Seismic

ELEMENT D
SEISMIC

GOAL: Minimize the loss of life, disruption of goods and services, and destruction of property associated with an earthquake.

Description of Seismic Activity

A seismic event, or earthquake, is the movement of the earth's crust along a fault. The impact of a seismic event on any given location depends on two factors: geologic setting and geologic conditions.

Geologic setting refers to an area's proximity to active earthquake faults. A fault is a fracture in the earth's crust forming a boundary between rock masses that have shifted. For planning purposes, an active fault is usually defined as a fault that shows movement within the last 11,000 years and can be expected to move within the next 100 years.

Geologic conditions refer to the stability of the soil during an earthquake. For example, loose, unconsolidated soil is more prone to liquefaction during an earthquake than compacted soil or rock. The City of Irvine and sphere of influence are located in Seismic Zone 4, as identified in the Uniform Building Code. This zone indicates the highest classification of the four zones in the United States, with the most stringent requirements for building design. In addition, the Seismic Element evaluates five general types of geologic conditions called Seismic Response Areas (SRA), which are described in the Existing Conditions Section of this Element and shown in Figure D-3.

This element identifies seismic hazards and discusses strategies for reducing disasters. Due to the strong relationship between this element and the Safety Element, both elements should be considered together in identifying the location and type of development permitted in the City, in developing building standards and in providing services to City residents.

Existing Conditions

The City of Irvine and its sphere of influence are affected by both local and regional active faults. Figure D-1, Regional Geology, depicts the City's location in relation to these active faults. The following list describes these surrounding faults:

a. Norwalk Fault - a local fault on which there has been some recorded activity north of the City.

b. Newport-Inglewood Fault - the nearest regional, active fault. Originates north of Inglewood, passes below Newport Bay and Balboa Island and continues south off the coast, possibly as far as San Diego. This fault is capable of generating earthquakes up to a magnitude of 7.5 on the Richter Scale.

c. Whittier-Elsinore Fault - passes the City and sphere of influence about ten miles to the northeast. It is considered potentially active, as there is evidence of large movements in the recent geologic past (10,000 years); and it is considered capable of generating earthquakes up to a magnitude of 7.5 on the Richter Scale.

d. San Andreas Fault - passes within 35 miles of the City and sphere of influence and is capable of generating earthquakes of 8.0 on the Richter Scale.

e. San Jacinto Fault - approximately 30 miles to the northeast of Irvine and parallel to the San Andreas fault. This fault has been more active than the San Andreas fault within the last 100 years. It is capable of generating earthquakes up to 7.5 on the Richter Scale.

In addition, a number of inactive faults have been identified in the City. These are shown on Figure D-2, Inactive Fault Location. Figure D-3 shows the locations of the Seismic Response Areas (SRAs) within the City.

SRAs describe the different types and magnitudes of potential seismic hazards, making it possible to evaluate the risks of property damage, personal injury, and loss of vital services which may result from an earthquake.

The predominant characteristics of the Seismic Response Areas are:

Failed Support Columns - Northridge

SRA 1: Potential soft or loose soils/high ground water. This is one of the two areas considered to have a greater potential for ground failure in the form of liquefaction, in comparison to the other seismic response areas. Liquefaction is not expected to occur for all earthquakes, or over the whole of SRA 1.

SRA 2: Denser soils/deeper ground water. The predominant potential seismic hazard in this area is ground motion. Ground breakage and/or ground failure is not expected to characterize this area. Localized liquefaction potential is remote.

SRA 3: Shallow alluvium over and abutting bedrock. Ground motion is the primary

potential seismic hazard. As a slope increases in this area, slope instability potential also increases. Localized liquefaction potential is remote.

SRA 4: Highlands characteristically over 20 percent slope. In general, this area is potentially less stable than in SRA 3 due to the larger incline. Liquefaction potential is extremely remote.

Parking Structure - Northridge

SRA 5: Less stable geologic formations. These are areas representing existing mapped landslide areas. As such, potential for slope instability is higher than in SRA 4.

Ground breakage is not expected to occur within the City and sphere of influence. However, the City would be subject to ground motion and other effects of earthquakes. Careful planning will be necessary to minimize public maintenance costs for development in these areas.

The magnitude of risk will vary throughout the City and sphere of influence depending upon the land use. Land uses differ~~s~~ in terms of type of construction, type of occupancy, function, cost~~s~~, and value of improvements. Figure 1 in Appendix D, the Seismic Land Use Compatibility Matrix, indicates the level of compatibility between different land uses and the seismic response areas within the City.

