SAFETY ELEMENT

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I. INTRODUCTION AND PURPOSE

The Safety Element is one of the seven mandatory General Plan Elements. The purpose of the Safety Element is to ensure protection of the City's residents and property from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides, subsidence, and other geologic hazards known to the legislative body; flooding; and wildland and urban fires. The Safety Element includes mapping of known seismic and other geologic hazards. It also addresses evacuation routes, peak load water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards.

II. GEOLOGIC HAZARDS

The entire Imperial valley, including the City of Imperial, is located within a seismically active area. In Imperial, seismic disturbances (earthquakes) occur on a relatively frequent basis. The magnitude of these earthquakes varies greatly from minor disturbances (magnitude 1-3 on the Richter Scale) which are barely detectable to moderate and major earthquakes (magnitudes 4-8 on the Richter Scale). The principal geologic hazards in Imperial are related to those impacts caused by earthquakes. Most of the problems associated with earthquakes in Imperial are because of the proximity to numerous faults and from poor land development practices.

III. LOCAL SEISMIC ACTIVITY

Based upon the available information and historical records, Imperial has a significant risk from faults due to the relatively high earthquake activity along the major fault systems in Southern California. It can be expected that major damage could result from seismic activity and this has been the case in the recent past. Stringent building codes should be adopted, implemented and enforced, and unreinforced commercial and industrial buildings should be retrofitted and reinforced to ensure public safety during major seismic events.

IV. LOCAL FAULT SYSTEMS

The entire Imperial Valley area is impacted by various fault systems. The Imperial fault is located a few miles east of the existing City limits and is the nearest fault to the City. The San Andreas Fault zone is located near the western boundary of the Algodones Dunes Sand Hills approximately 30 miles east of the City. The San Andreas Fault is a major fault that extends northward toward the San Francisco Bay area. The Imperial County Fault map is included in the Safety Element as Figure S-1.

V. FAULTING AND SURFACE RUPTURE

Surface ruptures normally occur on existing faults or fault traces, but may occur anywhere within a fault zone. A surface rupture occurs when a fault displacement extends upward from depths of the epicenter and intersects the ground surface. The surface will not rupture every time a fault moves. As earthquakes increase in magnitude, there is a stronger possibility of ground rupture occurring. When the surface is ruptured, everything in its path will be affected. Because of faults within the area near Imperial, surface rupture is considered a possible hazard.

VI. GROUND SHAKING

As displacement occurs along a fault, the energy released creates a shock wave movement through the rock and soil materials of the earth's outer crust, radiating outward from the earthquake epicenter. This action is felt as a shaking motion at the ground surface. The severity of the ground shaking depends on the magnitude of the earthquake, the distance of the site from the quake epicenter, and soil conditions at the site and in between. Ground shaking can be felt and can cause damage hundreds of miles from the epicenter of the earthquake. The effects of ground shaking depend on its severity, on the proximity of the site to the epicenter, and on the type of construction and its integrity.

Ground shaking is expected to have the greatest amount of seismic impact on Imperial. Major seismic events along one of the fault systems discussed previously would cause significant ground shaking to occur that has and could cause future property damage. Also, most of the other potential seismic hazards discussed in the following will occur primarily as a result of intense ground shaking.

Ground Failure

Ground failures are a result of earth movement caused by a seismic shock wave. Nearly all ground failure is in the form of landslides or mudslides where the seismic event, gravity, and poor geologic conditions all work together to displace small or large amounts of earth. Imperial, due to its relatively flat topography, is not susceptible to landslides or mudslides.

Liquefaction

Liquefaction is the loss of strength in granular, saturated, unconsolidated sediments. Areas with deep sediments and shallow water tables are particularly susceptible to liquefaction. Damage from liquefaction may be caused as the ground liquefies and flows or lurches, or the ground may respond as quicksand causing buildings to tilt or sink. For liquefaction to occur, three factors must be present:

A. Soils must be loose, unconsolidated, evenly graded fine sands or silts.

B. The water table must be shallow.

C. Intense, long duration ground shaking (greater than .13 g with a duration of greater than 45 seconds) must occur.

Subsidence

Subsidence is the downward settling of soil materials with little horizontal motion. There are four primary causes of subsidence:

Ground water withdrawal.

Oil or gas withdrawal.

