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Forecasting and Mitigating Future Urban Encroachment Adjacent to California Military Installations: A Spatial Approach

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Authors

Landis, John D.
Foster, Howard
Frontiera, Patricia
et al.

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Forecasting and Mitigating Future Urban Encroachment
Adjacent to California Military Installations:
A Spatial Approach

John Landis and Michael Reilly
Institute of Urban and Regional Development

Robert Twiss, Howard Foster and Patricia Frontiera
Center for Environmental Design Research

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University of California at Berkeley
Institute of Urban and Regional Development

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Forecasting and Mitigating Future Urban Encroachment Adjacent to California Military Installations: A Spatial Approach

John Landis and Michael Reilly
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Chapter One: Introduction and Purpose

California is home to sixty-four military facilities, more than any other state.¹ All four military service branches in addition to the US Coast Guard operate facilities in California. California's military installations span an immense area, ranging from the Sierra Supply Depot at Huerlong in the north, to the Naval Air Facility at El Centro in the south. (See Map 1 and Figure 1.) In terms of physical size, they range from over a million acres (China Lake Naval Weapons Station) to fewer than 300 acres (San Bruno Engineering Field Activity Center). California's military facilities also vary in terms of layout, ranging from clusters of office buildings, to college campuses, to airfield facilities, to large artillery and maneuvering ranges. More than half of California's military facilities are located within, at the edge of, or within a stone's throw of major metropolitan areas.

California is also home to more than 34 million people, most of whom live in metropolitan areas. By 2020, the California Department of Finance projects, California's population will grow to 45 million. If past trends continue, the majority of this growth will occur at the edges of existing metropolitan areas, nearby or adjacent to active military facilities. Without some degree of forward planning to reconcile the space needs of California's growing population with the operational needs of the military, the encroachment of urban growth on California military installations (and their surrounding buffer zones) may significantly compromise the presence, functions and missions of the military in California.

The encroachment problem is more complicated than just urban growth edging closer and closer to installation boundaries. Many military facilities conduct operations (e.g., flight operations, training exercises) that extend beyond their perimeter boundaries and generate significant aircraft and artillery noise. As California's urban population grows, the number of people living near military facilities and impacted by facility operations will also grow.

Figure 1: California Military Installations

<u>Active Installations Included in This Study (sorted by acreage)</u>	<u>Acreage</u>	<u>Installations Not Included in this Study</u>
China Lake Naval Air Weapons Station, Ridgecrest	1,091,515	Alameda Coast Guard Integrated Support Command
Fort Irwin, Barstow	615,552	Alameda Naval Reserve Center
Marine Corps Combat Center, Twentynine Palms	583,751	Army National Guard Aviation Support Facility - Mather
Edwards Air Force Base, Lancaster	307,308	California Air National Guard
Camp Pendleton, Oceanside	124,800	California Army National Guard
Vandenberg Air Force Base, Lompoc	102,090	Camp Roberts
Naval Air Station, Lemoore	29,383	Camp San Luis Obispo
Miramar Marine Corps Air Station, San Diego	22,493	Channel Island Air National Guard Base
Naval Weapons Support Facility, Concord	10,384	Defense Contract Management District-West
Naval Weapons Support Facility, Fallbrook	8,948	Defense Depot-Barstow
Naval Base Complex, San Diego	6,525	Defense Depot-San Diego
Marine Corps Logistics Base, Barstow	6,316	Fleet and Industrial Supply Center
Travis Air Force Base, Fairfield	5,091	Fort Hunter Liggett
Naval Air Weapons Station, Pt. Mugu	4,256	Fresno Air Terminal
Naval Weapons Support Facility, Seal Beach	3,690	Fresno Naval Reserve Center
Onizuka Air Station, Sunnyvale	1,699	Headquarters, California National Guard
Naval Facilities, Port Hueneme	1,494	March Air Reserve Base
Naval Base Coronado, Imperial Beach	608	Moffett Federal Air Field
Naval Warfare Assessment Station, Norco	607	Naval Air Station, North Island
Naval Postgraduate School, Monterey	582	Naval Communication Station, Rough and Ready Island
San Diego Marine Corps Recruit Depot, San Diego	499	Naval Medical Facility, San Diego
Defense Language Institute, Presidio of Monterey	409	Navy Region Southwest
Engineering Field Activity West, San Bruno	258	North Highlands Air Guard Station
		Pacific Fleet Anti-Submarine Warfare Training Center
		Pacific Fleet Combat Training Center
		PEO (SCS), San Diego
		Petaluma Coast Guard Training Center
		Salton Sea Test Range
		San Diego Fleet Combat Directions Systems Support Activity
		San Diego Naval Supply Center
		San Diego Submarine Base
		San Diego Supervisor of Shipbuilding
		San Joaquin Depot
		Santa Clara Naval Reserve Center
		Sierra Army Depot (Realigned)
		Space and Navy Warfare Systems Center and Headquarters, San Diego
<u>Active Installations Not Included in the This Study</u>		
Beale Air Force Base, Marysville		
Naval Air Facility, El Centro		
Naval Air Weapons Station, San Nicolas Island		
Naval Base Coronado, San Clemente Island		
Sierra Army Depot, Herlong		

Source: Office of Military Base Retention, California Technology, Trade and Commerce Agency



Environmental issues are becoming more important as well. As suburban growth consumes ever more critical habitat, remaining natural areas in and around military facilities take on new importance as ecological preserves, especially in coastal and desert areas. Increasingly, base commanders find they must balance mission performance with being a sound steward of the land and being a good neighbor.

Anticipating that future urban growth will only exacerbate these issues, the California legislature enacted SB 1099, the California Defense Retention and Conversion Act of 1999, also known as the Knight Bill. SB 1099 established the California Defense Retention and Conversion Council (CDRCC) in the California Technology, Trade and Commerce Agency (§15346.4) and charged it with developing a strategic plan for state and local defense retention and conversion efforts as well as recommending specific retention programs to the legislature (§15346.5). As part of these efforts, the legislature directed the CDRCC to:

- Provide a central clearinghouse for all retention or conversion assistance activities (employee training programs, regulation review, permit streamlining).
- Provide technical assistance to communities with potential or base closure activities.
- Provide a central clearinghouse for all defense retention and conversion funding, regulation, and applicable federal and state grants.
- Serve as a central clearinghouse for input and information, including needs, issues, and recommendations for business, industry, labor, local government, and communities relative to retention and conversion efforts.
- Identify available state and federal resources to facilitate stakeholder efforts focused on retention and conversion.
- Provide one-stop coordination and develop a fast-track review process of grant-seekers.
- Maintain and establish databases to support retention and conversion efforts and provide electronic access to such data.

The legislature also directed the CDRCC to prepare a study that analyzed long-term strategies to protect lands adjacent to military installations from development that would be incompatible with the ongoing missions of those installations. Or, succinctly stated, to sustain the mission and viability of California's military installations. The required study is to address three sets of issues: (i) the effects of local land use encroachment;

(ii) environmental impact considerations; and (iii) population growth. Based on a thorough analysis of these issues, the study is to develop recommendations for legislative/congressional action, as well as recommendations for criteria to help local governments identify incompatible development that might adversely affect base missions. The legislature stipulated that the required study consider Lemoore Naval Air Station or Edwards Air Force Base as case studies, and that public hearings on the study results be conducted in the vicinity of Lemoore and Edwards.

The purpose of this report is three-fold. Its principal purpose is to provide information to the legislature, the governor, CDRCC, and the US military regarding the potential encroachment effects of projected population growth and urban development on California military installations. Its second purpose is to present and evaluate alternative planning and policy approaches for dealing with current and projected encroachment issues. Its final purpose is to develop a web-enabled spatial database for use by civilian land use planners and military operations planners in analyzing encroachment issues and undertaking future encroachment zone studies.

The rest of this report is organized into four chapters. Chapter Two presents the forecasting and analysis methodology. Chapter Three takes a statewide look at encroachment issues from three perspectives: that of each installation, that of each installation's urban neighbors, and that of habitat protections for threatened and endangered species. Chapter Four considers the encroachment issue in greater detail by focusing on four case study bases: Camp Pendleton in San Diego County, Edwards Air Force Base in Lancaster, Miramar Marine Corps Air Station in San Diego, and Travis Air Force Base in Fairfield. Chapter Five concludes by reviewing the applicability and efficacy of different land use planning and regulatory approaches toward issues of urban encroachment.

