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.

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 Riverside County Building Code. Active enforcement, peer review, and homeowner 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 Riverside 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 expansive soils in an affected area.

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. These 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.

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 structures;
- sagging floors; or
- non-functional windows and doors.

Policies:

- S 3.8 Require geotechnical studies within documented subsidence zones, as well as zones that may be susceptible to subsidence, as identified in Figure S-7 and the Technical Background Report, prior to the issuance of development permits. Within the documented subsidence zones of the Coachella, San Jacinto, and Elsinore valleys, the studies must address the potential for reactivation of these zones, consider the potential impact on the project, and provide adequate and acceptable mitigation measures.
- S 3.9 Develop a liaison program with all Riverside County water districts to prevent water extraction induced subsidence (AI 4).

- S 3.10 Encourage and support efforts for long-term, permanent monitoring of topographic subsidence in all producing groundwater basins, irrespective of past subsidence.

Wind Erosion

Wind erosion is a serious environmental problem attracting global attention. Soil movement is initiated as a result of wind forces exerted against the surface of the ground. Dust particles in the air create 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 abrasive blowing soil.

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. The Coachella Valley, the Santa Ana River Channel in northwestern Riverside County, and areas in and around the cities of Hemet and San Jacinto are zones of high wind erosion susceptibility (Figure S-8).

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 here 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 in this area has been noted following heavy flood events. Therefore, 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, may not be effective in mitigating wind erosion.

However, the Whitewater River provides a large component of sand to sustain the dune fields, home to several endangered species. Erosion intervention has had serious and unforeseen consequences in many places, so any proposed mitigation program should be approached carefully, with an extended period of preparatory study.

Policies:

- S 3.11 Require studies that address the potential of this hazard on proposed development within “High” and “Very High” wind erosion hazard zones as shown on Figure S-8, Wind Erosion Susceptibility Map.
- S 3.12 Include a disclosure about wind erosion susceptibility on property title for those properties located within “High” and “Very High” wind erosion hazard zones as shown on Figure S-8, Wind Erosion Susceptibility Map. (AI 92)
- S 3.13 Require buildings to be designed to resist wind loads.
- S 3.14 Educate builders about the wind environment and encourage them to design projects accordingly (AI 93, 97, 98).

Flood and Inundation Hazards

Riverside County has experienced severe flooding many times throughout its history, resulting in the loss of lives and millions of dollars in property damage. Floods are caused by rivers and creeks overrunning their banks, and most



Since 1965, eleven Gubernatorial and Presidential flood disaster declarations have been declared for Riverside County. State law generally makes local government agencies responsible for flood control in California.



Flood Facts:

Most lives are lost when people are swept away by flood currents.

Most flood-related deaths are due to flash floods.

Fifty% 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.

property damage has occurred where development has been allowed without regard for flood hazard. If urban development continues to encroach onto the floodplains without major structural improvements, Riverside County will face an ever-increasing flood hazard, and potential losses will escalate.

The tremendous capital investments made in dikes, channels, levees, and dams over the last half century have not eliminated all flood hazards, and in some instances, the protective facilities may be unable to accommodate the 100-year flood. In recent years, the idea has become increasingly accepted that, while it is essential to protect existing development, the provision of massive flood control facilities merely to permit new development over major floodplains may be unwise. It is often more effective and less costly to locate development outside of hazard areas than to attempt to control the hazard itself.

Furthermore, consistent with the intent and policies of the Multipurpose Open Space Element, the Safety Element recognizes the need to protect watercourses in their natural state. Flood and inundation policies limit the alteration of floodways and channelization when alternative methods of flood control are not technically feasible. The intent is to balance the need for protection with prudent land use solutions, recreation needs, and habitat requirements; and, as applicable, to provide incentives for natural watercourse preservation, including density transfer programs.

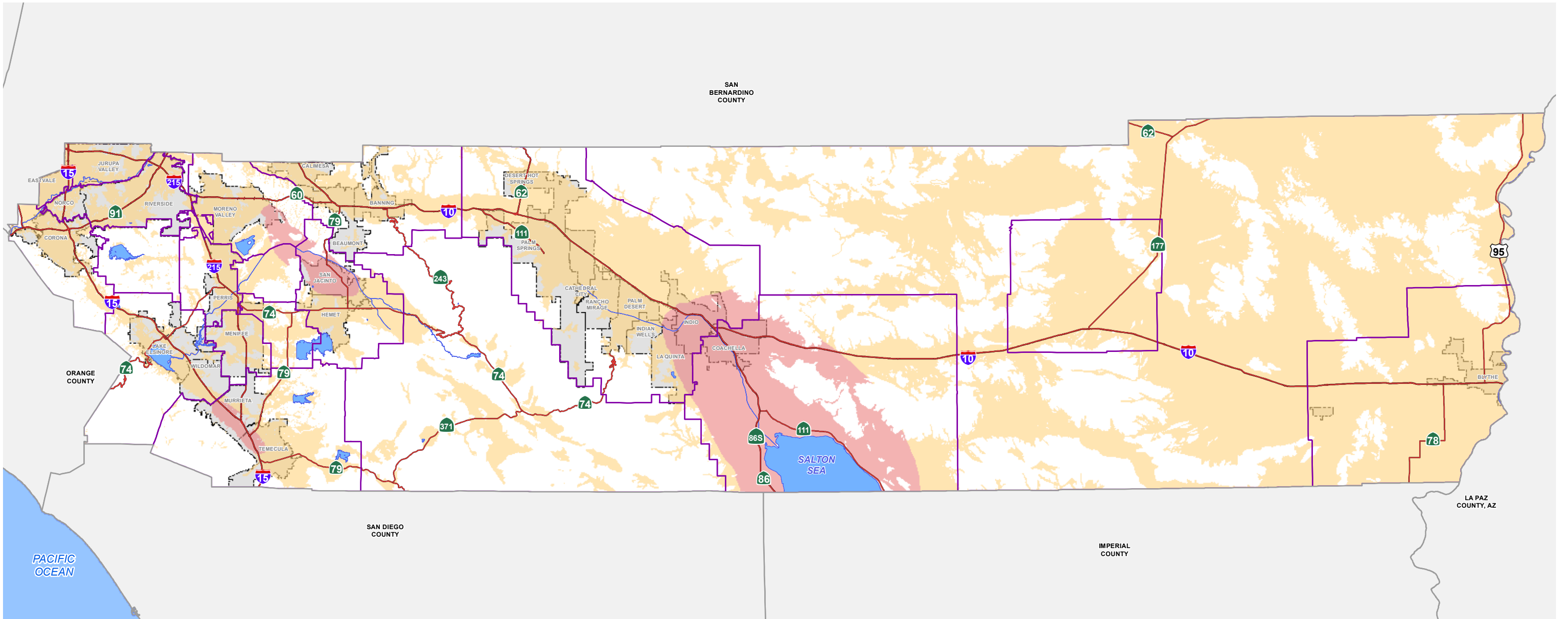
One-hundred-year flood hazard zones are identified in Figure S-9, while dam inundation zones are identified in Figure S-10.

The intent of these policies is to eliminate the need for state or federal flood disaster declarations through aggressive flood mitigation activities.

Flood and Inundation Hazard Abatement

While local agencies operate and maintain many flood control facilities, funding for the construction of such facilities often is shared with federal and state agencies. Nevertheless, local agencies independently fund many local projects without financial assistance from the federal or state governments.

Flooding susceptibility in Riverside County is primarily associated with several major stream drainages, including but not limited to the Santa Ana, San Jacinto and Whitewater Rivers, as well as smaller scale and flash flood events on many of the alluvial fans that flank Riverside 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.



Data Source: RBF Consultants (2003) and Riverside County (2007)

Subsidence Zones

- Areas with Documented Subsidence
- Susceptible Areas
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Figure S-7

December 8, 2015
 Miles

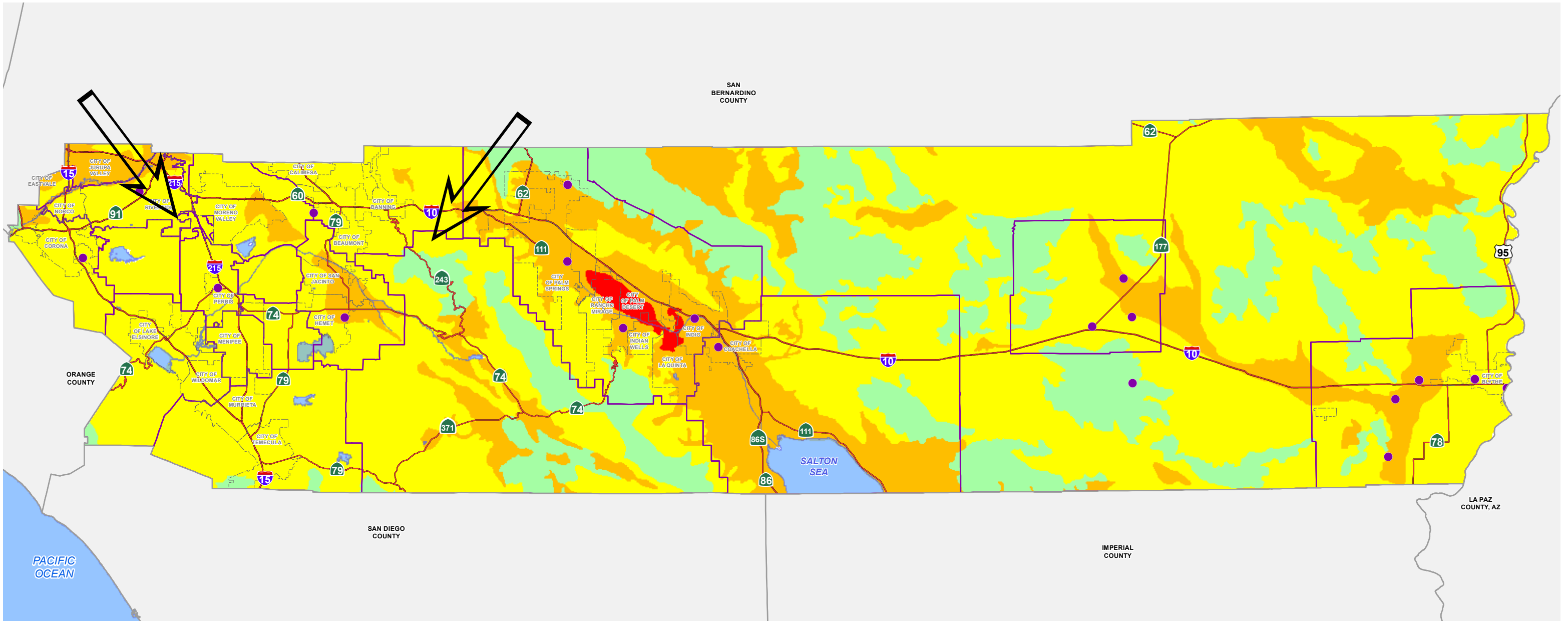
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DOCUMENTED SUBSIDENCE AREAS

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Data Source: Earth Consultants International (2003)

Wind Erodibility Rating

- Very High
- High
- Moderate
- Low
- Weather Station
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies
- General Prevailing Wind Direction

Figure S-8

I:\agency\images\Projects\Planning\SafetyElement\Winr\Erosion.mxd

December 8, 2015
 Miles
 0 10 20

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**WIND EROSION
SUSCEPTIBILITY AREAS**

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The nation has seen several catastrophic collapses of highway and railroad bridges, due to scouring and a subsequent loss of support of foundations. Major bridge crossings that are vital to the County of Riverside should be designed and built to withstand scouring. Scour at highway bridges involves flood water sediment-transport and erosion processes that cause streambed material to be removed 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. In western Riverside County, this is expected to 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 are of lower priority for seismic underpinning.

A review of records maintained at the California Office of Emergency Services provided potential failure inundation maps for 23 dams affecting Riverside County. These maps were compiled into the geographic information system digital coverage of potential dam inundation zones for Riverside County. 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 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).

Seismically-induced inundation refers to flooding that occurs when water retention structures fail during an earthquake. Often, inundation is triggered by damage from a seiche. A seiche is a wave that reverberates on the surface of water in an enclosed or semi-enclosed basin, such as a reservoir, lake, bay or harbor, in response to ground shaking during an earthquake. Seismically-induced inundation can also occur if strong ground shaking causes structural damage to above-ground water tanks. In response to this hazard, a new tank design includes flexible joints that can accommodate movement in any direction.