Hydrocompaction (usually caused by first-time wetting of open textured soils which compact under their own weight).

Peat Oxidation (results from shrinkage of buried organic debris).

Structural Hazards

The large majority of buildings within the City of Imperial have been constructed prior to the last 35 years. The Uniform Building Code has contained seismic design standards since 1943, although plan checking, inspection, and the standards themselves have significantly improved since that time. Experience in recent earthquakes indicates that when structures are built according to seismic design standards they can be expected to perform well during an earthquake. The City was required by State law to identify unreinforced masonry buildings within the City and to notify owners of the unreinforced masonry status. Two such buildings have been identified in the City of Imperial. The addresses of these buildings are as follows:

Unreinforced Masonry Buildings

1. 123 W. Barioni Boulevard.
2. 119-1/2 S. Imperial Avenue

The building located at 119-1/2 S. Imperial Avenue is a residence and is technically exempt from the State unreinforced masonry building law. Owners of unreinforced masonry buildings will be required to structurally reinforce the buildings or demolish the buildings in the future in order to comply with the City ordinance regulating such buildings.

Concept of Risk

Earthquakes are not predictable with any accuracy. It is presumed that an earthquake will occur in certain areas at some point in the future. Geotechnical experts are beginning to be able to establish an approximate rate of occurrence and potential magnitude of future earthquakes based upon historical data. In the past, California earthquakes have caused significant damage and injury. It is the knowledge of the past events and the potential for future quakes that makes the determination of acceptable risk important in future land use planning.

Risk is the chance of damage or injury occurring over some period of time. The basic objective of evaluating seismic risk is to reduce the loss of life and property damage due to seismic activity to an "acceptable" level. It is not possible or completely practical to eliminate all risk to life and property.

The Council of Intergovernmental relations guidelines for the General Plan Safety Elements define acceptable risk as:

> "The level of risk below which no specific action by the local government is deemed to be necessary other than making the risk known."

Because risk is a function of change, there is an inherent degree of uncertainty in using risk as a basis for land use planning. However, when risk can be determined, programs incorporating or avoiding the risk may be developed. Risk-reduction measures can be enacted and risk can, therefore, be a framework for land use decision-making. The identification of unreinforced masonry buildings is an example of a risk reduction measure.

Every seismic hazard has an associated element of risk. This risk has two aspects. The first is the chance that the hazard will in fact occur, and the second is the chance that if the hazard does occur, the measures taken to mitigate the hazard will be sufficient to reduce the damage to life or property to a predetermined acceptable level. There are no means with which to prevent an earthquake or its natural effects, but the potential for disaster can be minimized.

Factors which should be considered in establishing acceptable risk include:

A. Special importance of essential facilities during seismic events.
B. The number of persons subjected to hazardous conditions.

C. Voluntary or involuntary use.

D. Cost of eliminating potential risk.

Essential facilities are those structures which must be safe and usable for emergency purposes after an earthquake in order to preserve the peace, health, and safety of the public. Such facilities include, but are not limited to:

A. Hospitals and other medical facilities having surgery or emergency treatment areas.

B. Fire and police stations.

C. School buildings.

D. Municipal government disaster operation and communication centers deemed vital in emergencies.

E. Public utility facilities.

Because the destruction of any of these facilities could compound problems or emergencies resulting from earthquakes, only a very low level of risk should be acceptable in the location and construction of these facilities. Other factors involved in the determination of acceptable risk for essential facilities include the following:

A. <u>Occupancy Levels</u>

The number of persons using or occupying a structure should receive important consideration in determining acceptable risk.

High-occupancy uses such as large meeting halls, theaters, schools, churches, office buildings, and shopping centers could subject large numbers of persons to hazards. Only a low level of risk should be acceptable in high occupancy uses. A higher level of risk may be acceptable in low-occupancy uses such as warehouses and single family dwellings. The concept of "persons to hours of occupancy" can be useful in determining priority in reducing risk.

B. Voluntary vs. Involuntary:

Involuntary risk occurs in structures and uses where a person has no choice in whether to submit to a certain level of risk. These uses include schools, hospitals, detention facilities, and convalescent homes. Because persons using these facilities may be incapable or restrained from leaving during an earthquake, only a very low level of risk should be acceptable.