Trends

The City of Irvine's seismic activity report shows that Irvine might have a 50 percent probability in any 100-year period, for one of the following two earthquakes:

a. A nearby earthquake (within 10 miles of the City) of moderate Richter magnitude 5 to 6. Such an earthquake could occur on the Newport-Inglewood or Whittier-Elsinore fault systems.

b. A major, distant earthquake (20-40 miles from the City) of Richter Magnitude 8 to 8.5. Such an earthquake could occur on the San Andreas Fault.

Identification of Issues

1. **How can the City appropriately regulate development in areas subject to differing levels of risk, thus minimizing the risk of seismic hazards to life and property?**
2. **What steps can the City take to minimize loss of life and property in the occurrence of an earthquake?**
3. **What steps can the City take to implement standards for retrofit to ensure that all buildings meet seismic restraint requirements?**

Response to Issues

The following objectives and policies have been adopted to address the seismic issues.

OBJECTIVE D-1: POTENTIAL HAZARDS

Take potential environmental hazards into account in the General Plan.

The following policies support Objective D-1:

Policy (a): Identify the locations of potential seismic hazards to minimize the effects of the potential hazard through special development constraints. Conduct a research program to develop more refined boundaries for seismic response areas, particularly for SRA 1.

OBJECTIVE D-2: RESPONSE TO HAZARDS

Require appropriate measures to protect public health and safety and to respond to seismic hazards in all public and private developments.

The following policies support Objective D-2:

Policy (a): Use Figure D-3 during development review to minimize the effects of environmental hazards as follows:

- For development in Seismic Response Areas 1, 2, 3, and 4:

  Concurrent with submittal of applications for concept plans and zone changes, as well as the preparation of environmental impact reports, preliminary geotechnical reports are required for the following uses:

  1. All planning area level proposals.
  2. Community/regional level shopping centers.
  3. Major commercial/office centers.
  4. Major public facilities.
  5. Major public utilities.
  6. Major transportation linkages.
  7. Any facility critical to emergency response (i.e. hospitals, police and fire stations, municipal government centers, transportation linkages, and designated emergency centers).
  8. Major industrial development (applies to SRA 1 only).

  If a detailed geotechnical report confirms the existence of a seismic hazard, the City has the option to require special earthquake resistant design features or use limitations as appropriate to the specific case.

- For development in Seismic Response Area 5:

  Preliminary geotechnical reports shall be submitted with applications for concept plans and zone changes as well as with

environmental impact reports for non-open space uses. Those reports should concentrate on addressing slope instability and probable changes to the environment which would occur if these areas would be developed.

If a detailed geotechnical report confirms existence of potential seismic hazard, the City has the option to require special earthquake resistant design features or use limitations as appropriate to the specific case.

Policy (b): Incorporate the Seismic Land Use Compatibility Matrix Table D-1 requirements into the environmental impact review process.

Policy (c): Continue to coordinate emergency planning efforts with the other cities in Orange County, the County of Orange, and the state.

Policy (d): Require detailed site studies to determine the potential for seismic hazards for facilities which are critical in an emergency. These facilities include but are not limited to:

- Police and fire stations.
- Municipal government centers.
- Transportation infrastructure.
- Major public utilities (electrical, gas and water facilities).
- Designated emergency centers.
- Buildings greater than 15 stories in height.

Policy (e): Require installation of accelerographs to measure seismic movement in highrise structures, where deemed necessary by the Chief Building Official.

Policy (f): Continue to maintain a "command post" to facilitate emergency efforts if a seismic event should occur.

Policy (g): Require a detailed geological and soils study as needed, in accordance with the requirements of the City's Subdivision Ordinance, before approving development.

Policy (h): Continue to require structures to conform to the seismic design requirements found in the Uniform Building Code.

Policy (i): Ensure that the most recent adopted seismic standards are used for new construction.

OBJECTIVE D-3: CITIZEN PARTICIPATION

Encourage the community to take action to protect itself from seismic hazards.

The following policies support Objective D-3:

Policy (a): Sponsor earthquake insurance programs for City residents.

Policy (b): Sponsor educational programs to prepare the community for earthquakes and other natural disasters.