Policies:

- S 4.1 For new construction and proposals for substantial improvements to residential and nonresidential development within 100-year floodplains as mapped by FEMA or as determined by site specific hydrologic studies for areas not mapped by FEMA, Riverside County shall apply a minimum level of acceptable risk; and disapprove projects that cannot mitigate the hazard to the satisfaction of the Building Official or other responsible agency. (AI 25)
- S 4.2 The county shall enforce provisions of the Building Code in conjunction with the following guidelines: (AI 25)
 - a. All residential, commercial and industrial structures shall be flood-proofed from the mapped 100-year storm flow. This may require that the finished floor elevation be constructed at such a height as to meet this requirement.



Floodplains are comprised of the floodway and the floodway fringe. They are the low, flat, periodically flooded lands adjacent to rivers, lakes and oceans inundated by 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 100-year flood without cumulatively increasing the water surface elevation more than one foot.

Floodway Fringe: That portion of the floodplain between the floodway and the limits of the existing 100-year floodplain.

100-Year Floodplain: Land bordering a river or channel that can expect to be flooded in a storm that has a one-percent chance of occurring each year. Federal legislation requires that the County have a flood management program for areas that are within the 100-Year Floodplain.

Non-residential (commercial or industrial) structures may be allowed with a “flood-proofed” finished floor below the Base Flood Elevation (i.e., 100-year flood surface) to the extent permitted by state, federal and local regulations. New critical facilities shall be constructed above grade to the satisfaction of the Building Official, based on federal, state, or other reliable hydrologic studies. To the extent that residential, commercial, or industrial structures cannot meet these standards, they shall not be approved.

- b. Critical facilities shall not be permitted in floodplains unless the project design ensures that there are two routes for emergency egress and regress, and minimizes the potential for debris or flooding to block emergency routes, either through the construction of dikes, bridges, or large-diameter storm drains under roads used for primary access.
- c. Development using, storing, or otherwise involved with substantial quantities of onsite hazardous materials shall not be permitted within a 100-year floodplain or dam inundation zone, unless all standards for evaluation, anchoring, and flood-proofing have been satisfied; and hazardous materials are stored in watertight containers, not capable of floating, to the extent required by state and federal laws and regulations.
- d. Specific flood-proofing measures may require: use of paints, membranes, or mortar to reduce water seepage through walls; installation of water tight doors, bulkheads, and shutters; installation of flood water pumps in structures; and proper modification and protection of all electrical equipment, circuits, and appliances so that the risk of electrocution or fire is eliminated. However, fully enclosed areas that are below finished floors shall require openings to equalize the forces on both sides of the walls.



Alteration of Watercourses: For more detailed policies regarding the alteration of natural watercourses, please refer to the Watershed Management Section of the Multipurpose Open Space Element.

S 4.3 Prohibit construction of permanent structures for human housing or employment to the extent necessary to convey floodwaters without property damage or risk to public safety. Agricultural, recreational, or other low intensity uses are allowable if flood control and groundwater recharge functions are maintained. (AI 25)

S 4.4 Prohibit alteration of floodways and channelization unless alternative methods of flood control are not technically feasible or unless alternative methods are utilized to the maximum extent practicable. The intent is to balance the need for protection with prudent land use solutions, recreation needs, and habitat requirements, and as applicable to provide incentives for natural watercourse preservation, including density transfer programs as may be adopted. (AI 25, 60)

- a. Prohibit the construction, location, or substantial improvement of structures in areas designated as floodways, except upon approval of a plan which provides that the proposed development will not result in any significant increase in flood levels during the occurrence of a 100-year flood discharge.
- b. Prohibit the filling or grading of land for nonagricultural purposes and for non-authorized flood control purposes in areas designated as floodways, except upon approval of a plan which

provides that the proposed development will not result in any significant increase in flood levels during the occurrence of a 100-year flood discharge.

- S 4.5 Prohibit substantial modification to watercourses, unless modification does not increase erosion or adjacent sedimentation, or increase water velocities, so as to be detrimental to adjacent property, nor adversely affect adjacent wetlands or riparian habitat. (AI 60, 61)
- S 4.6 Direct flood control improvement measures toward the protection of existing and planned development. (AI 25)
- S 4.7 Any substantial modification to a watercourse shall be done in the least environmentally damaging manner practicable in order to maintain adequate wildlife corridors and linkages and maximize groundwater recharge. (AI 25, 60)
- S 4.8 Allow development within the floodway fringe, if the proposed structures can be adequately flood-proofed and will not contribute to property damage or risks to public safety. (AI 25, 60)
- S 4.9 Within the floodway fringe of a floodplain as mapped by FEMA or as determined by site specific hydrologic studies for areas not mapped by FEMA, require development to be capable of withstanding flooding and to minimize use of fill. However, some development may be compatible within flood plains and floodways, as may some other land uses. In such cases, flood proofing would not be required. Compatible uses shall not, however, obstruct flows or adversely affect upstream or downstream properties with increased velocities, erosion backwater effects, or concentrations of flows. (AI 60)
- S 4.10 Require all proposed projects anywhere in the county to address and mitigate any adverse impacts that it may have on the carrying capacity of local and regional storm drain systems.
- S 4.11 Encourage neighboring jurisdictions to require development occurring adjacent to the County to consider the impact of flooding and flood control measures on properties within unincorporated Riverside County.

High-Risk Facilities

Many essential public and quasi-public facilities and hazardous materials sites are located within the 100-year flood zones of Riverside County, including: 14 of Riverside County's 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.



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% 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 the losses associated with flooding, as well as the costs associated with mitigation. Developers can still profit from leaving wash corridors untouched, as home buyers will pay premiums to live by open space.

Policies:

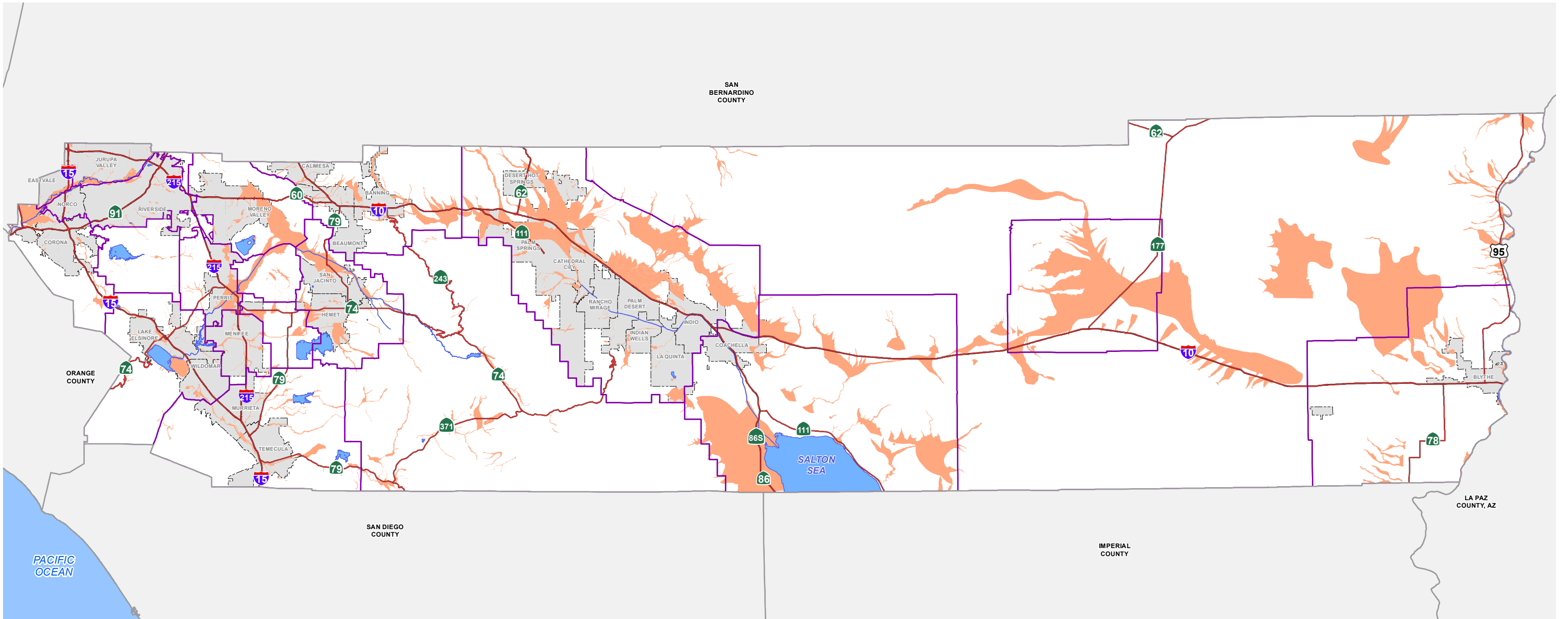
- S 4.12 Require certain existing essential, dependent care, and high-risk facilities that are not in conformance with provisions of the County zoning to upgrade or modify building use to a level of safety consistent with the inundation risk. (AI 25, 101)
- S 4.13 Require that facilities storing substantial quantities of hazardous materials within inundation zones shall be adequately flood-proofed and hazardous materials containers shall be anchored and secured to prevent flotation and contamination. (AI 25)
- S 4.14 Require that dependent care facilities have all flood-vulnerable electrical circuitry flood-proofed. (AI 101)
- S 4.15 Require that high-risk facilities maintain and rehearse inundation response plans.
- S 4.16 Utilize power of public land acquisition and other land use measures to create open space zoning of inundation zones in areas that are destined for redevelopment; when this is not feasible, low density land uses should be employed. (AI 25)

Risk Assessment

Recent environmental legislation and improved understanding and analysis of flood hazards in arid environments have resulted in new approaches to flood hazard mitigation implementation. 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 in regions susceptible to sheet flow. Where water spreads across broad areas, mitigation without channels or culverts is more difficult. Flood control structures have often been built piecemeal over the years, and new development may funnel water into older systems with insufficient capacity. These issues have been mitigated in recent years by the preparation of Master Plans by local public works agencies.

Policies:

- S 4.17 Continue to assess and upgrade inundation risk and protection in the County. (AI 83, 88)
- S 4.18 Require that the design and upgrade of street storm drains be based on the depth of inundation, relative risk to public health and safety, the potential for hindrance of emergency access and regress from excessive flood depth, and the threat of contamination of the storm drain system with sewage effluent. In general, the 10-year flood flows shall be contained within the top of curbs and the 100-year flood flows within the street right-of-way.
- S 4.19 Encourage periodic reevaluation of the 500-year, 100-year and 10-year flood hazard in the county by state, federal, county, and other sources, and use such studies to improve existing protection, to review protection standards proposed for new development and redevelopment, and to update emergency response plans. (AI 59, 60, 83, 88)
- S 4.20 Balance flood control mitigation with open space and environmental protection. (AI 59, 61)



Data Source: Riverside County Flood Control (2015)


-  Special Flood Hazard Areas
-  Highways
-  Area Plan Boundary
-  City Boundary
-  Waterbodies

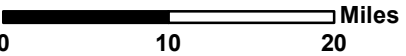
Disclaimer:
 The Public Flood Hazard Determination Interactive Map incorporates all of the Special Flood Hazard Areas in the unincorporated County of Riverside as listed in Ordinance No. 458.14 Section 5. It is updated quarterly to include any amendments, revisions or additions thereto that go into effect pursuant to Federal Law, and those that are adopted by resolution by the Board of Supervisors of the County of Riverside after a public hearing.

The flood hazard information is believed to be accurate and reliable. Flood heights and boundaries may be increased by man-made or natural causes. Moreover, this Interactive Map does not imply that land outside the regulated areas or the uses and development permitted within such areas will be free from flooding or flood damages. It is the duty and responsibility of CVWD and RCFC&WCD to make interpretations, where needed, as to the exact location of the boundaries of the special flood hazard areas and whether a property is governed by Ordinance 458.

Decisions made by the user based on this Interactive Map are solely the responsibility of the user. RCFC&WCD and CVWD assume no responsibility for any errors and are not liable for any damages of any kind resulting from the use of, or reliance on, the information contained herein without first consulting the respective flood control agency with jurisdiction. If the property of interest is close to a floodplain, users are advised to contact the appropriate flood control agency for additional information and to obtain information regarding building requirements.