C. Cost of Mitigation:

Cost may be the most important factor in reducing risk. The reduction of risk must be balanced against the cost of achieving that reduction. These costs may be direct, as in the case of reinforcing a building, or indirect, as in the case of zoning seismically or geologically hazardous areas as open space. The following are examples of mitigation measures in which cost is an important factor in reducing risk:

1. Rehabilitation or demolition of nonconforming structures.

2. Requiring design of certain new buildings to meet extraordinary seismic design criteria.

3. Limiting or prohibiting development in hazardous areas.

Safety Goal

Seismic hazards should be controlled to a level of acceptable risk through the identification and recognition of potentially hazardous conditions and areas.

Objective 1

The risk level to the residents should be controlled to an acceptable level through proper land use and public facilities planning.

A. The Scale of Acceptable Risk for New Structures (Table S-1) shall be used when determining the location of future land uses.

B. Land uses should not be subjected to risks greater than the level suggested in the scale unless no other alternative exists.

C. The City shall require that all geologic/geotechnical investigations for all "essential" and "low risk" projects contain a site-specific evaluation of peak horizontal ground acceleration.

Seismic Hazard Mitigation

Objective 2

Standards for grading and construction should be maintained which provide for the mitigation of potential seismic hazards.

Policy 2

A. Due to the high seismic accelerations possible within the area, the City may wish to consider design and construction standards beyond the minimum Uniform Building Code (UBC) standards for certain projects.

B. The City shall maintain appropriate ordinances to identify and mitigate seismic hazards such as ground shaking, ground failure, liquefaction, and structural hazards.

C. Investigations by a qualified engineering geologist shall be required for all development projects.

D. The City shall regularly inform community residents of the potential seismic hazards that can exist and the best methods of reducing injury, property damage or loss of life in the home or business establishment.

Water Hazards

City Water

Objective 3

City water detention basins and sewer lagoons should be regularly maintained and inspected to reduce the risk of failure as a result of a seismic event.

Policy 3

A. Water levels should be kept at or below the designated high water level to reduce the risk of overtopping.

B. City water detention basins and sewage lagoons shall receive regular inspections of the embankment, and inlet/outlet facilities to ensure safe operation and maintenance.

Imperial Irrigation District Canals

Objective 4

The City should work with the Imperial Irrigation District to ensure that appropriate measures are established and implemented with respect to the canals within the City and its planning area.

Policy 4

A. The City should encourage the Imperial Irrigation District to adopt a Damage Assessment and Cost Recovery Plan with the assumption that it will cover appropriate measures to be taken in the likelihood of a major seismic event.

B. The City should cooperate and assist, where possible, the District in responding to damage from a major seismic event.

C. The City should act upon the IID recommendation of a 10 day water supply storage facility in case of an emergency, such as a major seismic event.

D. The City should implement additional mitigation measures that address the design and construction of canals, retention basins, etc... to withstand strong ground shaking as well as the future location of such facilities in an area where flood damage can be minimized in the event of a structural failure.

Peakload Water Supply Requirements

Objective 5

The City should establish a capital improvements program for water system improvements to ensure adequate peakload *water supply requirements can be met in the future taking into consideration the future population growth of the City.*

Policy 5

A. Adequate treated water storage facilities will be constructed to provide for a minimum ten day supply of potable water to be used during emergencies.

B. During a period when the water treatment plant is inoperable due to earthquake damage, damage to power facilities , or flooding, all non-essential uses of water within the City shall cease and water rationing for domestic uses will be implemented by the City. Non-essential uses of water includes watering of lawns, washing of vehicles, and similar types of water uses.

C. Adequate water distribution and storage facilities will be maintained to ensure required fire flows from existing and future fire hydrants. All hydrants will provide at least a 1,000 GPM flow at a minimum residual pressure of 20 psi.

D. Developers of new projects will be required to provide the necessary water distribution facilities and fire hydrants to ensure that peakload water supply requirements for fire flows and domestic uses can be met.