Chapter Two: Approach

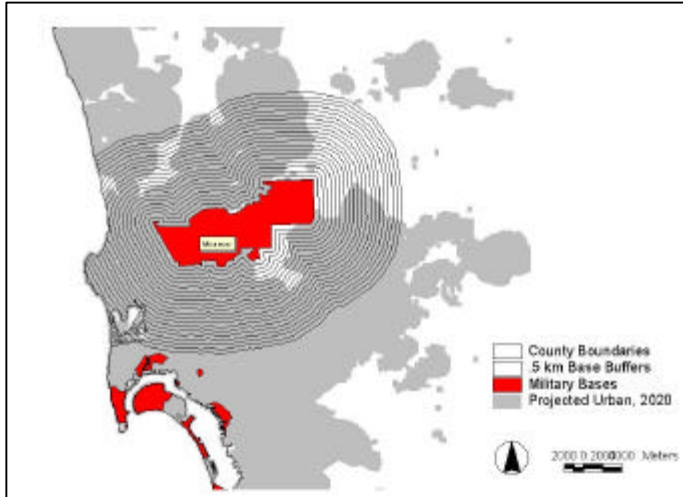
This study evaluates the potential impacts of projected urban growth upon selected California military facilities at two levels of detail. The first considers the magnitude of current and projected future urban encroachment upon 23 of the state's 26 remaining active military facilities. (The three facilities not included in this analysis are Beale Air Force Base in Marysville, the Naval Air Facility at El Centro, and the Sierra Army Depot at Huerlong). A second level of study considers the nature of specific encroachment issues around four case study facilities facing significant urban growth pressures: Camp Pendleton in San Diego County, Edwards Air Force Base in Lancaster, Miramar Marine Corps Air Station in San Diego, and Travis Air Force Base in Fairfield. Both analyses are undertaken over a 20-year period, culminating in 2020.

The two levels of analysis are intended to complement each other. The first takes more of a macro view of the amount of encroachment without focusing on specific encroachment impact areas or issues. The second level takes a more micro view by considering the spatial pattern of specific noise and/or habitat impacts at particular facilities. To be effective, state and federal encroachment policies must be capable of responding to both macro- and micro-level issues; and this analysis supports such a comprehensive view.

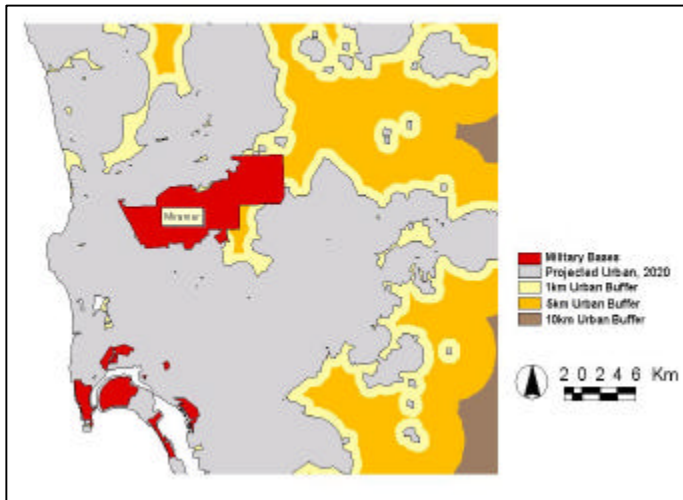
Level One Statewide Urban Encroachment Analysis

The Level One Statewide Urban Encroachment Analysis makes use of the buffer and overlay capabilities of geographic information systems (GIS) to precisely identify the overlap areas between California military installations and surrounding urban development. This is accomplished by generating two sets of spatial buffer zones (i.e., encroachment zones). The first set of buffers, henceforth termed base buffers, are one kilometer in width and are generated around each military installation. The second set, termed urban buffers, are five kilometers in width and are generated around current and future urban development areas. (See Figure 2.)² The two types of buffers are then used to precisely identify the amount of current and future urban development within a given distance of each installation, as well as the amount of installation area falling within a given distance of current and future urban development. Comparisons were made between two time periods: 1996, representing current urban development; and 2020, representing projected urban development. Figure 3 outlines the logic of the Level One analysis in greater detail.

- Step 1: Identify Installation Boundaries: There is no single digital map of US or California military installations. Accordingly, we used GIS to identify and “clip-out” the boundaries of 26 active California military installations from the California Government Ownership coverage (Teale Data Center, 1998).
- Step 2: Identify the Current Extent of Urban Development : Using digital map layers provided by the California Department of Conservation’s Farmland Mapping and Monitoring Program (CFMMP), we identified the spatial extent of urban development throughout California as of 1996. The CFMMP defines urban development as a uniquely urban use, such as an office building or a retail center, or as residential development of more than one unit per two acres. Baseline urbanization data were available for all 26 active facilities except Beale Air Force Base, the Naval Air Facility at El Centro, and the Sierra Army Depot at Huerlong.
- Step 3: Generate a Series of Spatial Buffers around each installation, as well as around known urban development. Buffers are zones of fixed width. Using GIS, we generated a series of buffers around each military base at one-kilometer intervals. Simultaneously, we identified a series of five-kilometer buffers around every urban feature identified in Step 2.
- Step 4: Calculate Initial Encroachment Proportions by overlaying each one-kilometer military encroachment buffer generated in Step 3 on the 1996 urban layer generated in Step 3 to identify the amount of urban land area falling within each buffer. Simultaneously, we overlaid each five-kilometer urban buffer on top of the military base layer to identify the share of each military base falling within each urban buffer.
- Step 5: Develop Projections of Future Urban Growth. Using a combination of spatial and statistical methods, we calibrated a series of statistical probability models of urban development in California by county during the periods 1972-1984, 1984-1996, and 1972-1996. Once calibrated, the models were used to allocate future population projections to one-hectare development sites in order of their likely probability of development. County population projections for 2010 and 2020 were obtained from the California Department of Finance and used to generate a series of 2010 and 2020 projected urban footprints.



One-half Kilometer
Base Buffers
Generated Around
Miramar MCAS,
and their Overlap
with Projected
(2020) Urban
Areas



One, Five, and Ten
Kilometer Urban
Buffers Generated
Around San Diego
County Urban
Development, and
their Overlap with
Miramar MCAS.

Figure 2: Example Generation of Base and Urban Buffers

Figure 3: Logic of the Statewide Encroachment Analysis

-
-
1. Identify military installation boundaries (Source: California Government Ownership coverage)
 2. Identify the baseline (1996) extent of urban development. (Source: California Farmland Mapping and Monitoring Program)
 3. Generate a series of 1/2 kilometer spatial buffers around each military installation (*base buffers*); and a series of 5-kilometer buffers around each urban development location (*urban buffers*).
 - 4a. Overlay the 1/2 kilometer base buffers upon the 1996 baseline urban development map, and calculate the area and proportion of overlapping sites.
 - 4b. Overlay the 5-kilometer urban buffers on a map of military installations, and count the number of overlapping sites
 5. Project the locations and extent of urban development in 2020.
 - 6a. Overlay the initial 1/2-kilometer base buffers on the projected 2020 urban development map; count the overlap, and compare to step 4a.
 - 6b. Generate a new series of 5-kilometer buffers around the 2020 projected urban footprints; overlay them upon current military base boundaries, count the overlap, and compare to initial 1996 levels.
-
-

- Step 6: Duplicate Step 4 for Projected 2020 Urban Development. Duplicating the procedures established in Step 4, above, we then overlaid each one-kilometer base buffer on top of the projected 2020 urban footprints identified in step 5. We then generated a new set of five- kilometer buffers around the projected 2020 urban footprints and compared those with current base boundaries.

The results of these comparisons are presented and discussed in the next chapter.

Endangered and Threatened Species Habitat Baseline Analysis

California is home to more than half of the plant and animal species currently listed by the US Department of Interior as threatened or endangered (T & E), and many of California’s larger military installations currently include large amounts of T & E habitat.³ To the extent that unchecked urban growth consumes comparable habitat adjacent to particular military installations, pressures will mount for these installations to serve as species and/or habitat preserves—a purpose they were certainly not intended for nor are necessarily capable of.

To assess the role of California military installations as critical habitat area, we used GIS to estimate the amount of critical T & E habitat falling within the boundaries of each of 26 active military bases, as well as within their respective 5-, 10-, and 20-kilometer base buffers. Critical habitat areas were identified by coupling the California Gap Analysis vegetation database with the California Department of Fish and Game’s Wildlife Habitat Relationship database (WHR). Developed at the University of California at Santa Barbara, the Gap Analysis database is a statewide GIS listing of vegetation polygons at three canopy heights. The WHR database, in turn, lists which vegetation types are commonly associated with particular terrestrial vertebrate species.⁴ By coupling the two data sources, it is possible to identify which locations are more or less appropriate for which species. Habitat quality is assessed on a one-to-five scale, with a rating of 1 indicating the lowest quality habitat and a rating of 5 indicating the best. The Gap and WHR data were used to calculate the following Threatened and Endangered Species Richness Index (TESRI) for all locations in the state:

$$TESRI_j = \sum_i (\text{Presence of a Threatened or Endangered Vertebrate Species}_{ij} * \text{Habitat Quality}_{ij})$$

where *j* indicates each one-hectare grid cell and *i* indicates all possible threatened or endangered terrestrial vertebrate species.