Figure S-9

 December 8, 2015

 Miles

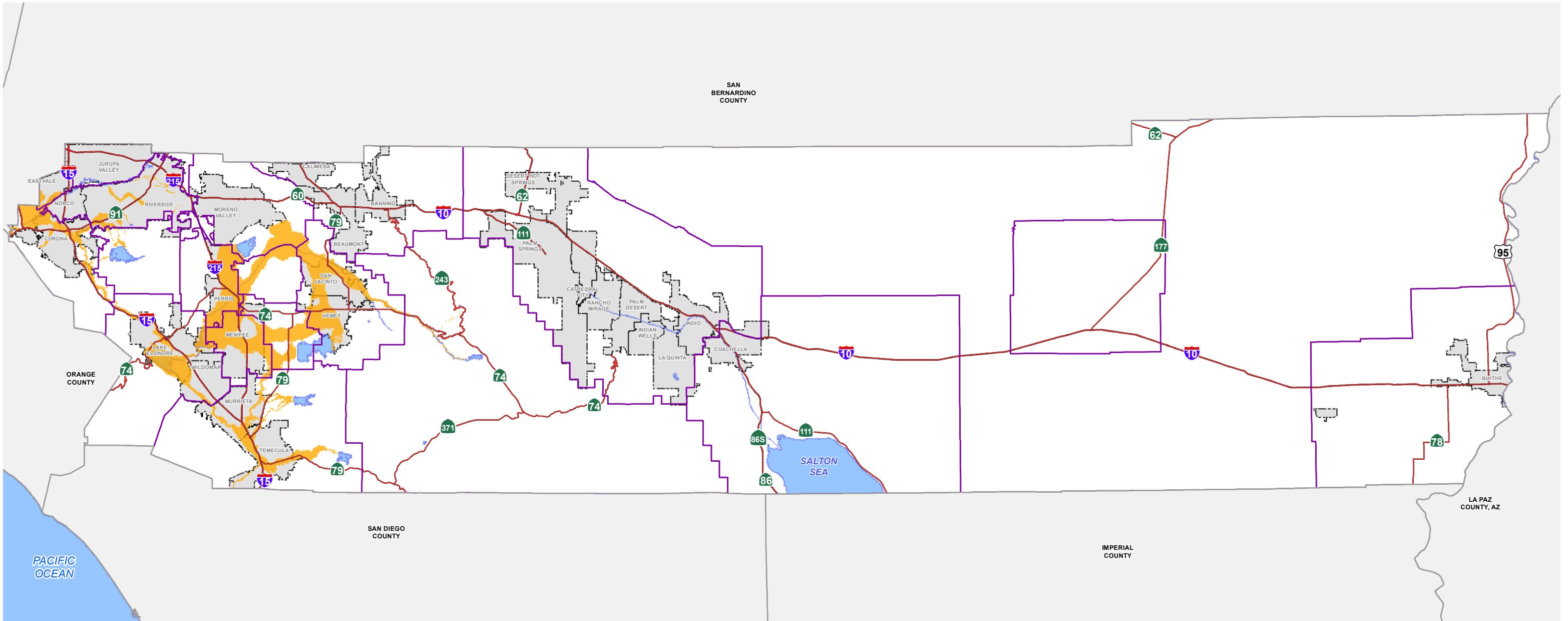
Disclaimer: Maps and data are to be used for reference purposes only. Map features are approximate, and are not necessarily accurate to surveying or engineering standards. The County of Riverside makes no warranty or guarantee as to the content (the source is often third party), accuracy, timeliness, or completeness of any of the data provided, and assumes no legal responsibility for the information contained on this map. Any use of this product with respect to accuracy and precision shall be the sole responsibility of the user.



SPECIAL FLOOD HAZARD AREAS

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Data Source: State of California Office of Emergency Services (2003) and Riverside County (2006)

Dam Hazard Zones







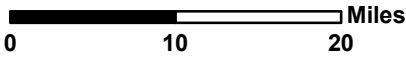
-  Dam Hazard Zones
-  Highways
-  Area Plan Boundary
-  City Boundary
-  Waterbodies

Figure S-10

 December 8, 2015

 Miles

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DAM FAILURE INUNDATION ZONES

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- S 4.21 Encourage the use of specific plans to allow increased densities in certain areas of a proposed development; or apply Transfer of Development Credits to encourage the placement of appropriate land uses in natural hazard areas, including open space, passive recreational uses, or other development capable of tolerating these hazards. (AI 25)
- S 4.22 Take an active role in acquiring property in high-risk flood zones and designating the land as open space for public use or wildlife habitat. (AI 59)

Fire Hazards

A significant portion of the county is undeveloped and consists of rugged topography with highly flammable vegetation. In particular, the hillside terrain of Riverside County has a substantial fire risk. Fire potential for Riverside County is typically greatest in the months of August, September, and October, when dry vegetation coexists with hot, dry Santa Ana winds. However, in Riverside County, fires with conflagration potential can occur at any time of the year.

Widespread fires following an earthquake, coupled with Santa Ana winds, constitute a worst-case fire suppression scenario for Riverside County. Because the fire danger is extreme, there is a statistically significant chance that the worst-case fire suppression scenario could occur.

Following a major earthquake, water availability would likely be curtailed due to breaks in water lines caused by fault rupture, liquefaction or landslides. In addition, above-ground reservoirs are vulnerable to earthquakes, which would also affect the ability to fight fires.

Over time, a majority of Southern California's wildlands will burn, as they are ecologically adapted to do. However, various human-created factors increase the 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). Wildfires in Riverside County often result in death, injury, and economic and natural asset losses. In long-term, the losses in vegetation can also lead to possible soil erosion and flooding. Wildfire susceptibility broken out by Federal, State and Local Responsibility Area (Fire Hazard and Very High Fire Hazard Severity Zones) has been mapped in Figure S-11. For additional Fire Hazard information and the most recently adopted Cal Fire maps please refer to their website at <http://frap.fire.ca.gov/index>. Additionally, assets at risk due to wildfire threat are identified in the Vegetation Management Plan and Abatement of Hazardous Vegetation Ordinance 695.

The intent of these policies is to eliminate earthquake-induced fire as a threat and to develop an integrated approach to minimizing the threat of wildland fires.

To minimize the potential for disastrous loss of structures and life (human and wildlife), a coordinated program to manage development in the hazardous areas has been identified in this section. The identified policies seek to direct growth away from high fire areas and provide effective tools to manage construction and development in these areas. In the policies that follow, references to 'Fire Hazard Severity Zones' apply to both Local and State Responsibility Areas (LRAs and SRAs) where the underlying land is under County of Riverside land use jurisdiction and designated 'Very High' fire hazard severity.



Mobile home fires erupted at a greater rate (49.1 per thousand) than other structural fires (1.1 per thousand) as a result of the Northridge earthquake. Because the County of Riverside has a large number of mobile homes, there is a potential for high numbers of earthquake-induced structural fires.

Building Code and Performance Standards

Riverside 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 pre-fire management, suppression, and post-fire management. These strategies should lessen the costly impacts of future wildfires and offer alternatives to continually increasing suppression forces. The continued use of the Riverside County Fire Department Fire Protection and Emergency Medical Services Strategic Master Plan and the Riverside County Emergency Operations Plan adopted by the Board of Supervisors will provide the necessary foundation for these management efforts.

The Riverside County Fire Department Fire Protection and Emergency Medical Services Strategic Master Plan discusses, at a minimum, descriptions of emergency services including available equipment, personnel, appropriate facilities, and capacity to assist and support wildfire suppression emergency service needs.

The Riverside County Emergency Operations Plan outlines the functions, responsibilities, and regional risk assessments of Riverside County for emergencies (e.g., wildland fires, hazardous materials incidents, flooding, dam failure, light airplane crashes) and sets forth the planned response for managing these incidents. The plan addresses initial and extended emergency response and the recovery process.



Defensible Space:

Defensible space refers to 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.

Policies:

- S 5.1 Develop and enforce construction and design standards that ensure that proposed development incorporates fire prevention features through the following:
- a. All proposed development and construction within Fire Hazard Severity Zones shall be reviewed by the Riverside County Fire and Building and Safety departments.
 - b. All proposed development and construction shall meet minimum standards for fire safety as defined in the Riverside County Building or County Fire Codes, or by County zoning, or as dictated by the Building Official or the Transportation Land Management Agency based on building type, design, occupancy, and use.
 - c. In addition to the standards and guidelines of the California Building Code and California Fire Code fire safety provisions, continue to implement additional standards for high-risk, high occupancy, dependent, and essential facilities where appropriate under the Riverside County Fire Code (Ordinance No. 787) Protection Ordinance. These shall include assurance that structural and nonstructural architectural elements of the building will not impede emergency egress for fire safety staffing/personnel, equipment, and apparatus; nor hinder evacuation from fire, including potential blockage of stairways or fire doors.



Travel time is based on standards published by the National Fire Protection Association and calculated using the travel distance from the fire station to the farthest dwelling unit of the development.

- d. Proposed development and construction in Fire Hazard Severity Zones shall provide secondary public access, in accordance with Riverside County Ordinances.
 - e. Proposed development and construction in Fire Hazard Severity Zones shall use single loaded roads to enhance fuel modification areas, unless otherwise determined by the Riverside County Fire Chief.
 - f. Proposed development and construction in Fire Hazard Severity Zones shall provide a defensible space or fuel modification zones to be located, designed, and constructed that provide adequate defensibility from wildfires.
- S 5.2 Encourage continued operation of programs for fuel breaks, brush management, controlled burning, revegetation and fire roads.
- S 5.3 Monitor fire-prevention measures (such as fuel reduction) through a site specific fire-prevention plan to reduce long-term fire risks in the Very High Fire Hazard Severity Zones.
- S 5.4 Limit or prohibit development or activities in areas lacking water and access roads.
- S 5.5 Encourage proposed development in Fire Hazard Severity Zones to develop where fire and emergency services are available or planned.
- S 5.6 Demonstrate that the proposed development can provide fire services that meet the minimum travel times identified in Riverside County Fire Department Fire Protection and EMS Strategic Master Plan.
- S 5.7 Minimize pockets of flammable vegetation that increase likelihood of fire spread through conceptual landscaping plans to be reviewed by Planning and Fire Departments in the Fire Hazard Severity Zones. The conceptual landscaping plan of the proposed development shall at a minimum include:
- a. Plant palette suitable for high fire hazard areas to reduce the risk of fire hazards.
 - b. Retention of existing natural vegetation to the maximum extent feasible.
 - c. Removal of onsite combustible plants.
- S 5.8 Design to account for topography of a site and reduce the increased risk from fires in the Fire Hazard Severity Zones located near ridgelines, plateau escarpments, saddles, hillsides, peaks, or other areas where the terrain or topography affect its susceptibility to wildfires by:
- a. Providing fuel modification zones with removal of combustible vegetation, but minimizing visual impacts and limiting soil erosion.
 - b. Replacing combustible vegetation with fire resistant vegetation to stabilize slopes.

- c. Submitting topographic map with site specific slope analysis.
- d. Submitting erosion and sedimentation control plans.
- e. Providing a minimum 30 foot of setback from the edge of the fuel modification zones.
- f. Minimizing disturbance of 25% or greater natural slopes.

Wind-Related Hazards



Santa Ana winds create a special hazard. Named by the early settlers at Santa Ana, these hot, dry winds enhance the fire danger throughout Southern California.

Widespread fires following an earthquake, coupled with Santa Ana winds, constitute a worst-case fire suppression scenario. Because of dry vegetation conditions and Santa Ana winds, the fire danger for Riverside County is considered extremely high. Therefore, there is a statistically significant chance that this worst-case fire suppression scenario could occur.