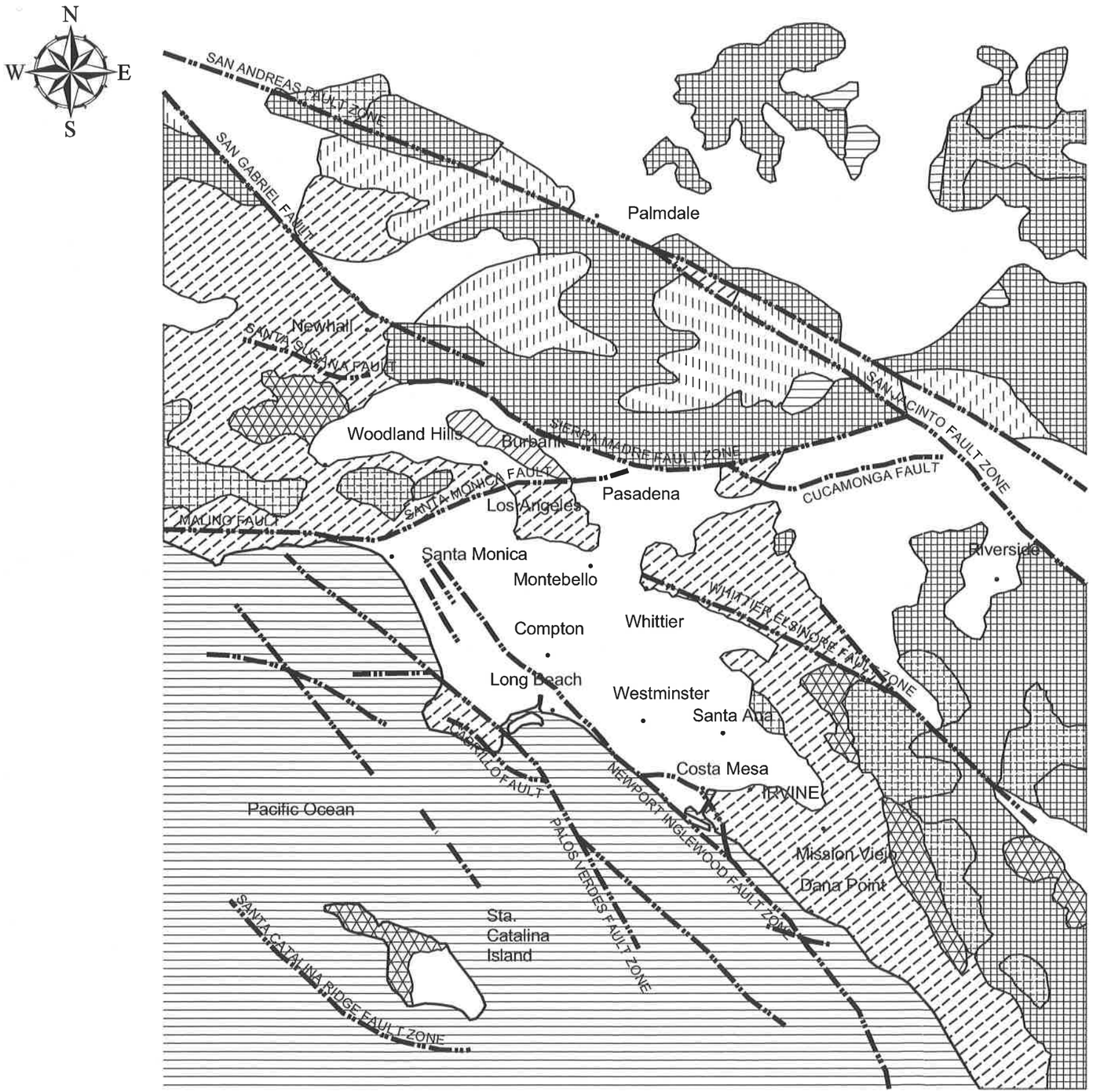
Policy (c): Encourage the community to establish "family emergency disaster plans."

Policy (d): Encourage the community to purchase disaster insurance.