The City of Imperial receives its water from the Colorado River through the All American Canal, the Central Main Canal, and the Dahlia Canal. The Newside Canal provides a secondary source of water to the City's water plant in the event water cannot be obtained from the Dahlia Canal. The City's water treatment plant has a current treatment capacity of 3.5 MGD (millon gallons per day). The current peak water usage during the summer months is approximately 2.0 MGD. The water treatment plant currently has a 100,000 gallon elevated steel tank for pressurization of the distribution system and a 700,000 gallon steel ground level storage tank is also located at the water plant. The City intends in the near future to construct a new 2,000,000 gallon ground level storage tank in the northeast section of the City near the wastewater treatment plant. The new tank will provide finished water storage for the east section of the City and will provide additional fire flow in the event of a major fire in the eastern section of the City. Peakload water supply requirements include the water needed to extinguish a major fire within the City which may burn for an hour or longer before being extinguished. As previously stated in this element, the minimum required fire flow for hydrants within the City is 1,000 GPM (gallons per minute). The peakload water supply requirements are mainly affected by the amount of water storage available and by the pumping capacity of the City's water system. The size of the water mains and whether or not a hydrant is located on a dead end or looped water main will also have an affect on the amount of water in GPM that a specific fire hydrant can deliver. However, the amount of water storage and the pumping capacity available to the water system are still the most critical factors.

Future peakload water supply requirements can be determined by calculating the normal water usage per capita per day based upon the projected future population, and then applying a peaking factor of 2.0 to account for fire flow requirements and higher water usage for domestic purposes during extremely hot weather. Based on this methodology and a future population for Imperial of 19,500 in the year 2015, the future peakload water supply requirements would be as follows:

Future Population		Per Capita Usage Per Day		
19,500	X	200 gallons	=	3,900,000 gallons per day

X a peaking factor of 2.0 = peakload water supply requirements of 7,800,000 gallons per day.

Evacuation Routes

Objective 6

Coordinate with the County office of emergency services to develop an emergency evacuation plan for the City of Imperial.

Policy 6

A. Post evacuation routes and evacuation procedures in prominent locations such as City Hall, police station, airport terminal building, and the public library.

B. Rehearse evacuation procedures on an annual basis utilizing personnel of the police and fire departments.

C. Develop and publish a public information pamphlet regarding emergency procedures and evacuation routes and distribute to the public.

Evacuation routes would be used during events such as the following:

A. National emergency due to imminent nuclear attack.
B. Severe earthquake.
C. Major hazardous materials spill on highways, at the airport, or on the railroad.

The purpose of the evacuation routes is to quickly move the City's population a safe distance away from the City when necessary for public health and safety reasons. A map of the evacuation routes is included at the end of the Safety Element. The evacuation routes for various categories of emergencies are as follows:

A. Imminent Nuclear Attack

The main evacuation route will be Highway 86 and the route proceeds north out of Imperial toward Brawley and Westmorland. The route will end at Salton City.

B. Earthquake

The evacuation routes will be at Aten Road and Barioni Boulevard (Worthington Road). The routes will proceed west to Forrester Road.

C. Hazardous Materials Spill or Natural Gas

The evacuation routes will be Barioni Boulevard (Worthington Road) and Aten Road. The routes will proceed east to Dogwood Road and west to Austin Road. Upon reaching Dogwood Road, the evacuation route will proceed north on Dogwood Road (depending on prevailing wind direction).

Flood Hazards

Objective 7

Minimize exposure of the public to flooding hazards caused by severe storms, earthquakes, or other phenomena.

Policy 7

A. Require the finished floor elevation of new structures to be built a minimum of 12 inches above the top of adjacent curbs for flood protection.

B. Require all new development projects to contain a grading and drainage plan based upon the requirement to adequately accommodate stormwaters from a 100 year flood in order to prevent flooding of structures.

C. Utilize flood hazard maps produced by the Federal Emergency Management Agency to determine flood hazards within the planning area.

D. Establish a storm drain system for flood control when feasible.

There are no identified floodplains within the City of Imperial Planning Area. The nearest floodplains are located along the New and Alamo Rivers. Neither of these rivers are located within the planning area. Therefore, flooding within the City of Imperial would be mostly localized and would be concentrated in streets and intersections within low lying areas. Flooding hazards can be minimized by ensuring adequate drainage systems are constructed and maintained.

Wildland and Urban Fires

Objective 8

Minimize exposure of the public to wildland and urban fires and protect the public to the maximum extent possible when fires do occur. Ensure the City has adequate fire fighting capability.