Policies:

- S 5.9 Reduce fire threat and strengthen fire-fighting capability so that the County could successfully respond to multiple fires. (AI 88)
- S 5.10 Require automatic natural gas shutoff earthquake sensors in high-occupancy industrial and commercial facilities, and encourage them for all residences.
- S 5.11 Utilize ongoing brush clearance fire inspections to educate homeowners on fire prevention tips by implementing annual countywide weed abatement program. (AI 96)

Long-Range Fire Safety Planning

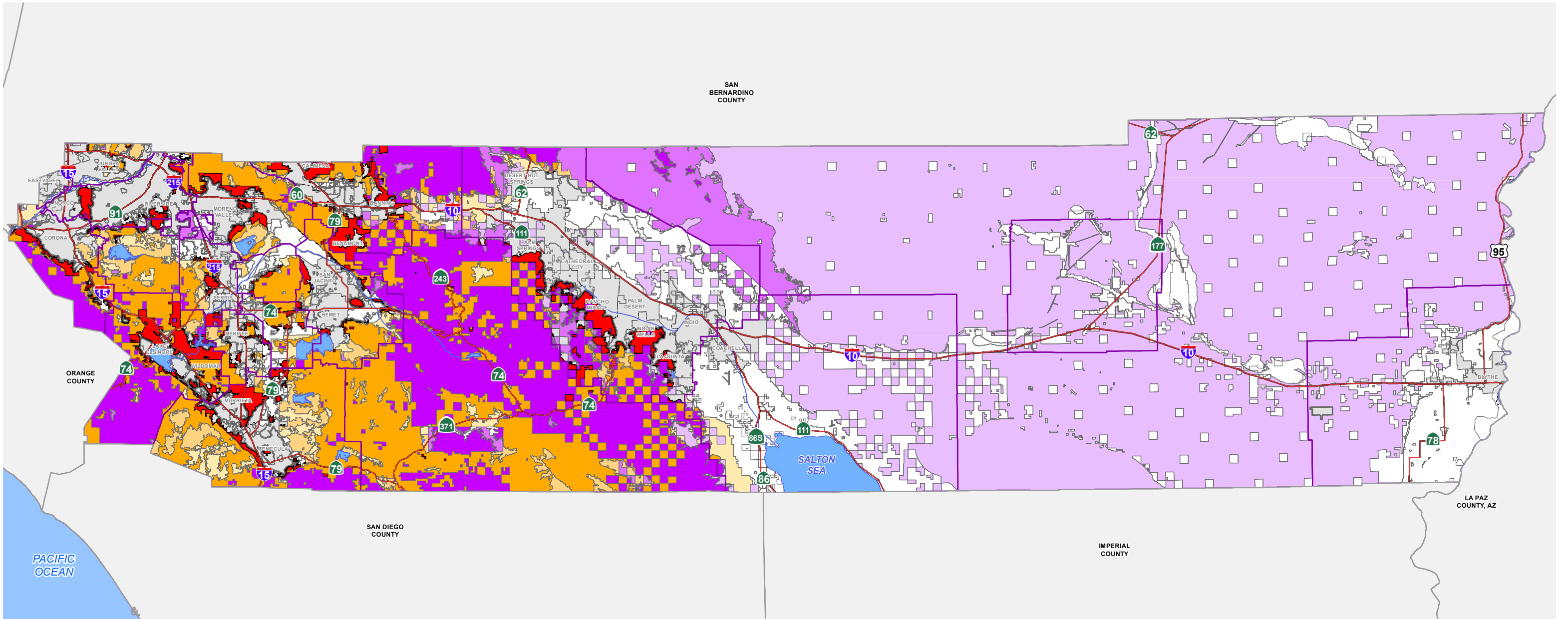
In the wildland/urban interface, flammable structures may be within reach of ignition sources from burning wildland and structural fuels. These are extremely dangerous and complex fire conditions that pose a tremendous threat to public and firefighter safety.

New developments frequently purport to maximize the amount of land left as natural open space. Cuts and/or fills are stopped at the natural interface. This leaves the backyard as the only buffer between the highly flammable natural vegetation and the house. Brush clearance is required, but can occasionally run into endangered species obstacles. The Multipurpose Open Space Element contains Policies OS 7.4 and 18.3 that address pests and invasive or nonnative species impacts related to wildfire hazard.

Wildfires leave problems behind them. During an intense wildfire, all vegetation may be destroyed, and 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; heavy rain can produce destructive debris flows. The relative importance of topography, vegetation conditions, and geologic engineering properties underlying the County of Riverside are compiled into digital databases and should be used to assist in the mitigation of post-fire debris flow hazards.

Policies:

- S 5.12 Conduct and implement long-range fire safety planning, including stringent building, fire, subdivision, and municipal code standards, improved infrastructure, and improved mutual aid agreements with the private and public sector.



Data Source: California Department of Forestry and Fire Protection (CAL FIRE), (2010)

Fire Hazard Severity Zones (FHSZ)

Local Responsibility Areas

- Very High
- All Others

State Responsibility Areas

- Very High
- High
- Moderate

Federal Responsibility Areas

- Very High
- High
- Moderate

- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Figure S-11

December 8, 2015
 Miles

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WILDFIRE SUSCEPTIBILITY

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- S 5.13 Develop a program to utilize existing reservoirs, tanks, and water wells in the county for emergency fire suppression water sources.
- S 5.14 Periodically review inter-jurisdictional fire response agreements, and improve firefighting resources as recommended in the Riverside County Fire Department Fire Protection Plan and EMS Strategic Master Plan to keep pace with development, including construction of additional high-rises, mid-rise business parks, increasing numbers of facilities housing immobile populations, and the risk posed by multiple ignitions, to ensure that (AI 4, AI 88):
- Fire reporting and response times do not exceed the goals listed in the Riverside County Fire Department Fire Protection Plan and EMS Strategic Master Plan identified for each of the development densities described.
 - Fire flow requirements (water for fire protection) are consistent with Riverside County Ordinance 787.
 - The planned deployment and height of aerial ladders and other specialized equipment and apparatus are sufficient for the intensity of development desired.
- S 5.15 Continue to utilize the Riverside County Fire Department Fire Protection Plan and EMS Strategic Master Plan as the base document to implement the goals and objectives of the Safety Element.
- S 5.16 Encourage property owners to utilize clustering and Transfer of Development Rights (TDR) program when developing lands within Fire Hazard Severity Zones by:
- Restricting the development of a property through placement of conservation easement.
 - Acquiring the conservation easements similar to that of MSHCP Program.
- S 5.17 Identify, map, and update on an as-needed continual basis, the Fire Hazard Severity Zone maps. (Figure S-11)
- S 5.18 Ensure that the Fire Department has appropriate municipal staffing and fire protection planning staff that meet the needs of development pressure and adequately respond to long range fire safety planning.
- S 5.19 Implement a coordination program with fire protection and emergency service providers to reassess fire hazards after wildfire events and to adjust fire prevention and suppression needs, as necessary.
- S 5.20 Implement a regional coordination program to increase support for coordination among fire protection and emergency service providers.
- S 5.21 Implement a long-term training and education program among government agencies and communities about fire protection. (AI 93)

Hazardous Waste and Materials

Technically, the term “hazardous materials” includes the entire spectrum of such substances from pre-product materials to waste. However, the laws and regulations governing hazardous materials, and how they are stored, transported and handled, distinguish between “hazardous materials” and “hazardous waste.” For regulatory purposes, “hazardous materials” are defined as manufactured hazardous items and materials, as well as the “pre-product” hazardous substances used to create them. These materials, both pre-and post-production, are subject to extensive management and safety requirements. The waste generated by, or resulting from, the production that process becomes “hazardous waste,” which must be safely disposed of in an appropriate manner. And, in all cases, hazardous materials that have been spilled, dumped or otherwise released into the environment, regardless of source, immediately become hazardous waste.

Although the term “hazardous waste” is much more widely known, and the effects of its poor management in the past are very evident today, hazardous materials are actually more commonly used in close proximity to the general public. They are more frequently transported on freeways and public roads, and are more frequently stored near residential areas. An excellent example is the local service station which stores thousands of gallons of highly volatile, flammable and carcinogenic material, gasoline, adjacent to or near residential development with virtually no concern on the part of the public. Hazardous waste, on the other hand, is in the spotlight of public concern. The Love Canal, Stringfellow Acid Pits, Times Beach, and other incidents have dramatically publicized the result of mismanaging hazardous waste and have left the public with a not altogether undeserved distrust of industry and government policies on hazardous waste.

To ensure that hazardous materials are disposed of safely, there is a great need for facilities to process or treat hazardous wastes to render them safe for disposal. After waste minimization, these facilities are the key to the new management philosophy, and without them, waste management would remain in the dark ages. Unfortunately, public distrust has resulted in “Not-In-My-Back-Yard” (NIMBY) syndrome, making it more difficult to site the facilities necessary to implement these procedures.

Hazardous Waste Management

Senate Bill 1082 of 1993 (Health and Safety Code Chapter 6.11) required the Secretary of the California Environmental Protection Agency (Cal/EPA) to establish a “unified hazardous waste and hazardous materials management” regulatory program (Unified Program). A local agency, such as a county, could apply to Cal/EPA for certification as a Unified Program Agency and become responsible for implementing the Unified Program within its jurisdiction. Such an agency is called a Certified Unified Program Agency (CUPA).

The State of California’s Unified Program consolidates and coordinates the following six regulatory efforts:

- Hazardous Materials Release Response Plans and Inventories (Business Plans)
- California Accidental Release Prevention (CalARP) Program
- Underground Storage Tank (UST) Program
- Aboveground Petroleum Storage Act
- Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs

- California Uniform Fire Code: Hazardous Material Management Plans and Hazardous Material Inventory Statements

The CUPA carries out the State of California's Unified Program on a regional basis and ensure that the program's implementation is consistent throughout the entire county. To that end, the CUPA must establish a program which consolidates, coordinates and makes consistent the administrative requirements, permits, inspection activities, enforcement activities, and fees for hazardous waste and materials. In order to retain its certification, the CUPA must perform an annual self-audit and is periodically reviewed by the Secretary of Cal/EPA every three years.

Shortly after Riverside County formed the Department of Environmental Health, its Hazardous Materials Management Division was designated as the Riverside County CUPA. As CUPA for Riverside County, the Division manages the following elements of the Unified Program:

Hazardous Waste Generators:

The Riverside County CUPA regulates businesses that conduct treatment of hazardous waste under certain tiered permitting requirements. Under a Memorandum of Understanding (MOU) with the California Department of Toxic Substances Control (DTSC), the DTSC regulates and inspects facilities both DTSC-permitted and non-permitted hazardous waste generators in Riverside County.

Hazardous Materials Business Plan Program (HMBP) and the Hazardous Materials Release Response Plan and Inventory Program:

The County of Riverside implements the HMBP to comply with AB2185, which addresses emergency response and the accessibility of hazardous materials information. A significant focus of the HMBP is safeguarding the community by making business' hazardous materials information readily available, both to the public and any first responders in the event of an emergency. The Riverside County CUPA addresses the issue of community-right-to-know through its records access section, which processes records requests for more than 1,000 sites each year.

Hazardous Materials Emergency Response Team:

As the environmental health representative of the Joint Hazardous Materials Emergency Response Team, the CUPA responds to hazardous materials incidents in tandem with the California Department of Forestry (CalFire) as HAZMAT 1.

Risk Management Prevention Program:

The Riverside County CUPA ensures countywide implementation of the California Accidental Release Prevention Program (CalARP) to comply with AB 3777, a state law that seeks to minimize potential emergencies involving acutely hazardous materials by requiring facilities which handle these materials to submit risk management prevention plans.

The Riverside County CUPA is also responsible for managing an "area plan" as required by the Health and Safety Code Chapter 6.95, Article 1, coordinating all local emergency resources, whether public or private. The plan addresses a variety of emergency concerns, including pre-emergency planning, emergency activities, coordination with other agencies and notification of appropriate agencies with regard to emergency incidents. The plan is a component of the California Emergency Management Agency's Regional Plan for Region VI, the California State mutual aid region encompassing Riverside County and its cities.

Underground Storage Tank (UST) Program:

The County of Riverside regulates USTs pursuant to Ordinance No. 617 (Regulating Underground Tank Systems Containing Hazardous Substances) which gives the CUPA authority to implement State of California UST regulations and to inspect USTs in the county.

Aboveground Petroleum Storage Act (APSA) Program:

AB 1130 was enacted in 2007 which allowed the State Water Resources Control Board to transfer the implementation, enforcement and administration of the APSA Program to the local agencies. As of January 2012, the CUPA began inspections of aboveground petroleum storage facilities in the county.

The following General Plan policy is intended to ensure that the land use and siting decisions take hazardous waste management and risk reduction into account:

Policies:

- S 6.1 Enforce the land use policies and siting criteria related to hazardous materials and wastes through continued implementation of the programs identified in the County of Riverside Hazardous Waste Management Plan including the following: (AI 98)
- a. Ensure county businesses comply with federal, state and local laws pertaining to the management of hazardous wastes and materials including all Certified Unified Program Agency (CUPA) programs.
 - b. Ensure active public participation in hazardous waste and hazardous materials management decisions in Riverside County through the County's land use and planning processes.
 - c. Encourage and promote the programs, practices, and recommendations contained in the Riverside County Hazardous Waste Management Plan, giving the highest waste management priority to the reduction of hazardous waste at its source.