In theory, TESRI values can vary from a low of 0, indicating that no known T & E species are present on a site, to a high of over 200, indicating that the site is excellent habitat for 40 or more T & E species. In practice, the highest TESRI value in California is only 66. (See Map 2.) Note that the TESRI index does not include threatened or endangered plant, insect or aquatic species.

Level Projecting the Spatial Pattern of Urban Growth

Measuring the current overlap between military installations and urban areas is hard enough. Projecting how much urban development will occur in the future is quite a bit harder. Projecting precisely where that development will occur is harder still.

The California Department of Finance (DoF) periodically issues long-term population forecasts organized by county. DoF's most recent forecasts, issued in 1998, suggest that California's population will grow by more than 10 million persons (+29%) between 2000 and 2020, bringing the state's 2020 population to just over 45 million persons. (See Figure 4.) More than ninety percent of California's population growth will occur within existing metropolitan areas. Almost sixty percent will occur in the seven counties of Southern California—Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura. These are the same seven counties that encompass or abut most of California's active military facilities.

Among counties with active military installations, DoF's 1997–2020 growth projections range from a high of over two million additional residents in Los Angeles County, to one million-plus additional residents in Riverside, San Bernardino, and San Diego counties, to less than 5,000 additional residents in Inyo County.

With respect to future urban encroachment, where population growth occurs is as important as how much occurs. Indeed, the two are directly related. The California Department of Finance projects population growth for counties, but not for the cities and unincorporated areas within counties. Nor does DoF deal with issues of either infill development or development density. All else being equal, the greater the share of county population growth which can be accommodated via infill development—that is, development within the existing urban footprint—the less fringe and greenfield lands required. Similarly, the greater Figure 4 population projections here the density of future urban growth, the less land required

Map 2: Threatened and Endangered Species Richness Index compared with Major Military Installation Locations

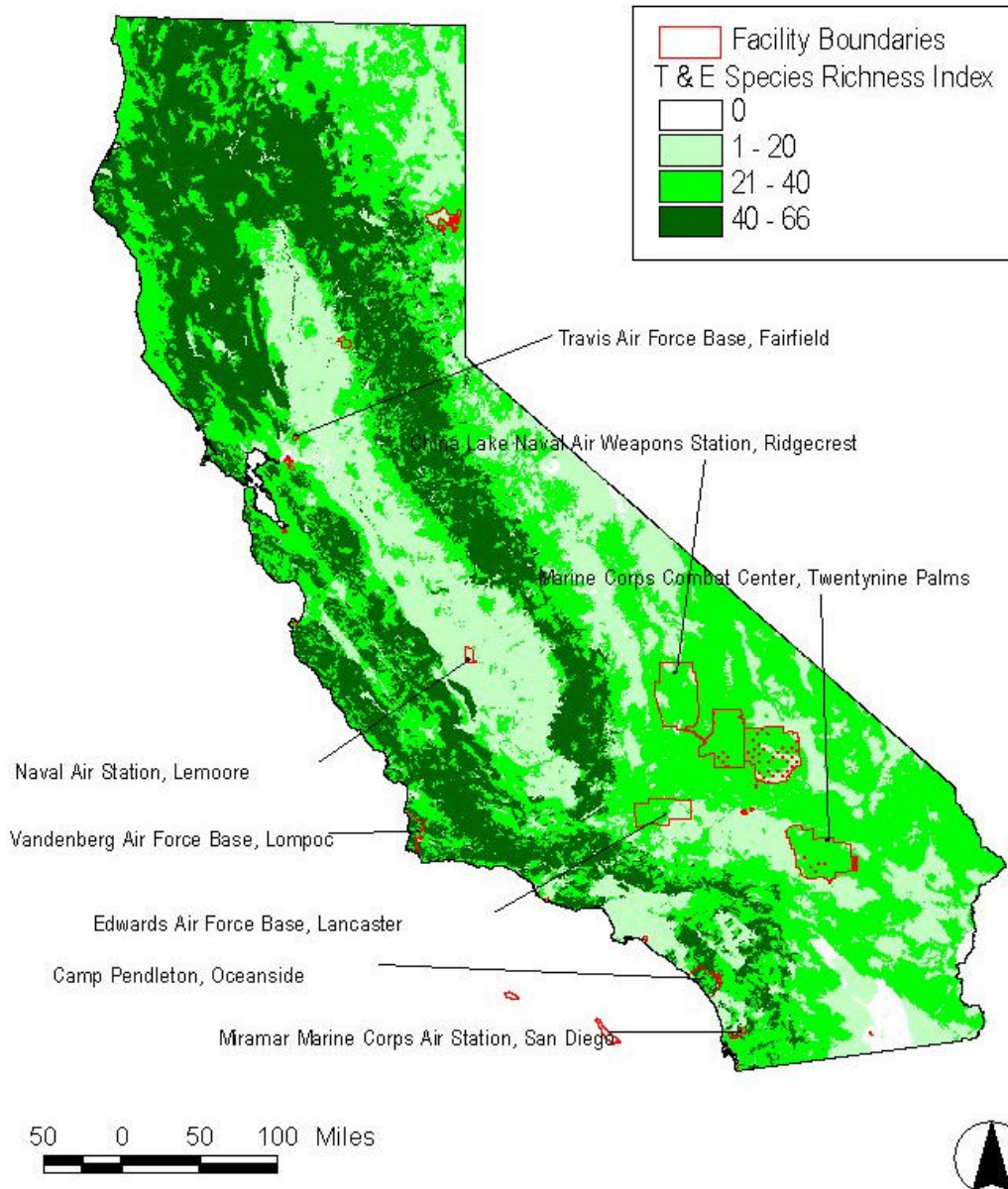


Figure 4: 1997-2020 Population Growth Projections for California Counties

County (sorted by 1997-2020 projected population growth)	California Department of Finance, Population Projections			Study Installations within or Immediately Adjacent to County
	1997	2020F	Change	
Los Angeles	9,524,767	11,575,693	2,050,926	Edwards AFB, Fort Irwin, China Lake NAWS
Riverside	1,423,664	2,773,431	1,349,767	Naval Warfare Assessment Station, Norco
San Diego	2,763,318	3,917,001	1,153,683	Camp Pendleton, Miramar MCAS, Fallbrook NWS, Navy Base Complex, Marine Recruitment Depot, Coronado Naval Base
San Bernardino	1,617,385	2,747,213	1,129,828	Fort Irwin, China Lake NAWS, Marine Combat Center, Marine Logistics Base, Edwards Air Force Base
Orange	2,705,287	3,431,869	726,582	Camp Pendleton, Seal Beach Naval Weapons Support Facility
Santa Clara	1,671,410	2,196,750	525,340	Onizuka Air Station
Sacramento	1,146,882	1,651,765	504,883	
Kern	634,333	1,073,748	439,415	China Lake NAWS, Edwards Air Force Base
Alameda	1,398,570	1,793,139	394,569	
San Joaquin	542,193	884,375	342,182	
Fresno	778,656	1,114,403	335,747	Lemoore Naval Air Station
Stanislaus	425,316	708,950	283,634	
Ventura	727,248	981,565	254,317	Pt. Mugu NAWS, Port Hueneme Naval Facility
Tulare	358,359	569,896	211,537	
Contra Costa	896,214	1,104,725	208,511	Concord Naval Weapons Station
Monterey	377,828	575,102	197,274	Naval Postgraduate School, Defense Language Institute
Sonoma	432,751	614,173	181,422	
Placer	215,505	391,245	175,740	
Solano	378,676	552,105	173,429	Travis Air Force Base
San Luis Obispo	234,661	392,329	157,668	
Imperial	142,674	298,700	156,026	El Centro Naval Air Facility
Santa Barbara	400,788	552,846	152,058	Vandenberg Air Force Base
San Mateo	711,723	855,506	143,783	San Bruno Engineering Center
Santa Cruz	247,252	367,196	119,944	
Merced	201,962	319,785	117,823	
Madera	113,462	224,567	111,105	
Butte	198,484	307,296	108,812	
El Dorado	147,386	256,119	108,733	
Shasta	163,254	240,975	77,721	
Yolo	154,898	225,321	70,423	
Kings	117,747	186,611	68,864	Lemoore NAS
Nevada	88,368	136,405	48,037	
Sutter	76,037	116,408	40,371	
Lake	55,034	93,058	38,024	
Napa	121,093	157,878	36,785	
San Benito	46,151	82,276	36,125	
Mendocino	85,956	118,804	32,848	
Tehama	54,623	83,996	29,373	
Marin	243,301	268,630	25,329	
Tuolumne	52,151	77,350	25,199	
Calaveras	37,894	62,688	24,794	
Yuba	61,265	84,610	23,345	Beale Air Force Base
Colusa	18,522	41,398	22,876	
Glenn	26,889	49,113	22,224	
Lassen	33,787	49,322	15,535	
Humboldt	126,069	141,092	15,023	
Del Norte	28,391	41,898	13,507	
Siskiyou	44,199	53,676	9,477	
Mariposa	15,976	23,390	7,414	
Amador	33,430	40,129	6,699	
Mono	10,582	14,166	3,584	
Plumas	20,422	23,077	2,655	
Inyo	18,262	20,694	2,432	China Lake NAWS, Fort Irwin
Trinity	13,245	15,594	2,349	
Modoc	10,152	12,396	2,244	
Alpine	1,205	1,701	496	
Sierra	3,412	3,575	163	Heurlong Military Depot
San Francisco	777,492	750,904	(26,588)	