Policy 8

A. Establish and maintain an active fire hazard inspection program through the fire department.

B. Require property owners to keep vacant lots and land parcels within the City clear of excessive brush and other combustible debris.

C. Ensure new development projects contain adequate water systems and fire hydrants for fire protection.

D. Ensure abandoned buildings and structures are properly boarded up to prevent access and the possibility of fire.

E. Consider the need for a new fire station to serve areas of the City east of the Southern Pacific railroad tracks.

F. Maintain mutual aid agreements with other cities and agencies to help ensure adequate assistance to extinguish major fires.

G. Ensure that farmers burning agricultural fields within the City's planning area have the proper burn permit and personnel/equipment to control the fire and prevent hazards to the public.

H. Report illegal burning activities to the County Agricultural Commissioner and Air Pollution Control Officer. Primary responsibility for this activity would be undertaken by the police department and/or fire department.

Minimum Road Widths and Clearances around Structures

Objective 9

Ensure adequate road widths and clearances around structures to enable emergency vehicles to obtain fast and efficient access to all areas of the City during fires, earthquakes, and other emergencies.

Policy 9

A. Maintain a minimum design standard for residential streets that dictates a 40 foot street width, face of curb to face of curb.

B. Ensure cul-de-sac streets have an adequate radius to allow for maneuvering of fire trucks and other emergency vehicles.

C. Prohibit angle parking in cul-de-sacs and ensure all vehicles park parallel to the curb, thereby allowing adequate room for emergency vehicles.

D. Ensure that setbacks for structures on corner lots are at least 10 feet in order to provide adequate clearance for large fire fighting vehicles.

E. All multiple family development projects shall provide two unobstructed fire access lanes at least 12 feet in width with at least a 35 foot radius for all curb returns.

F. All multiple family development projects shall have direct access to a public street at least 40 feet in width to ensure adequate emergency vehicle access.

G. Ensure that cul-de-sac streets are a maximum length of 600 feet and that they are clearly delineated on the official City map provided to the police and fire departments.

H. All alleys within the City shall be kept free of obstacles and debris and shall provide at least a 12 foot unobstructed access for emergency vehicles.

Table S-1

SCALE OF ACCEPTABLE RISKS

Level of Acceptable Risk	Kinds of Structures	Extra Project Cost Probably Required to Reduce Risk to an Acceptable Level
1. Extremely low[1]	Structures whose continued functioning is critical, or whose failure might be catastrophic: nuclear reactors, large dams, power intertie systems, plants manufacturing or storing explosives or toxic materials	No set percentage (whatever is required for maximum attainable safety)
2. Slightly higher than under level 1[1]	Structures whose use is critically needed after a disaster: important utility centers; hospitals; fire, police, and emergency communication facilities; fire stations; and critical transportation elements such as bridges and overpasses; also smaller dams	5 to 25 percent of project cost[2]
3. Lowest possible risk to occupants of the structure[3]	Structures of high occupancy, or whose use after a disaster would be particularly convenient: schools, churches, theaters, large hotels, and other high-rise buildings housing large numbers of people, other places normally attracting large concentrations of people, civic buildings such as fire stations, secondary utility structures, extremely large commercial enterprises, most roads, alternative or noncritical bridges and overpasses.	5 to 15 percent of project cost[4]
4. An "ordinary" level of risk to occupants of the structure[3,5]	The vast majority of structures: most commercial and industrial buildings, small hotels and apartment buildings, and single family residences.	1 to 2 percent of project cost, in most cases (2 to 10 percent of project cost in a minority of cases)[4]

[1] Failure of a single structure may affect substantial populations.