Disaster Preparedness, Response and Recovery

The Riverside County Emergency Services establishes the responsibilities of the various Riverside County agencies in times of a disaster. Disaster preparedness and response planning include identifying short-term actions to reduce the scope of an emergency, and managing necessary resources in the event of a disaster. After any disaster, particularly an earthquake, short-term disaster recovery requires many operations that are less urgent than fire suppression or medical attention, but are equally important.

The intent of these policies is to build Riverside County into a sustainable, disaster-resistant community by accommodating natural hazards through planning, zoning, and mitigation, while preparing to respond to disasters until this goal is achieved.

Disaster Preparedness

In recent years, the County of Riverside has expanded its emergency preparedness planning. The County of Riverside is required under state law to prepare and maintain a Standardized Emergency Management System

(SEMS) Multi-hazard Functional Plan. The California Governor’s Office of Emergency Services has extensive guidelines outlining the requirements of the Riverside County SEMS. These guidelines establish policies and procedures and assign responsibilities to ensure the effective management of emergency operations under the SEMS. However, the SEMS does not address long-range recovery planning issues.

Policies:

- S 7.1 Continually strengthen the Riverside County Office of Emergency Services’ Response Plan and Multi-Jurisdictional Local Hazard Mitigation Plan and maintain mutual aid agreements with federal, state, local agencies and the private sector to assist in:
 - a. Clearance of debris in the event of widespread slope failures, collapsed buildings or structures, or other circumstances that could result in blocking emergency access or regress.
 - b. Heavy search and rescue.
 - c. Fire suppression.
 - d. Hazardous materials response.
 - e. Temporary shelter.
 - f. Geologic and engineering needs.
 - g. Traffic and crowd control.
 - h. Building inspection.

- S 7.2 Encourage the utilization of multilingual staff personnel to assist in evacuation and short-term recovery activities, and meeting general community needs. (AI 97)

- S 7.3 Require commercial businesses, utilities, and industrial facilities that handle hazardous materials to: install automatic fire and hazardous materials detection, reporting and shut-off devices; and install an alternative communication system in the event power is out or telephone service is saturated following an earthquake.

- S 7.4 Use incentives and disincentives to persuade private businesses, consortiums, and neighborhoods to be self-sufficient in an emergency by: maintaining a fire control plan, including an onsite fire fighting capability and volunteer fire response teams to respond to and extinguish small fires; and
- identifying medical personnel or local residents who are capable and certified in first aid and CPR.
- S 7.5 Conduct regional earthquake drills and, where appropriate: (AI 82)
- utilize HAZUS results in the Technical Background Report to develop internal scenarios for emergency response; and
 - test back-up power generators in public facilities and other critical facilities taking part in the earthquake drill.
- S 7.6 Improve management and emergency dissemination of information using portable computers with geographic information systems and disaster-resistant Internet access, to obtain: (AI 86)
- Hazardous Materials Disclosure Program Business Plans regarding the location and type of hazardous materials;
 - Real-time information on seismic, geologic, or flood hazards; and
 - The locations of high-occupancy, immobile populations, potentially hazardous building structures, utilities and other lifelines.

Critical Facilities and Lifelines

Critical facilities are parts of infrastructure that must remain operational after an earthquake, or facilities that pose unacceptable risks to public safety if severely damaged. In Riverside County, critical facilities include schools, hospitals, fire and police stations, emergency operation centers, communication centers, dams, and industrial sites that use or store explosives, toxic materials or petroleum products. It is essential that critical facilities have no structural weaknesses that can lead to collapse.

Critical facilities may provide only limited services if lifelines are disrupted. The issue of seismic hazard mitigation for lifelines is very complex, given the diversity of lifeline facilities. The effects of strong ground motion applies to structures involved in lifeline service, such as the control tower in an airport, or the buildings that house computers and telephone circuits that are central to communication lifelines. Strong ground motion can also result in damage



HAZUS Earthquake Scenario Loss Estimations:

HAZUS is a standardized methodology for earthquake loss estimation based on GIS. HAZUS is designed for use by state, regional and local governments in planning for earthquake loss mitigation, emergency preparedness, response and recovery. The Safety Element Technical Background Report (Appendix H) provides a detailed earthquake loss estimation for Riverside County.



Critical Facilities: 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.

to freeway interchanges and bridges that are essential for successful transportation 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.

Figures S-12 through S-22 depict the locations of hospitals, emergency response facilities, school locations, communications facilities, dams, transportation facilities, hazardous materials sites, and natural resource lifelines in relation to varying degrees of ground shaking risk. Each figure illustrates the geographical relationship between Riverside County’s critical facilities and lifelines and the potential for ground shaking. The purpose of these maps is not to convey specifics, but rather to convey a picture of the concern that the County of Riverside can use to gain an appreciation of potential risk associated with ground shaking.

Policies:

- S 7.7 Strengthen the project permit and review process to ensure that proper actions are taken to reduce hazard impacts and to encourage structural and nonstructural design and construction. Damage must be minimized for critical facilities, and susceptibility to structural collapse must be minimized, if not eliminated.
 - a. Ensure that special development standards, designs, and construction practices reduce risk to tolerable levels for projects involving critical facilities, large-scale residential development, and major commercial or industrial development through conditional use permits and the subdivision review process. If appropriate, impact fees should be assessed to finance required actions.
 - b. Require mitigation measures to reduce potential damage caused by ground failure for sites determined to have potential for liquefaction. Such measures shall apply to critical facilities, utilities, and large commercial and industrial projects as a condition of project approval.
 - c. Require that planned lifeline utilities, as a condition of project approval, be designed, located, structurally upgraded, fit with safety shutoff valves, be designed for easy maintenance, and have redundant back up lines where unstable slopes, earth cracks, active faults, or areas of liquefaction cannot be avoided.
 - d. Review proposed uses of fault setback areas closely to ensure that county infrastructure (roads, utilities, drains) are not unduly placed at risk by the developer. Insurance, bonding, or compensation plans should be used to



State Seismic Hazard Zones:

The Alquist-Priolo Earthquake Fault Hazards Zones Act addresses only the hazard of surface fault rupture - a phenomenon that only accounts for a relatively small percentage of earthquake losses. The Seismic Hazards Mapping Act was enacted to address the other 95% of earthquake losses. This act requires the State Geologist to: 1) compile maps identifying seismic hazard zones, for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes; 2) submit these maps to all affected cities, counties, state agencies, and the State Mining and Geology Board for review; and 3) provide official maps to affected cities, counties, and state agencies.

For additional information regarding Seismic Hazard Zones, please visit the Division of Mines and Geology at:

<http://www.consrv.ca.gov/dmg/>

compensate the County of Riverside for the potential costs of repair.

- S 7.8 Promote strengthening of planned and existing utilities and lifelines, the retrofit and rehabilitation of existing weak structures, and the relocation of certain critical facilities.
- S 7.9 Find alternatives that improve site safety for the protection of critical facilities. Property acquisition for open space, change in building use or occupancy, or other appropriate measures can be employed to reduce risks posed by hazards. (AI 101)
- S 7.10 Discourage development of critical facilities that are proposed in dam failure inundation areas, and apply hazardous materials safety guidelines within such zones.
- S 7.11 Coordinate with the Public Utilities Commission (PUC) and/or utilize the Capital Improvement Program, to strengthen, relocate, or take other appropriate measures to safeguard high-voltage lines, water, sewer, natural gas and petroleum pipelines, and trunk electrical and telephone conduits that (AI 4):
- Extend through areas of high liquefaction potential.
 - Cross active faults.
 - Traverse earth cracks or landslides.
- S 7.12 Require extra design considerations for lifelines across subsidence areas.

Earthquake Response System

Half of the magnitude 5.0 and greater earthquakes in California are preceded by immediate foreshocks (earthquakes within 72 hours and 10 kilometers of their mainshock). In 1991, using this information, a group of scientists developed an earthquake preparation system based on anomalous earthquake activity along the southern San Andreas fault. 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.

Policies:

- S 7.13 Develop a system to respond to short-term increases in hazard on the southern San Andreas fault, based on probabilities associated with foreshocks. (AI 85)

Emergency Evacuation

The 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. 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 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. 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.

Policies:


- S 7.14 Regularly review and clarify emergency evacuation plans for dam failure, inundation, fire and hazardous materials releases. (AI 88)
- S 7.15 Develop a blueprint for managing evacuation plans, including allocation of buses, designation and protection of disaster routes, and creation of traffic control contingencies. (AI 84, 88)
- S 7.16 During countywide earthquake drills, encourage communication and cooperation between emergency response staff and designated contacts at hospitals, high-occupancy buildings, and dependent care facilities.
- S 7.17 Adopt inundation alert and readiness levels corresponding with official forecasts by the State Office of Emergency Services, regarding earthquake prediction and potential for dam failure.

Disaster Recovery Plans

Communities around the world have recovered and reconstructed from catastrophic events. Emergency and disaster management literature about their experiences demonstrates many common patterns of recovery activity. In preparing a Safety Element for adoption, Riverside County is well positioned to learn from the disasters of others, and include advance-planning policies that provide the overall direction for future recovery planning and action. A Recovery and Reconstruction Ordinance is one component of a pre-event strategy, which itself is part of a detailed plan in a disaster preparedness, response and recovery program.

There is a point, though, when it becomes apparent that some things should **not** be rebuilt; that there are other, more appropriate uses for the land; that rebuilding today only lays the seeds for some future disaster - that fixing today is not worth wrecking tomorrow. Once that realization is reached, genuine progress in disaster reduction can be achieved.

Riverside County should prepare a recovery ordinance. At present, only a few other jurisdictions utilize 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. Over time, this law will prove increasingly valuable as more experience is gained from earthquakes and other major disasters.



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 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.

Policies:

S 7.18 Develop plans for short-term and long-term post-disaster recovery. (AI 103)

Public Information and Outreach

Effective June 1, 1998, per the State Natural Hazards Disclosure Act, sellers of real property and their agents must 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. Currently, state-issued Seismic Hazard Zone maps for Riverside County have yet to be prepared. Consequently, the hazard maps prepared for this element will be used for the purpose of notifying potential buyers during real estate transactions.

Policies:

S 7.19 Establish a far-ranging, creative, forward-thinking public education and outreach campaign, to inform the community about: (AI 93, 96)

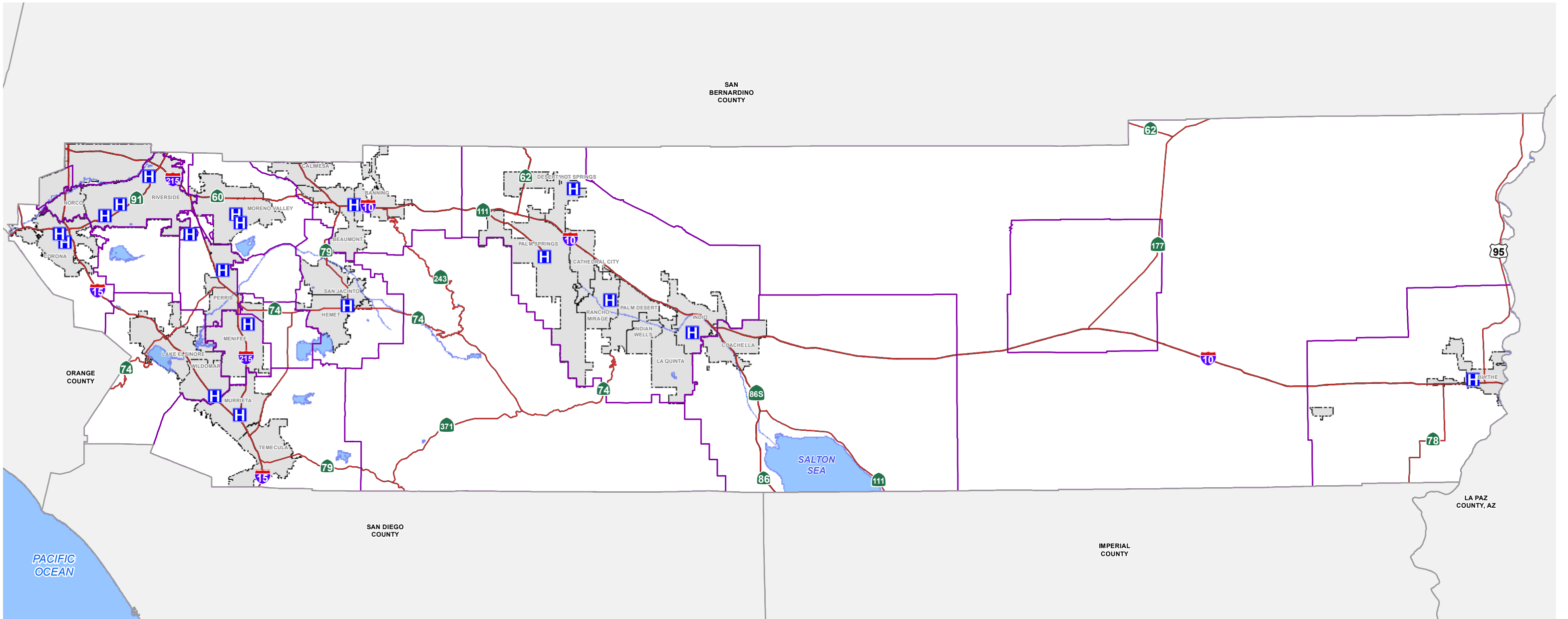
- The hazards they face.
- The costs of doing nothing to mitigate the hazards.
- What is known about each hazard.
- Why jurisdictions don't have all the answers.
- Mitigation incentives.
- What the County of Riverside does for them.
- What the County of Riverside cannot be expected to do for them.