RELATED OBJECTIVE NUMBERS

The following objectives are related to the Seismic Element:

Land Use Element- A-6
Safety Element - J-1
Conservation and Open Space Element - L-4, L-5, L-10



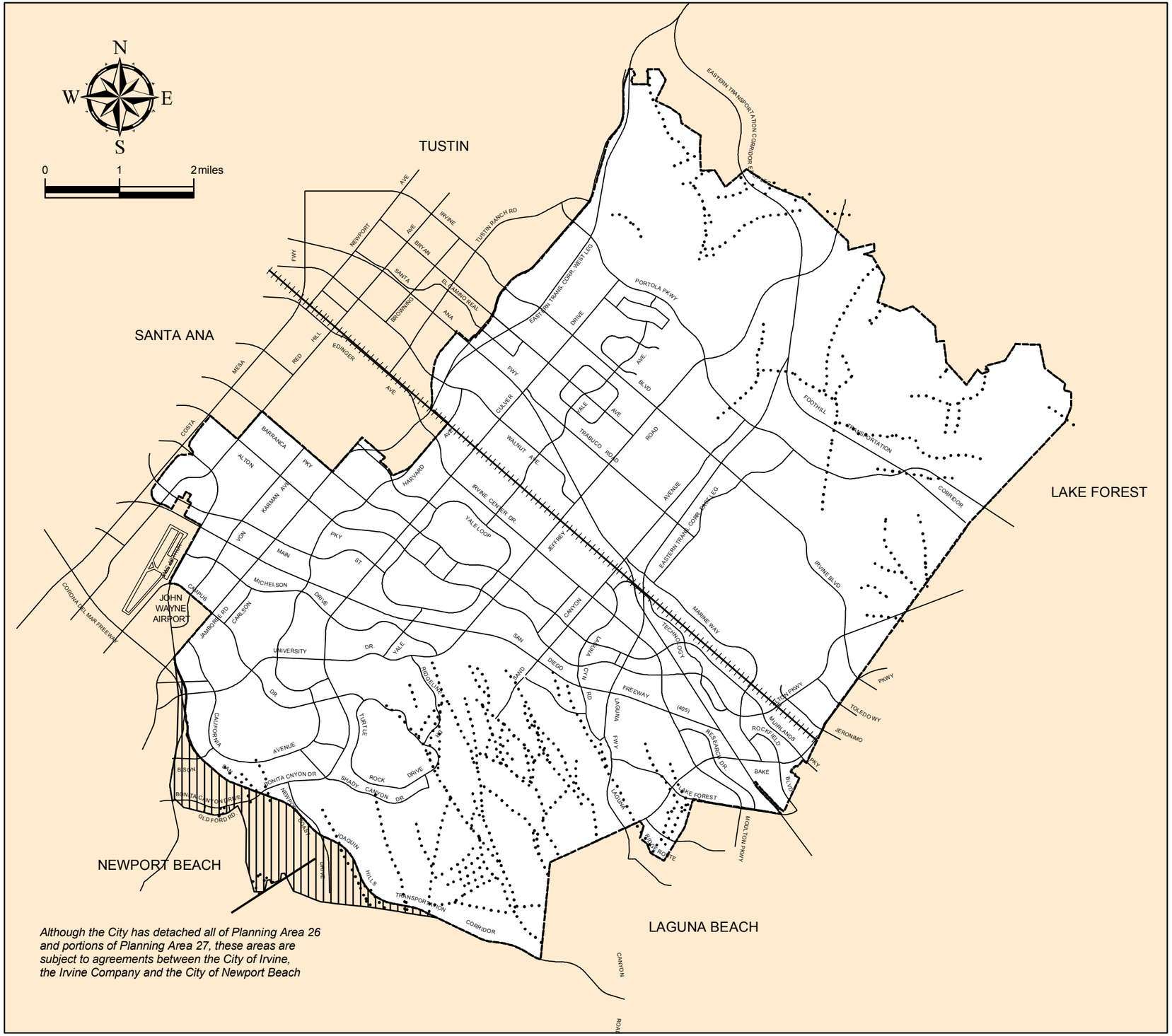
City of Irvine
General Plan

Figure D-1

REGIONAL GEOLOGY

LEGEND

- Major Faults and Fault Zones
- Cenozoic non-marine sedimentary rocks and alluvial deposits
- Cenozoic marine sedimentary rocks
- Cenozoic volcanic rocks
- Pre-Cenozoic metamorphic rocks of unknown age
- Late Mesozoic shelf and slope sedimentary rocks
- Granitic rocks chiefly of Mesozoic age
- Mesozoic sedimentary and volcanic rocks; in places strongly metamorphosed
- Paleozoic sedimentary and volcanic rocks; in places strongly metamorphosed
- Precambrian Rock of all types including coarse-grained intrusives