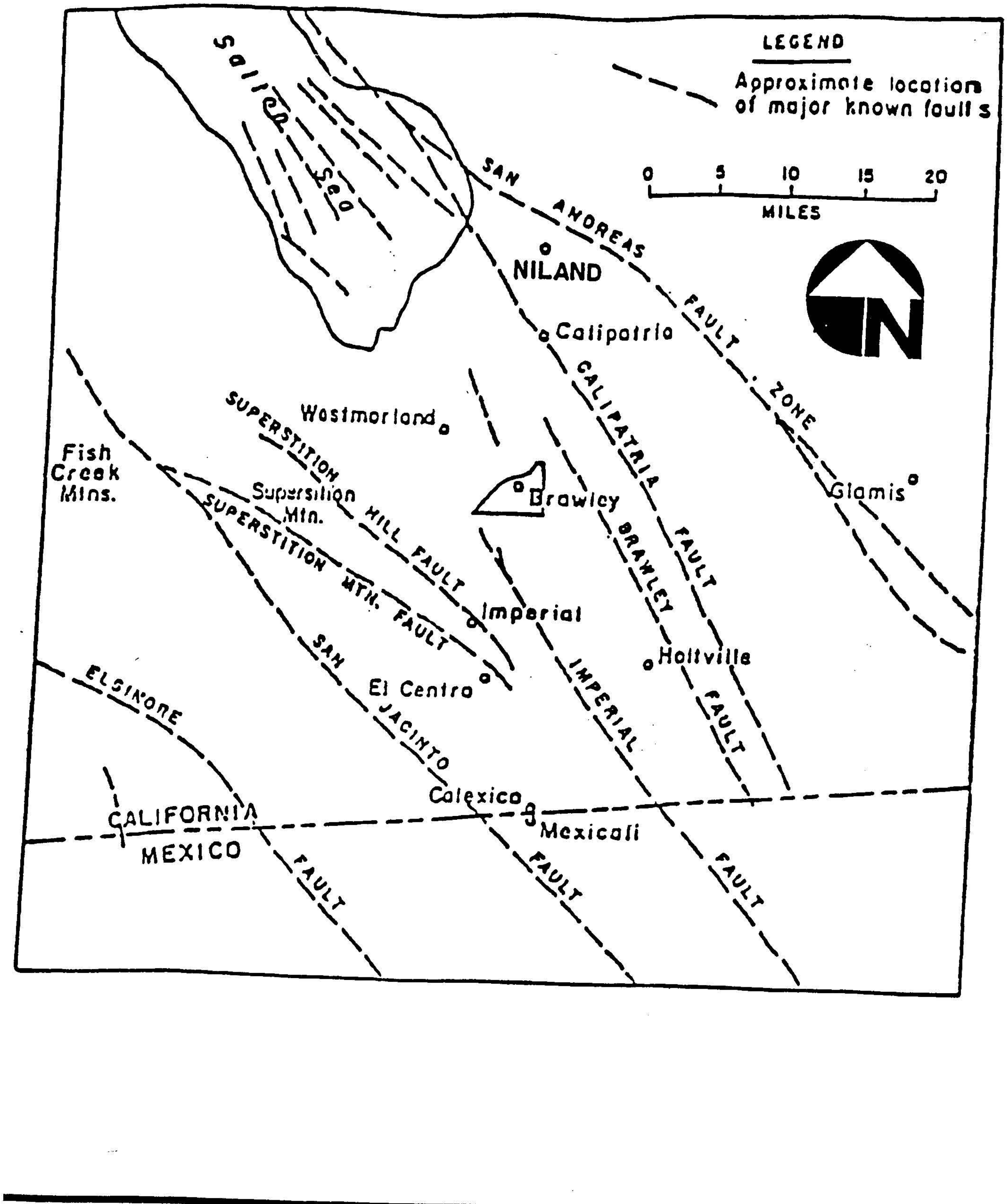
[2] These additional percentages are based on the assumption that the base cost is the total cost of the building or other facility when ready for occupancy. In addition, it is assumed that the structure would have been designed and built in accordance with current California practice. Moreover, the estimated additional cost presumes that structures in this acceptable-risk category are to embody sufficient safety to remain functional following an earthquake.

[3] Failure of a single structure would affect primarily only the occupants.

[4] These additional percentages are based on the assumption that the base cost is the total cost of the building or facility when ready for occupancy. In addition, it is assumed that the structures would have been designed and built in accordance with current California practice. Moreover the estimated additional cost presumes that structures in this acceptable-risk category are to be sufficiently safe to give reasonable assurance of preventing injury or loss of life during and earthquake, but otherwise not necessarily to remain functional.

[5] "Ordinary risk": Resist minor earthquakes without damage; resist moderate earthquakes without structural damage, but with some non-structural damage; resist major earthquakes of the intensity or severity of the strongest experienced in California, without collapse, but with some structural as well as nonstructural damage. In most structures, it is expected that structural damage, even in a major earthquake, could be limited to repairable damage. (Structural Engineers Association of California).