S 7.20 Forge assertive liaisons with researchers, other government agencies and providers of mitigation services.

S 7.21 Share data, experience, and strategies with other emergency management agencies.

S 7.22 Maximize use of technology and the Internet. (AI 94, 99)

S 7.23 Make the County of Riverside Hazard Management web site into a knowledge resource for Riverside County officials, educators, developers, builders, and the general public. (AI 94, 95, 99)



Data Source: Riverside County (2010)







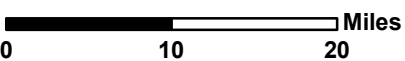
-  Hospital Locations
-  Highways
-  Area Plan Boundary
-  City Boundary
-  Waterbodies

Figure S-12

 December 8, 2015

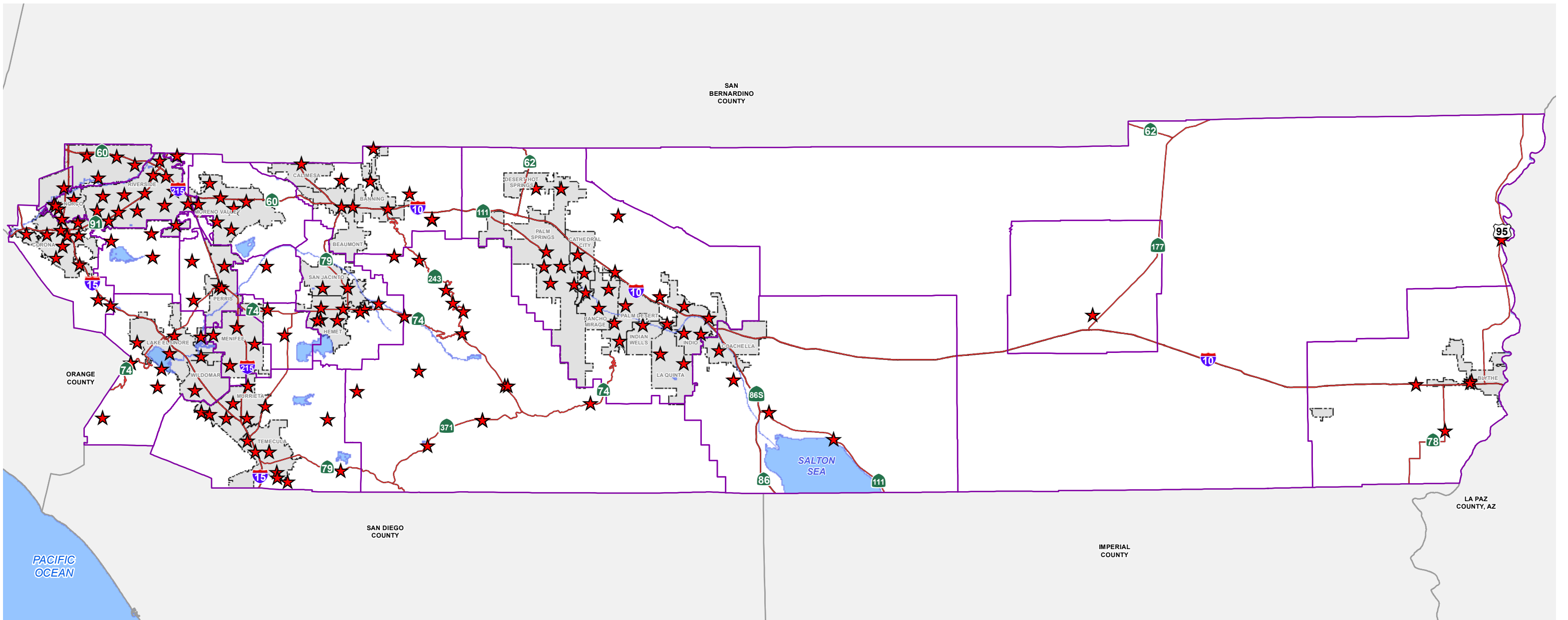
 Miles

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INVENTORY OF MAJOR HOSPITAL LOCATIONS

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Data Source: Riverside County (2010)

- ★ Fire Station Locations
- ~ Highways
- Area Plan Boundary
- ⊕ City Boundary
- ☪ Waterbodies

Figure S-13

December 8, 2015

0 10 20 Miles

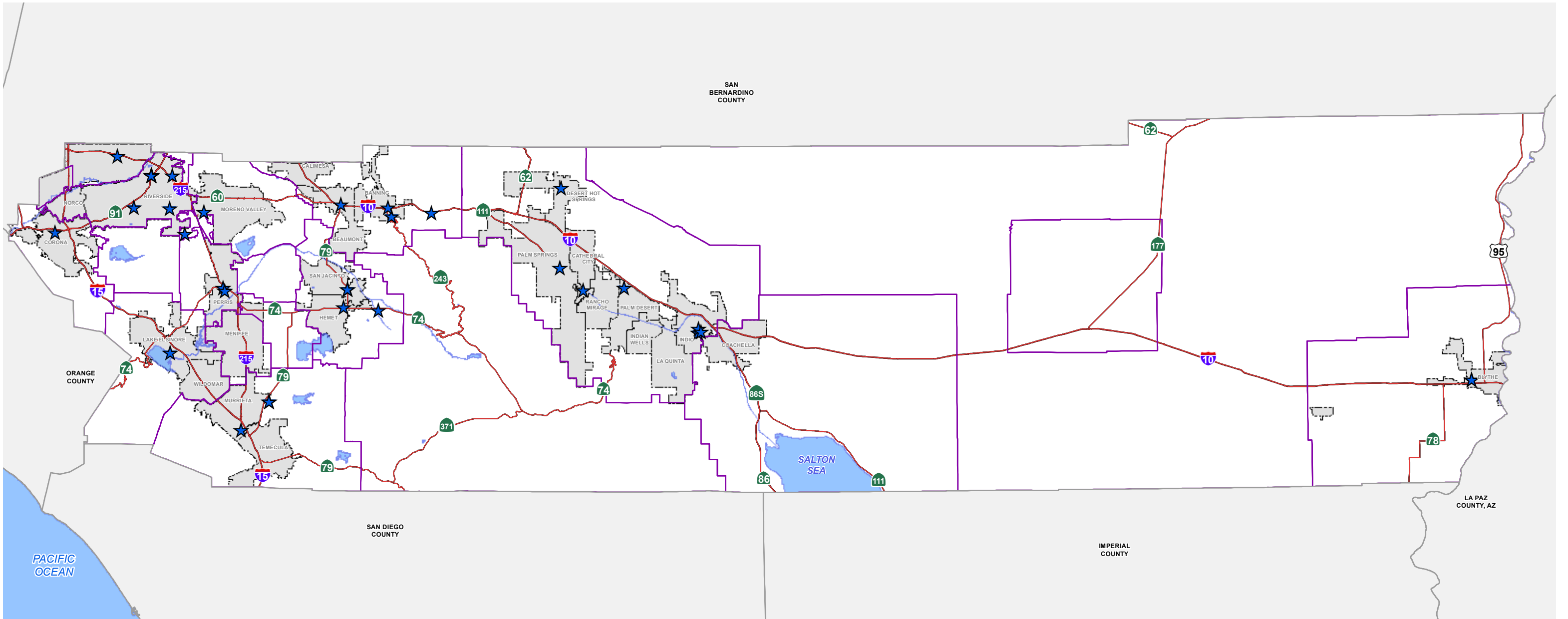
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INVENTORY OF FIRE STATIONS/FACILITIES

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Data Source: Riverside County (2010)

- ★ Police and Sheriff Stations
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Figure S-14

December 8, 2015

0 10 20 Miles

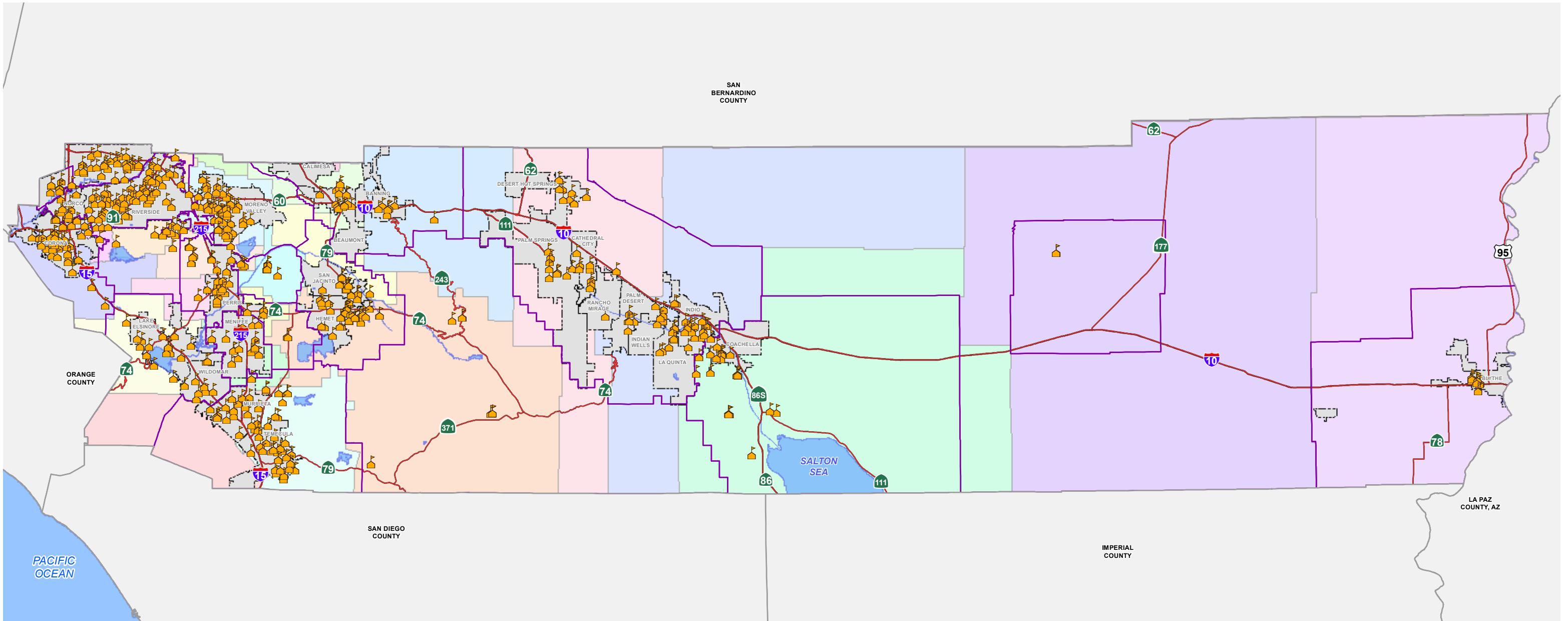
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INVENTORY OF EMERGENCY RESPONSE FACILITIES

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Data Source: Riverside County (2009)