Source: California Department of Finance, Demographic Research Unit, E-6 Projections

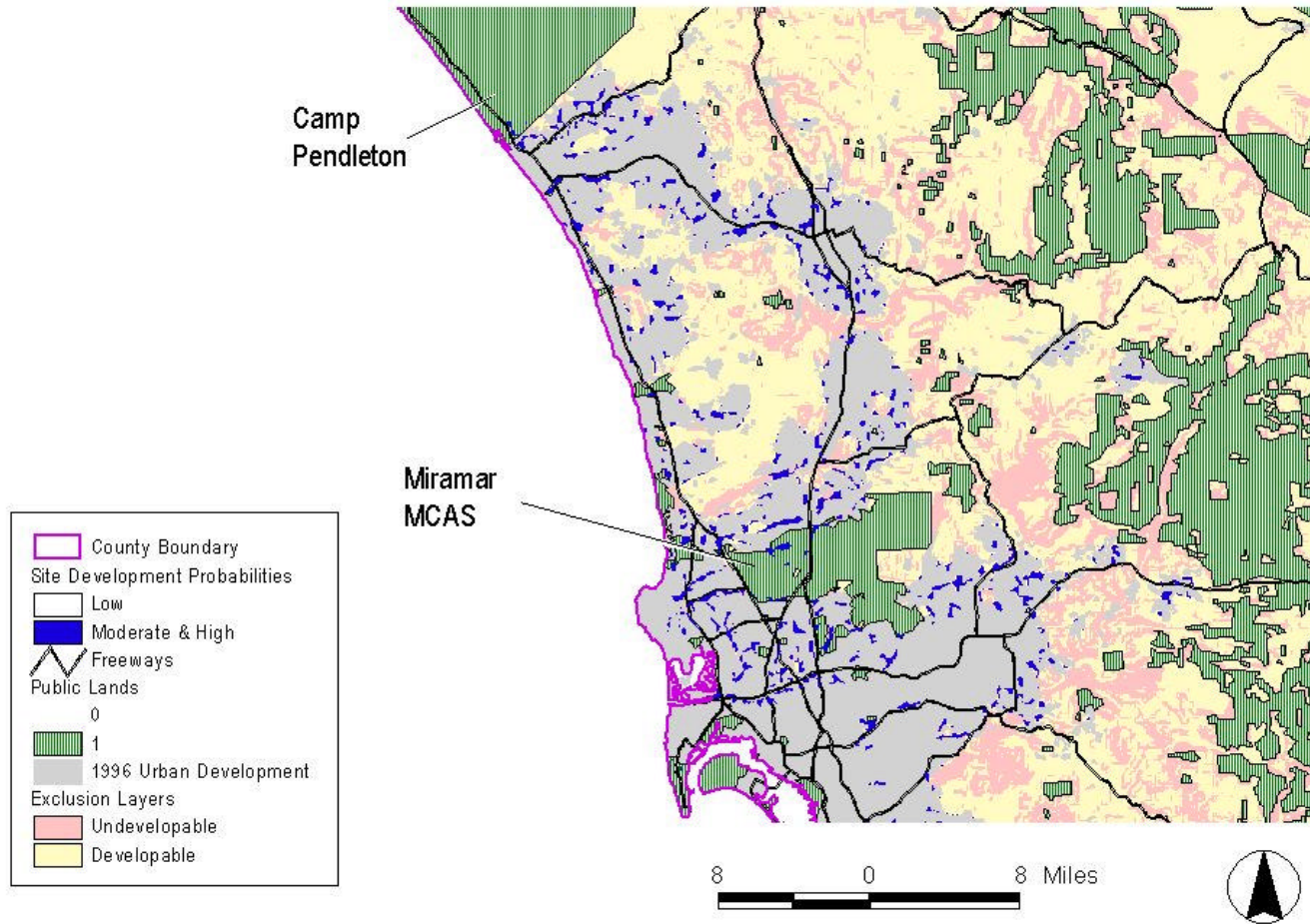
of any type, either infill or greenfield. To deal with the where of future urban growth, we estimated a series of statistical models comparing past urbanization patterns (evaluated at the level of one-hectare grid cells) to various spatial and geographic factors including distance to highways, distance to pre-existing urbanization, distance to city limits, site slope, and characteristics of adjacent and neighboring locations. Once calibrated, the resulting statistical equations can be used to estimate future urbanization probabilities for all remaining undeveloped land. (See Map 3.) These probabilities vary between 1 (indicating future development is certain) and 0 (indicating future urban development is essentially impossible). Appendix B reports the model parameters and estimation results for 31 California counties. Projected population growth can then be “allocated” to particular sites in order of development probability, starting from high to low.

Regardless of their estimated development probabilities, not all sites are appropriate for future urban growth. Public lands (including military installations) and water features cannot be developed regardless of how highly they score. Far distant sites and steeply sloped sites (those with slopes in excess of 15%) are also unlikely to be developed. Lastly, already-developed sites, while perhaps candidates for redevelopment, should not be considered as available for new development. To prevent the model from misallocating future urban growth to these “exclusion” sites, we excluded them from subsequent analysis. This was accomplished by setting their future development probability to zero.

Not all development need occur on previously undeveloped lands. Depending on the particular county, somewhere between 5% and 70% of new urban development takes the form of infill—that is, development that occurs within the existing urban footprint. The first data column of Figure 5 lists 1980–98 infill shares by county. These were estimated by comparing the amount of population growth occurring in cities having little or no remaining greenfield lands to total county population growth. Infill levels vary widely. Two-thirds of Los Angeles County’s population growth between 1980 and 1998, for example, was accommodated through infill development. In Orange County, infill’s share of 1980–98 population growth was 50%. In Santa Clara County, infill development accounted for 75% of 1980–98 population growth. At the opposite extreme, fewer than one in twenty new residents were accommodated via infill in Fresno, Kern, Riverside, and San Bernardino counties.

For the purposes of allocating future population growth, we assumed that future county infill shares would remain at the levels of the last twenty

Map 3: San Diego County Development Probability Map



years. Accounting for infill development reduces the amount of undeveloped land likely to be needed to accommodate projected population growth. The second data column in Figure 5 lists the shares of projected population growth to be accommodated in each county by greenfield or fringe development.

Density is the other part of the land allocation equation. The higher the density at which population growth is allocated, the less the amount of land needed to accommodate a given increment of growth. For reasons of topography, history, and market preference, development densities are generally higher among coastal counties and lower inland. The third data column of Figure 5 lists average county population densities as of 1996. Based on a combination of DoF population estimates and CFMMP farmland data, these density estimates apply to all urban lands, including residential, commercial, industrial, and public land uses, including local roads. Among the counties analyzed, average 1996 population densities ranged from highs of 30 persons per hectare in Los Angeles County and 25 persons per hectare in Orange and Santa Clara counties, to lows of 7 and 11 persons per hectare in San Bernardino and Kings counties.

The resulting 1997–2020 urban area growth projections—listed in the fourth data column of Figure 5—are thus based on current (1996) population densities and are net of projected infill development. They range from a high of 162,400 hectares for San Bernardino to just 750 hectares in Marin. Urban land conversion in San Diego, Orange, and Kern counties, three counties which include or are adjacent to large military bases is projected to exceed 350,000 hectares.

These growth totals were then allocated to sites in order of their estimated development probability, working backwards from high to low probability. As noted previously, excluded sites such as steep slopes, water bodies, and public lands were assigned development probabilities of zero. Development was not permitted to “spill-over” from one county to another.

The resulting spatial growth projections are presented in Maps 4 through 10. Among counties with military installations, the biggest changes are likely to occur in San Bernardino, San Diego, and Orange counties. In San Bernardino County, considerable urban growth will emanate outward from Barstow, Victorville, and Twentynine Palms, potentially encroaching upon the Marine Corps Logistics Base at Barstow, the Marine Corps Combat Center near Twentynine Palms, and the combined airspaces of Edwards Air Force Base and the China Lake Naval Weapons Station. San Diego

County will grow both northward and eastward, further hemming in both Miramar Marine Corps Air Station, Camp Pendleton, and Fallbrook Naval Weapons Support Facility. Camp Pendleton will also face urban development along its northern border with Orange County.