City of Irvine
General Plan

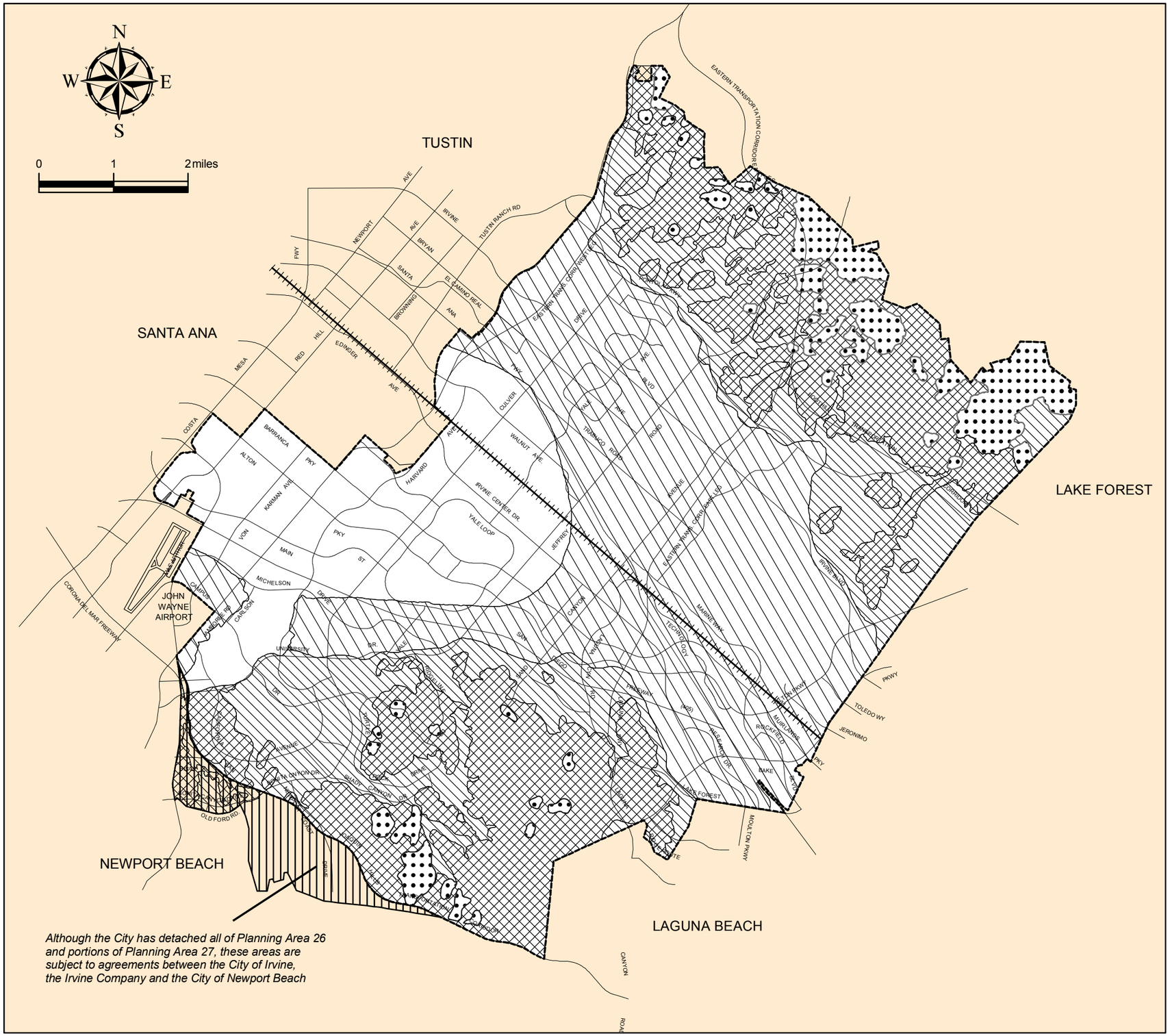
Figure D-2

INACTIVE FAULT LOCATIONS

LEGEND

------- City Sphere of Influence

. . . . . Fault Line



Although the City has detached all of Planning Area 26 and portions of Planning Area 27, these areas are subject to agreements between the City of Irvine, the Irvine Company and the City of Newport Beach

City of Irvine
General Plan

Figure D-3

SEISMIC RESPONSE AREAS

LEGEND

- SRA-1, Soft Soils/ High Ground Water
- SRA-2, Denser Soils/ Deeper Ground Water
- SRA-3, Alluvium/ Shallow Bedrock
- SRA-4, Highlands Over 20 Percent Slope
- SRA-5, Less Stable Geologic Formations