School Districts

- | | | | | |
|--------------------------|-----------------------------------|----------------------------------|--------------------------------|--------------------|
| Alvord Unified | Desert Center Unified | Moreno Valley Unified | Riverside Unified | School Sites |
| Banning Unified | Desert Sands Unified | Murrieta Valley Unified | Romoland & Perris Union High | Highways |
| Beaumont Unified | Hemet Unified | Nuview Union & Perris Union High | San Jacinto Unified | Area Plan Boundary |
| Coachella Valley Unified | Jurupa Unified | Palm Springs Unified | Temecula Valley Unified | City Boundary |
| Colton Joint Unified | Lake Elsinore Unified | Palo Verde Valley Unified | Val Verde Unified | Waterbodies |
| Corona-Norco Unified | Menifee Union & Perris Union High | Perris & Perris Union High | Yucaipa-Calimesa Joint Unified | |

Figure S-15

December 8, 2015

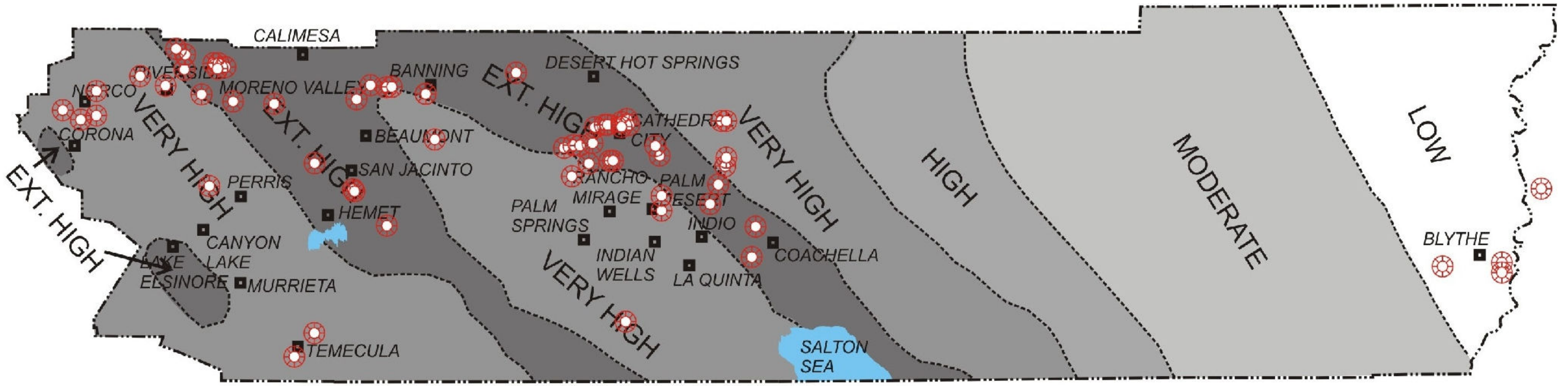
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INVENTORY OF SCHOOL LOCATIONS

I:\agency\images\Projects\Planning\SafetyElement\Schools.mxd

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Data Source: Earth Consultants International (2003)

 Location of Communication Facility: Television and Radio Stations and Businesses with a Commercial Licence (based on HAZUS '99 inventory.)

General Ground Shaking Risk







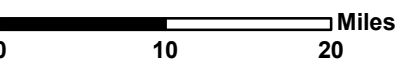
-  Low = <10% g
-  Moderate = 10-20% g
-  High = 20-30% g
-  Very High = 30-40% g
-  Ext. High = >40% g

Figure S-16

 December 8, 2015



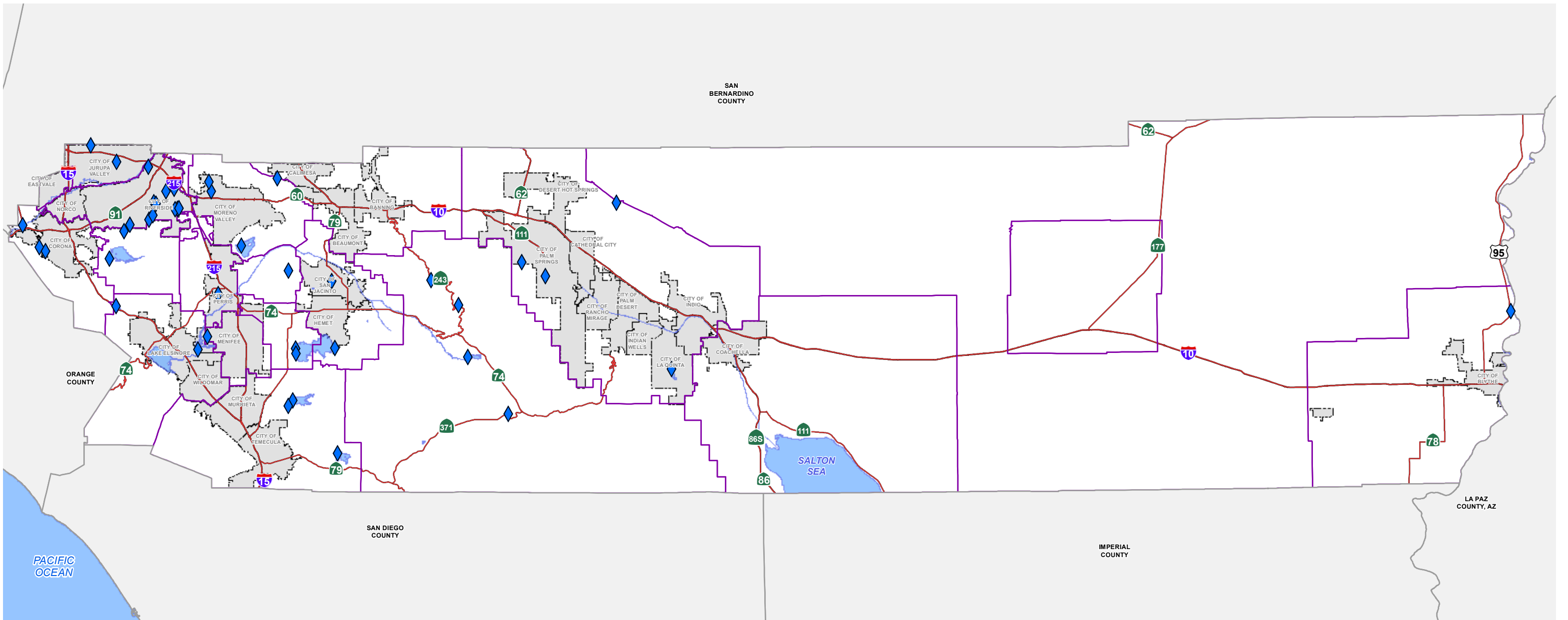
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INVENTORY OF COMMUNICATION FACILITIES

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Data Source: Riverside County (2003)

- ◆ Dam Locations
- ~ Highways
- Area Plan Boundary
- City Boundary
- ☾ Waterbodies

Figure S-17

↑ December 8, 2015
0 10 20 Miles

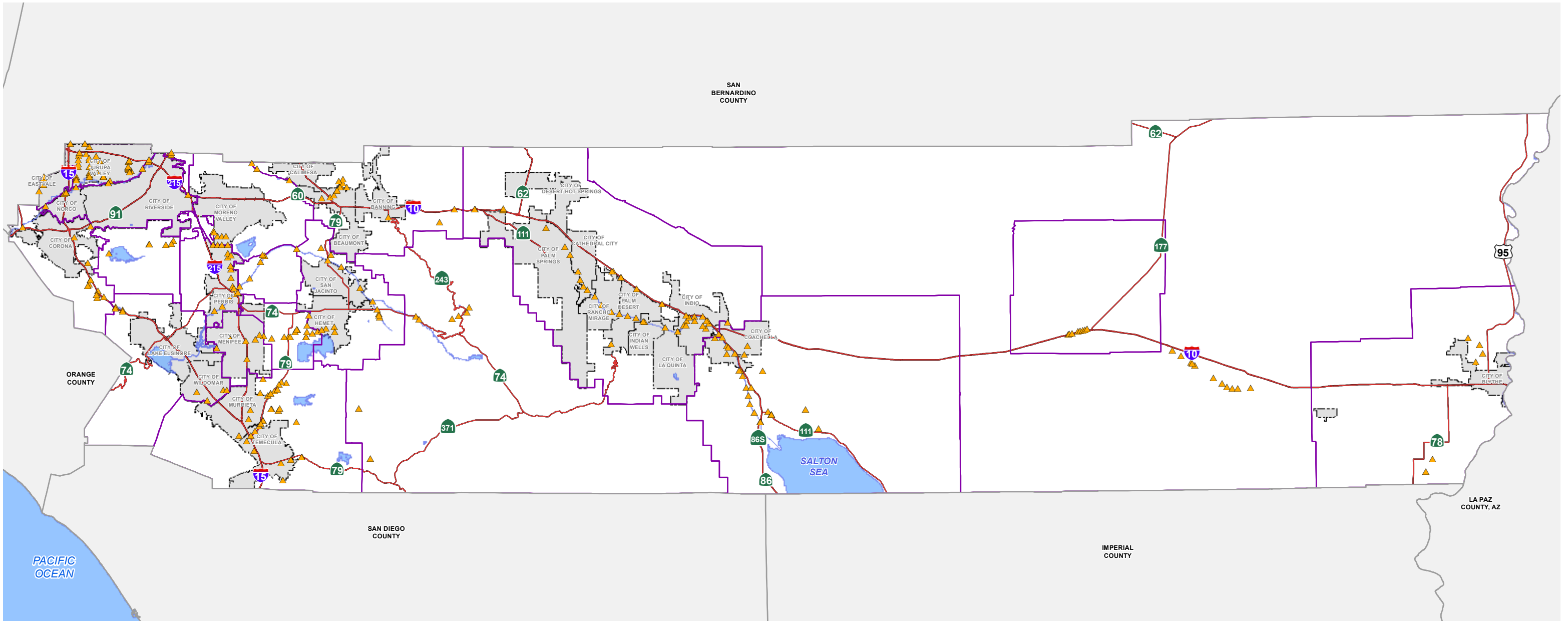
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INVENTORY OF DAM LOCATIONS

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Data Source: Riverside County (2012)

- ▲ Bridge Locations
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Figure S-18

December 8, 2015

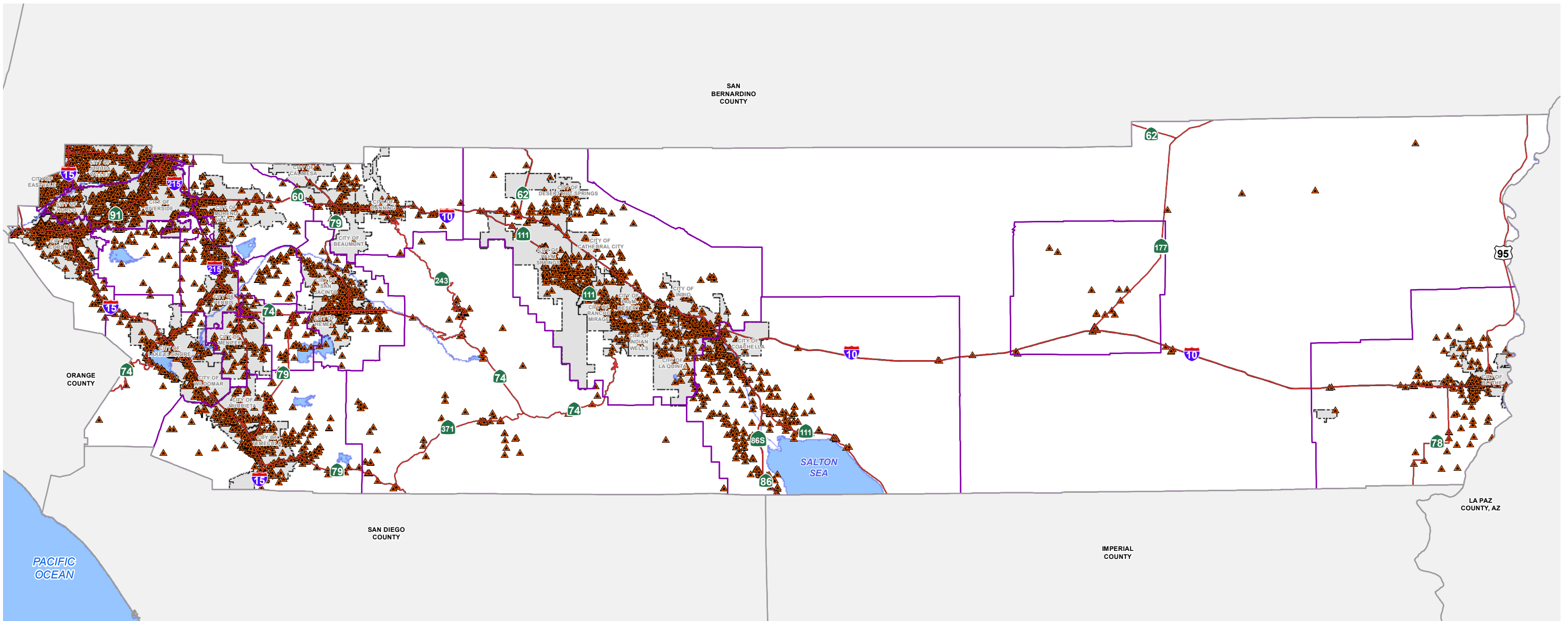
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INVENTORY OF HIGHWAY BRIDGES