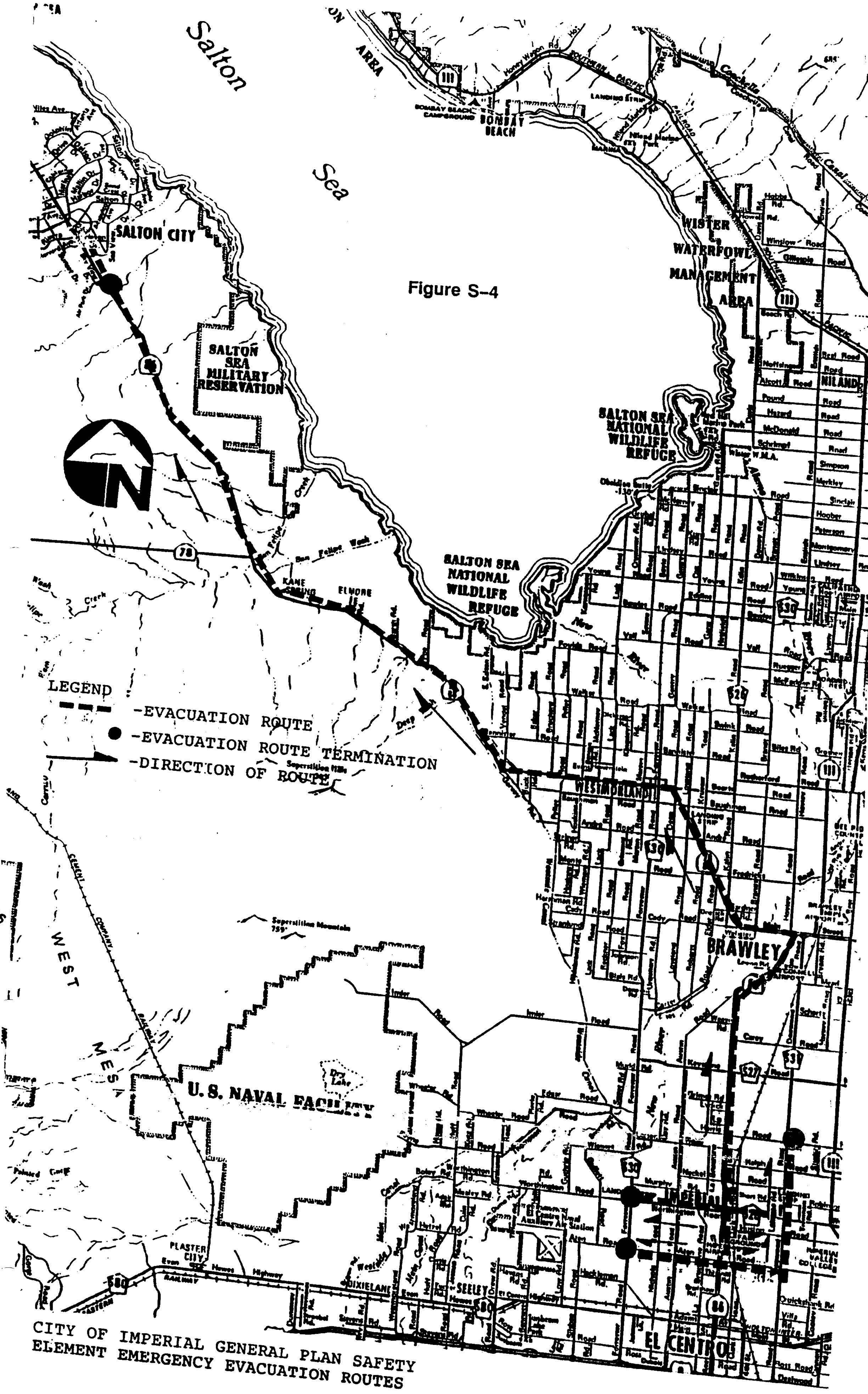
Figure S-3



City of Imperial
Location in Relation to Faults

GENERALIZED FAULT MAP OF IMPERIAL COUNTY.

Figure S-4



CITY OF IMPERIAL GENERAL PLAN SAFETY ELEMENT EMERGENCY EVACUATION ROUTES

SCALE: 1"= 3.5 MILES