Level Two Analysis: A Closer Look at Four Case Study Bases

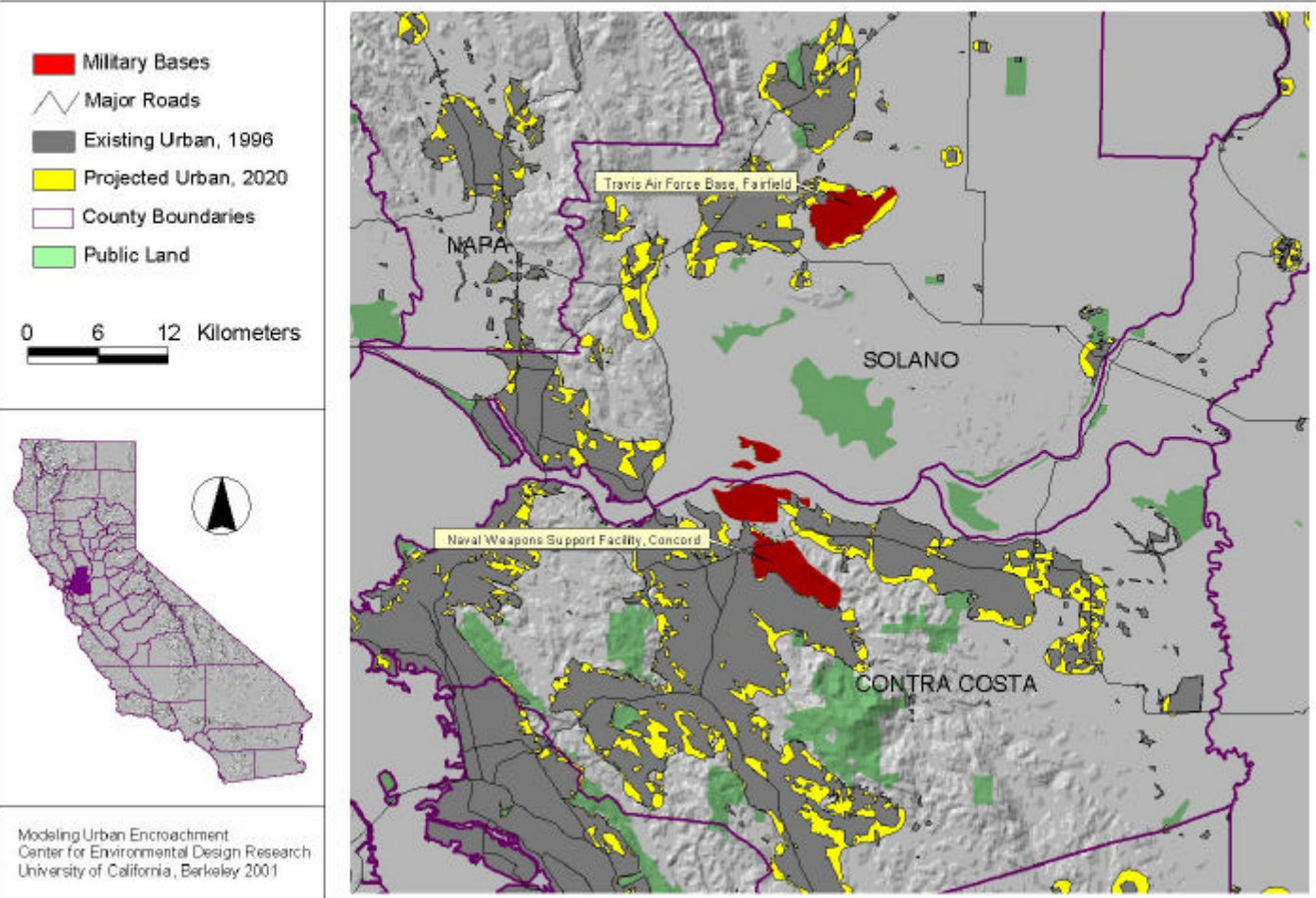
The “encroachment issue” is really a complex of related growth, noise, and environmental issues. Anti-encroachment policies that effectively limit subdivision intrusion into base areas may do little to limit the cumulative noise impacts of military operations on nearby population centers. Likewise, anti-encroachment policies that redirect development away from military installations and toward sensitive habitat lands may indirectly serve to exacerbate on-base or near-base habitat issues. Consideration of this complex of issues is best undertaken on an installation-by-installation basis.

Thus, the second level of analysis contained in this study takes a more detailed look at the form and impacts of projected urban growth on four military installations: Camp Pendleton, the Edwards Air Force Base complex (which includes Fort Irwin and China Lake Naval Air Weapons Station), Miramar Marine Corps Air Station, and Travis Air Force Base. Camp Pendleton was selected as a case study because of its large size, its location between two growing metropolitan areas, and its importance as a critical habitat area. The Edwards Air Force Base complex was selected as a case study because of its potential noise impact on surrounding urban areas, all of which are growing. Miramar Marine Corps Air Station was selected as a case study because of its large size, its central location within the San Diego region, and because projected urban growth will almost completely encircle it by 2020, adversely affecting its mission and relationship to neighboring communities. Travis Air Force Base was selected as a case study for many of the same reasons as Miramar—it’s located in a fast-growing urban corridor and its mission and operations are being increasingly impacted by nearby suburban growth. From an analysis perspective, these four installations cover the gamut of encroachment issues and problems. From a policy perspective, Camp Pendleton, Edwards Air Force Base, Miramar Marine Corps Air Station, and Travis Air Force Base provide a representative testbed for evaluating how effective different encroachment policy strategies might be.