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Data Source: Riverside County (2001),
California Department of Toxic Substances (2011)

- ▲ Hazardous Materials Sites
- Highways
- Area Plan Boundary
- + City Boundary
- Waterbodies

Figure S-19

December 8, 2015

0 10 20 Miles

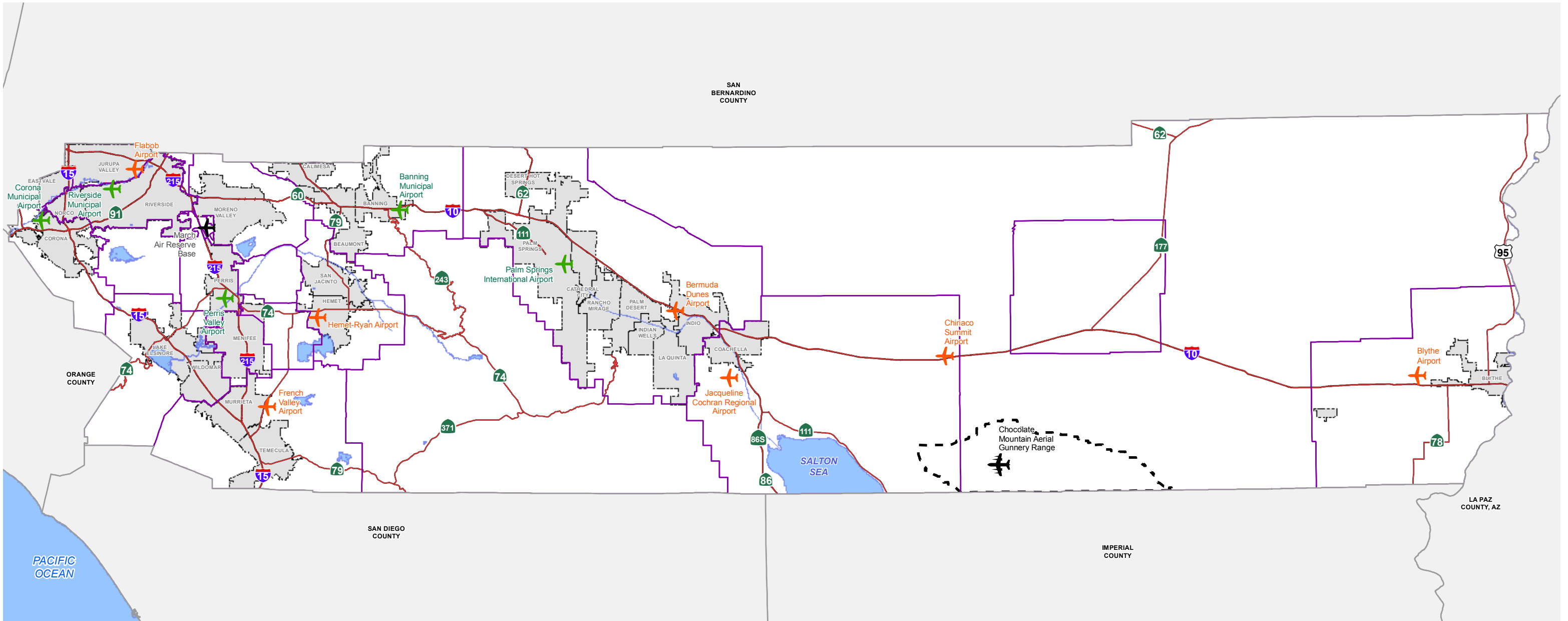
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INVENTORY OF FACILITIES STORING HAZARDOUS MATERIALS

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Data Source: Riverside County (2011)

- Public Use General Aviation Airport (Unincorporated Area)
- Public Use General Aviation Airport (Within Cities)
- Military/Civilian Facility
- Military Facility
- Highways
- Area Plan Boundary
- City Boundary
- Waterbodies

Figure S-20

December 8, 2015

0 10 20 Miles

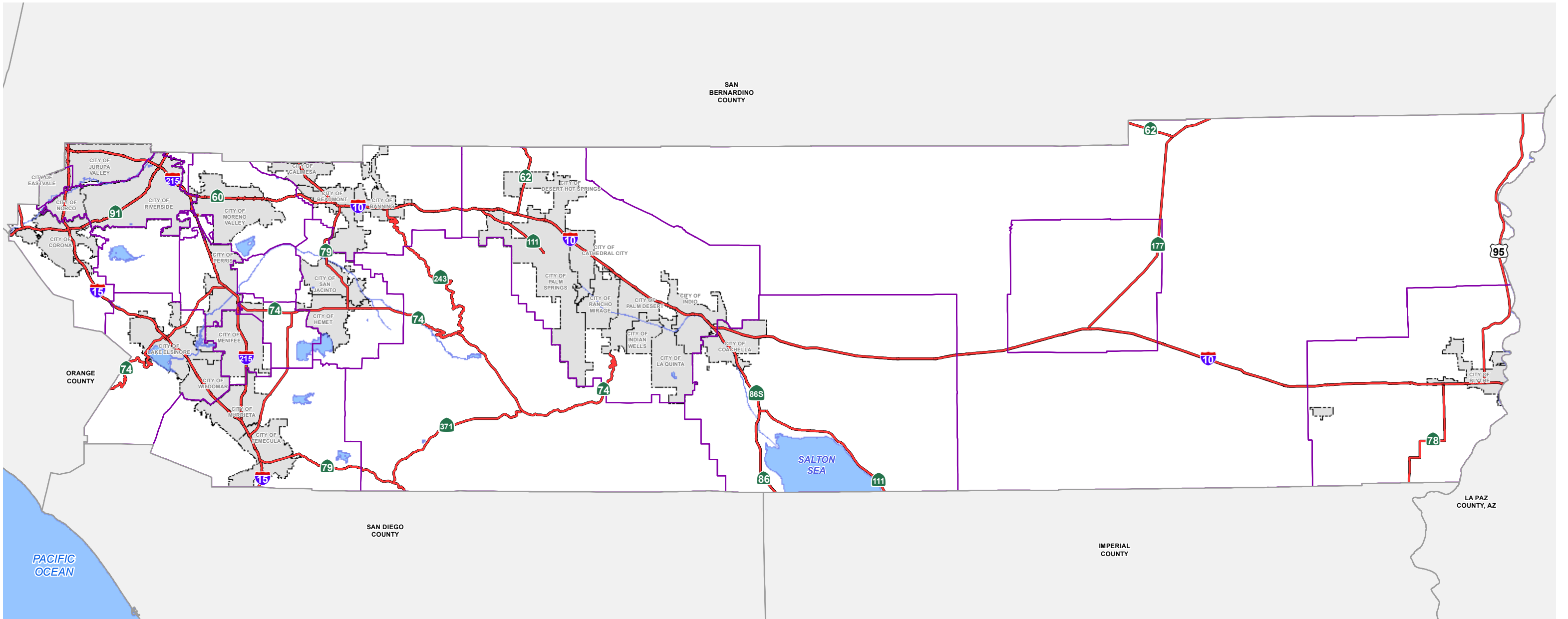
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AIRPORT LOCATIONS

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Data Source: Riverside County (2013)






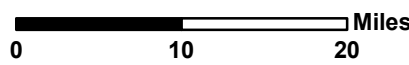
-  Highways
-  Area Plan Boundary
-  City Boundary
-  Waterbodies

Figure S-21

 December 8, 2015

 Miles

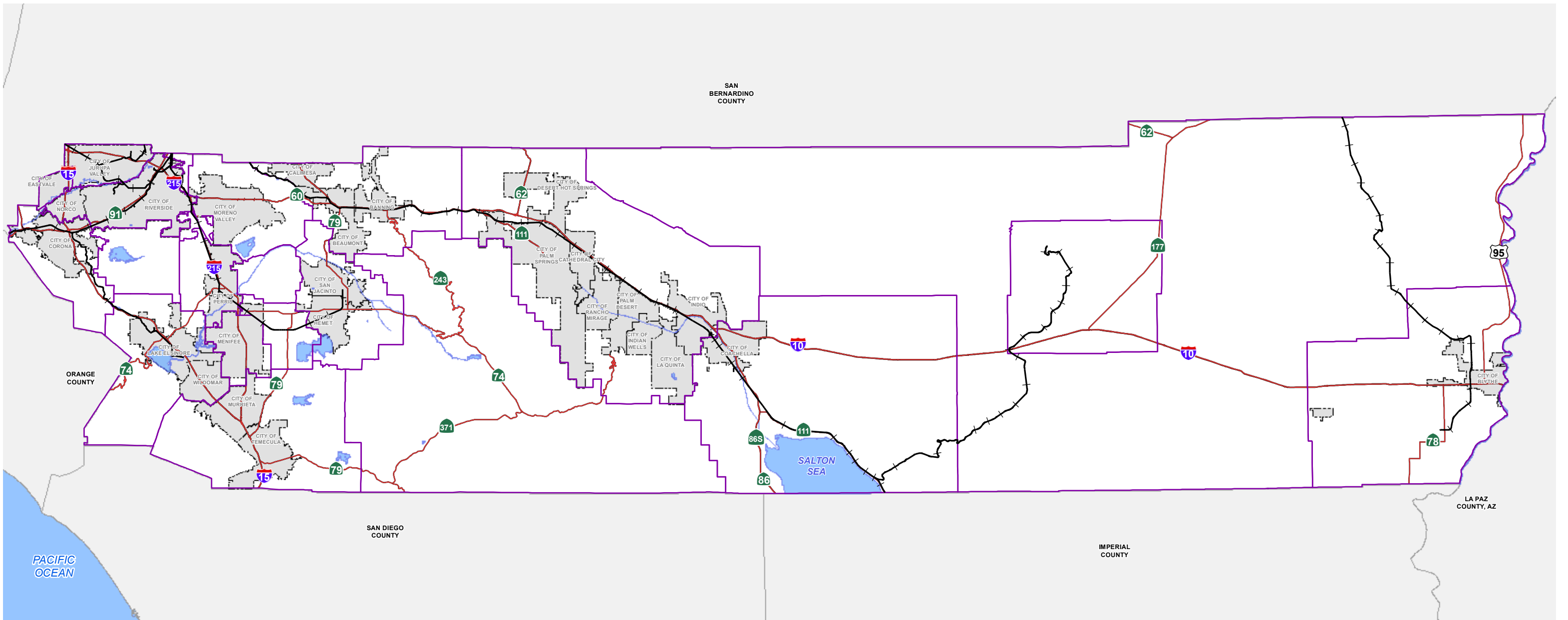
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MAJOR HIGHWAY LOCATIONS

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Data Source: Riverside County (2011)

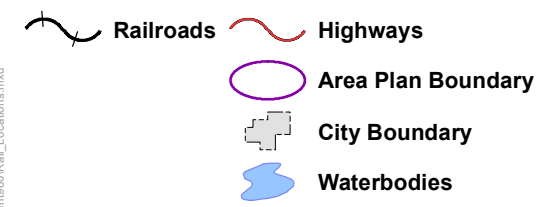
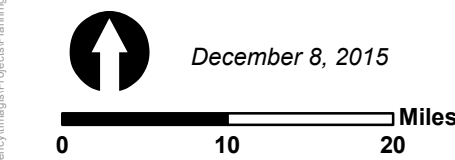


Figure S-22



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RAIL LOCATIONS

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