Figure 5: 1997-2020 Urban Land Area Projections by Urban County

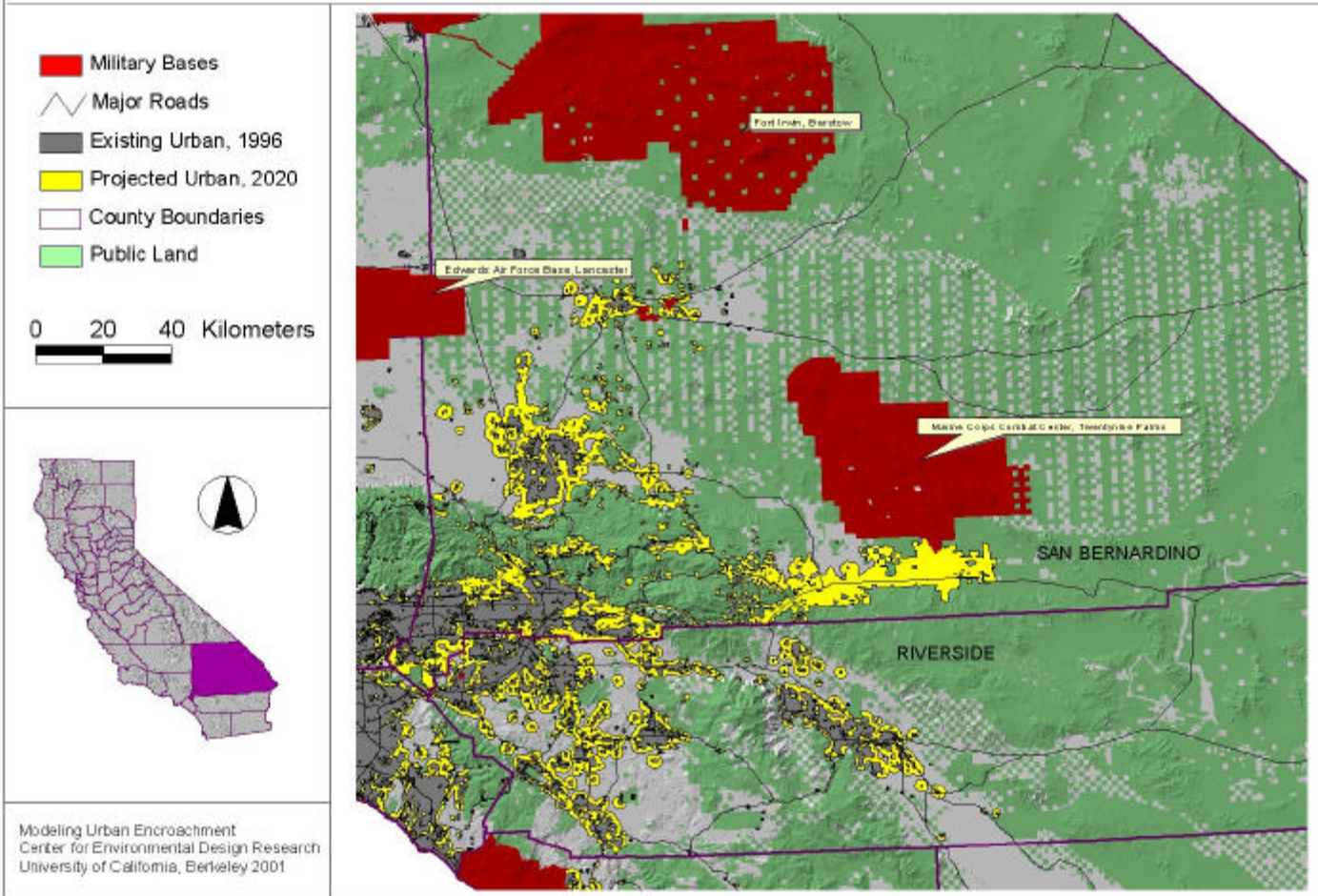
County	Projected Infill Growth Share (based on 1980-98 rates)	Projected Greenfield Growth Share [1-Infill Share]	Projected Allocation Density (persons/ha) [1996 density]	Projected Urban Growth, 1997-2020 (hectares)	Projected Urbanized Area, 2020 (hectares)	Projected Increase in Urbanized Area, 1997-2020 (percent)
Alameda	0.40	0.60	25	9,557	65,488	17%
Contra Costa	0.10	0.90	16	11,622	66,756	21%
El Dorado	0.20	0.80	14	6,177	16,460	60%
Fresno	0.05	0.95	21	15,259	51,386	42%
Kern	0.05	0.95	16	26,446	65,401	68%
Kings	0.10	0.90	11	6,595	17,590	60%
Los Angeles	0.67	0.33	30	22,922	331,405	7%
Madera	0.05	0.95	12	8,895	17,979	98%
Marin	0.55	0.45	15	750	16,826	5%
Merced	0.10	0.90	16	6,545	18,754	54%
Monterey	0.10	0.90	18	9,767	29,684	49%
Napa	0.10	0.90	15	2,174	10,386	26%
Nevada	0.10	0.90	15	15,963	122,115	15%
Orange	0.50	0.50	25	15,963	122,115	15%
Placer	0.10	0.90	15	10,625	24,748	75%
Riverside	0.05	0.95	15	93,019	186,924	99%
Sacramento	0.30	0.70	19	18,466	77,963	31%
San Benito	0.10	0.90	18	1,798	4,274	73%
San Bernardino	0.05	0.95	7	162,396	256,658	172%
San Diego	0.10	0.90	22	47,601	171,968	38%
San Joaquin	0.10	0.90	19	16,392	44,648	58%
San Luis Obispo	0.15	0.85	16	8,359	23,339	56%
San Mateo	0.70	0.30	25	1,730	30,125	6%
Santa Barbara	0.20	0.80	20	6,026	30,038	25%
Santa Clara	0.75	0.25	23	5,749	77,315	8%
Santa Cruz	0.25	0.75	22	4,069	15,255	36%
Solano	0.20	0.80	18	7,726	28,366	37%
Sonoma	0.10	0.90	16	10,561	36,492	41%
Stanislaus	0.45	0.55	21	8,243	27,342	43%
Tulare	0.10	0.90	19	10,006	28,881	53%
Ventura	0.40	0.60	19	8,121	45,842	22%
Yolo	0.75	0.25	15	1,171	11,107	12%

Projected Urban Encroachment, Vicinity of Concord Naval Weapons Facility



Map 4

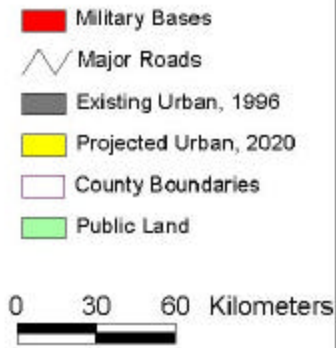
Projected Urban Encroachment, Vicinity of Twentynine Palms



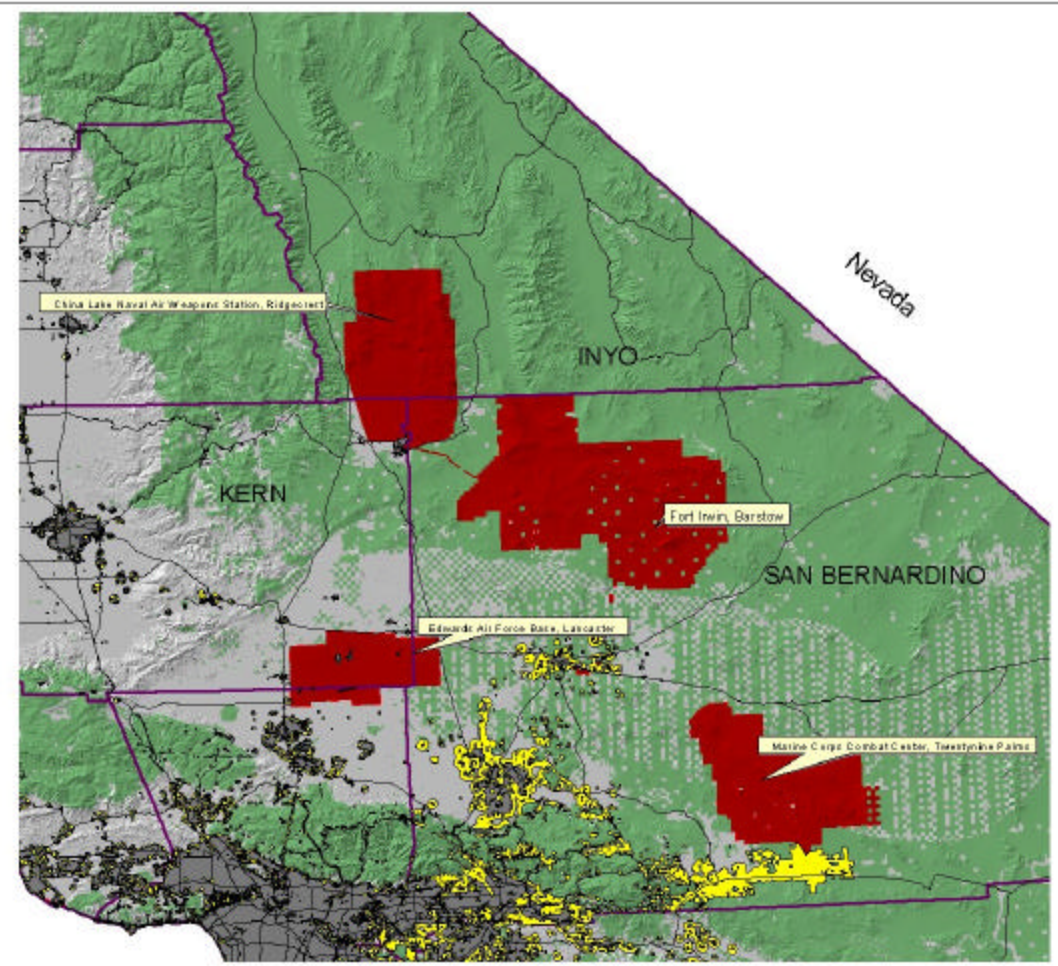
Modeling Urban Encroachment
Center for Environmental Design Research
University of California, Berkeley 2001

Map 5

Projected Urban Encroachment, Vicinity of China Lake & Ft. Irwin

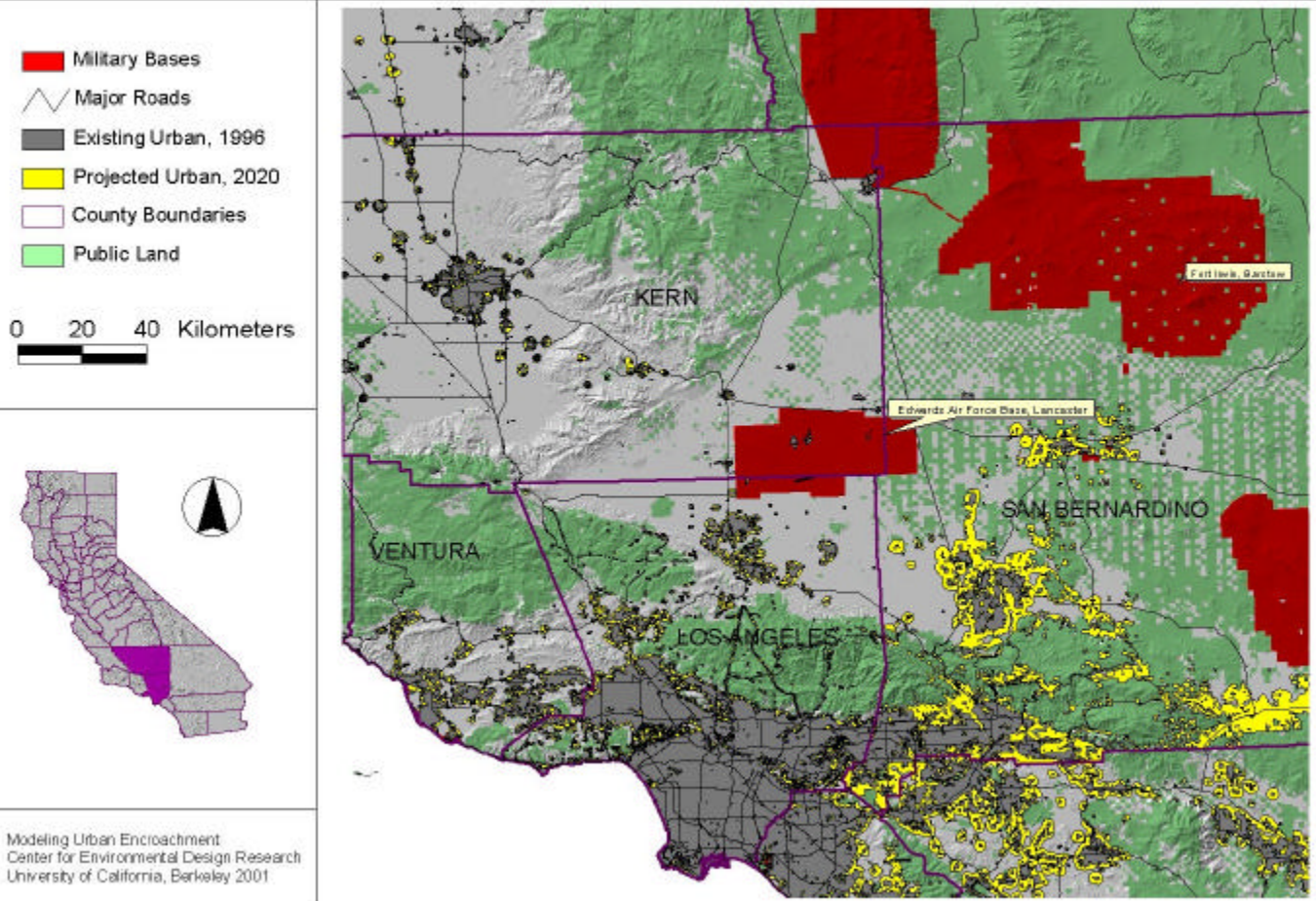


Modeling Urban Encroachment
Center for Environmental Design Research
University of California, Berkeley 2001



Map 6

Projected Urban Encroachment, Vicinity of Edwards Air Force Base



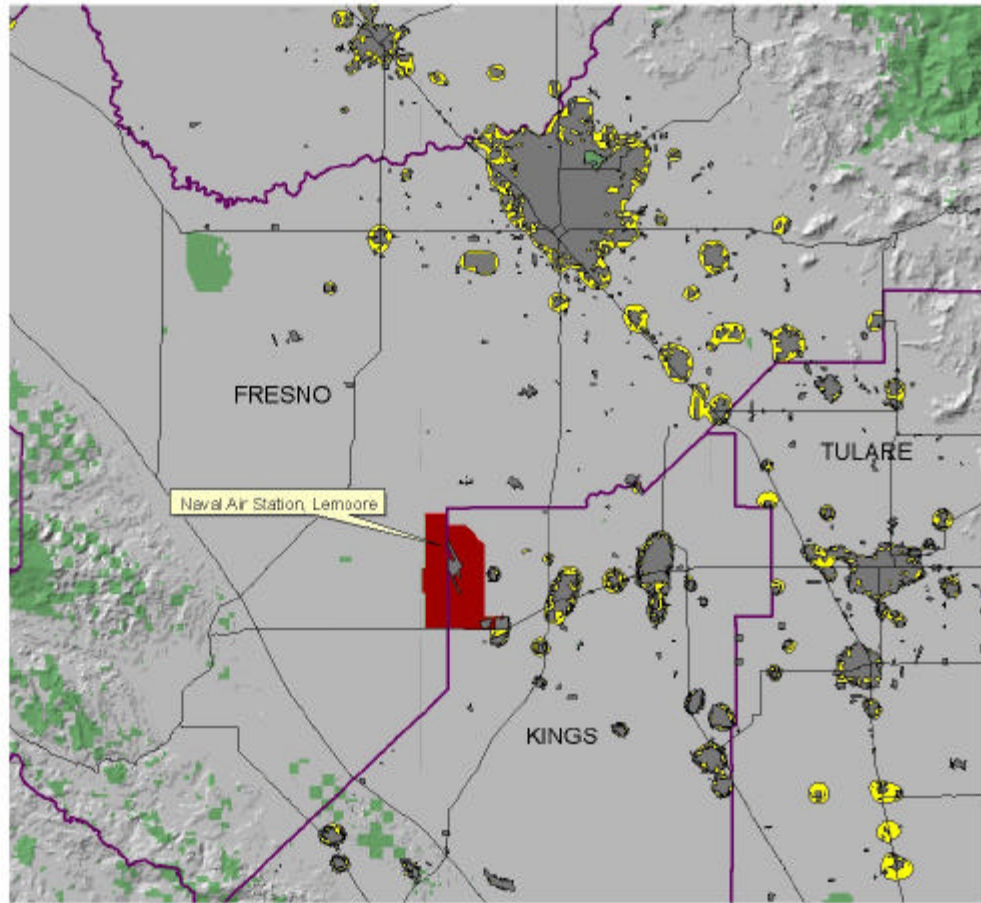
Map 7

Projected Urban Encroachment, Vicinity of Lemoore Naval Air Station

-  Military Bases
 -  Major Roads
 -  Existing Urban, 1996
 -  Projected Urban, 2020
 -  County Boundaries
 -  Public Land
- 0 9 18 Kilometers
- 

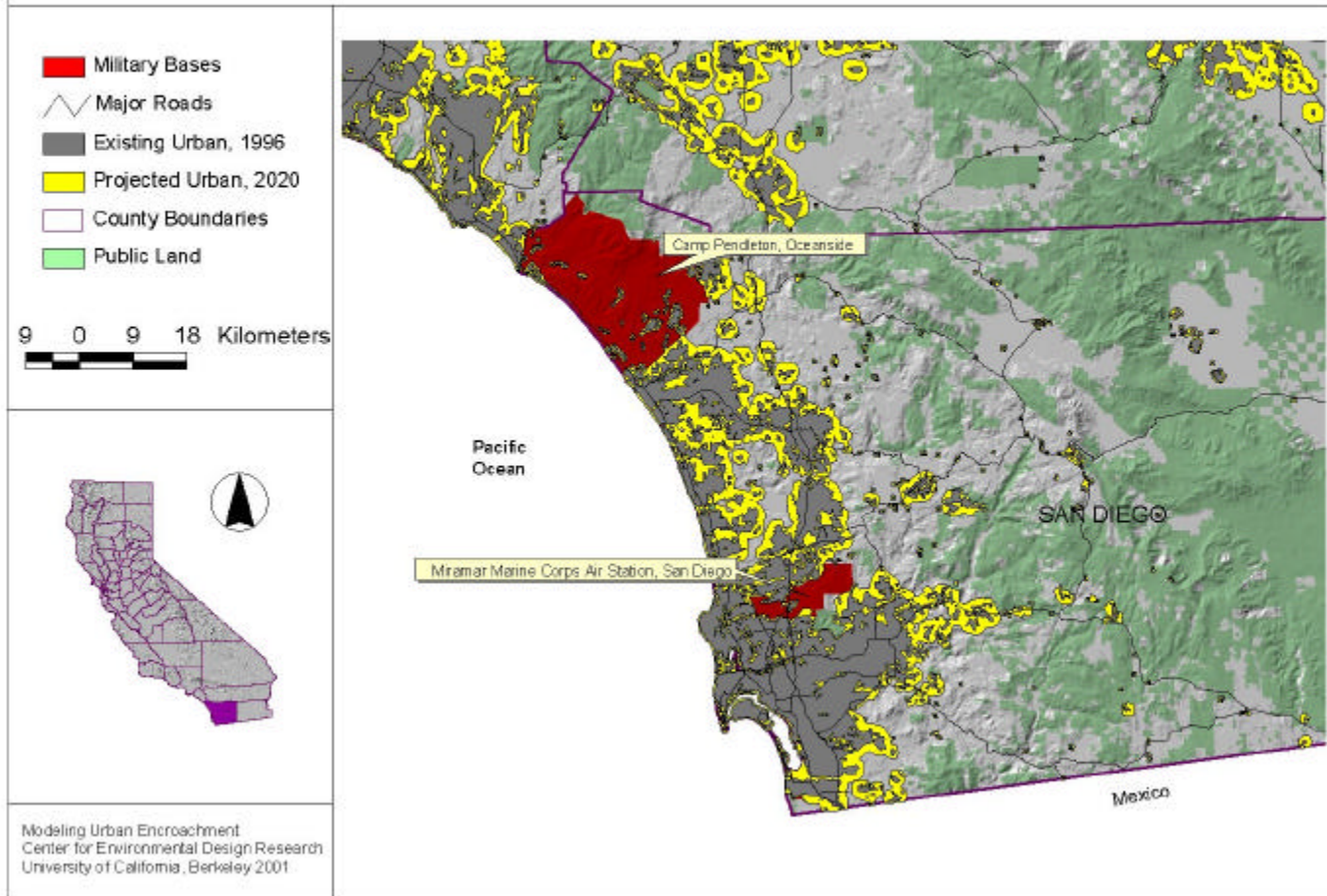


Modeling Urban Encroachment
Center for Environmental Design Research
University of California, Berkeley 2001



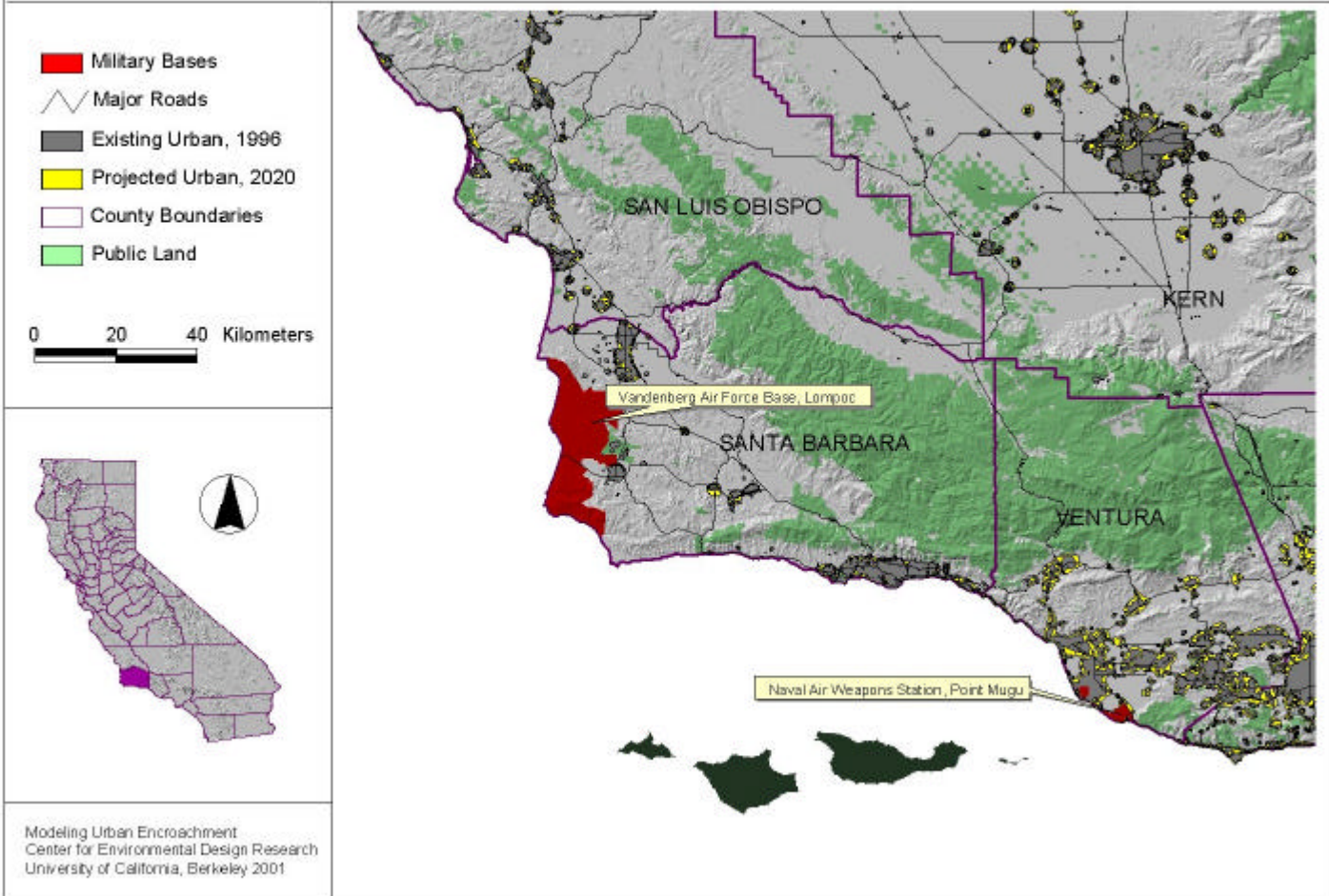
Map 8

Projected Urban Encroachment, San Diego County



Map 9

Projected Urban Encroachment, Santa Barbara & Ventura Counties



Map 10

Chapter Three: Statewide Results

This chapter reports on the results of the Level One statewide analysis of the impacts of projected urban growth on 23 of California's 26 remaining active military installations. Urban encroachment can be analyzed from two spatial perspectives—that of the military installation itself, and that of the installation's urban neighbors. From the military installation or base perspective, the key measurement is the share of succeeding buffer zones around each installation currently or projected to be occupied by urban development. Of course, the buffer zone of the greatest practical interest is the one immediately adjacent to each installation's perimeter.⁵ From the perspective of each installation's urban neighbors, the key measurement is the share of succeeding buffer zones around existing urban areas occupied by one or more installations. Depending on how California's metropolitan areas expand outward, these shares may increase or decrease. Base commanders presumably care more about the former than the latter. Base neighbors presumably care more about the latter than the former.

A separate set of indicators is used to measure the amount, quality, and share of threatened and endangered vertebrate species habitat within the boundaries of each installation and its five- and ten- kilometer buffer zones.

The Base Perspective: Baseline Measurements

To put change in the proper perspective, one must start from a baseline. The baseline for this analysis is the degree of encroachment by urban development upon California military installations as of 1996, as determined using digital data from the California Department of Conservation's Farmland Mapping and Monitoring Project (CFMMP).

Figure 6 summarizes the amount of urban land area (measured in hectares) within a half-kilometer of each installation as of 1996, as well as the urban share of a successive series of one-kilometer encroachment zones generated around each installation. The greater the proportion of urban land within each buffer, the greater the degree of encroachment.

- Nine installations were entirely or mostly surrounded by immediate urban development as of 1996: the Marine Corps Recruitment Center at San Diego, the San Bruno Engineering Center, the Port Hueneme Naval Facility, the Defense Language Institute in Monterey, the Naval Base Complex in San Diego, the Naval Warfare Assessment Station in

Figure 6: Base Buffer Analysis: Baseline (1996) Urban Proportions of One-half to Ten Kilometer Military Base Buffer

INSTALLATIONS (sorted by cumulative urban proportion of 0-.5 km base buffer)	1996 Urbanized Area within 0 -.5 km Base Buffer (hectares)	Cumulative Urban Proportion within 0 - 10 km Base Buffers										
		0-.5 km buffer	0-1 km buffer	0-2 km buffer	0-3 km buffer	0-4 km buffer	0-5 km buffer	0-6 km buffer	0-7 km buffer	0-8 km buffer	0-9 km buffer	0-10 km buffer
Marine Corps Recruit Depot, San Diego	387	98%	99%	95%	93%	93%	91%	89%	88%	88%	88%	89%
San Bruno Engineering Field Activity West	370	98%	97%	94%	86%	76%	70%	66%	62%	60%	55%	50%
Port Hueneme Naval Facilities	512	98%	96%	89%	82%	72%	62%	53%	49%	44%	42%	40%
Defense Language Institute, Monterey	329	85%	83%	78%	72%	69%	67%	63%	57%	51%	45%	40%
Naval Base Complex, San Diego	1,408	84%	89%	89%	87%	86%	85%	83%	83%	83%	83%	82%
Naval Warfare Assessment Station, Norco	362	82%	82%	67%	53%	47%	43%	44%	44%	43%	42%	39%
Onizuka Air Station	715	76%	72%	70%	70%	69%	71%	72%	71%	69%	66%	64%
Seal Beach Naval Weapons Support Facility	780	70%	74%	79%	80%	82%	83%	85%	87%	89%	91%	92%
Naval Postgraduate School, Monterey	446	65%	56%	49%	48%	46%	45%	42%	39%	34%	31%	28%
Miramar Marine Corps Air Station	1,271	40%	42%	47%	49%	51%	51%	51%	52%	53%	54%	54%
Naval Base Coronado, Imperial Beach	153	38%	36%	43%	39%	42%	47%	54%	56%	56%	56%	56%
Concord Naval Weapons Support Facility	816	23%	26%	30%	32%	31%	30%	31%	32%	32%	31%	29%
Fallbrook Naval Weapons Support Facility	233	15%	16%	17%	14%	11%	10%	9%	8%	7%	8%	8%
Camp Pendleton	454	9%	13%	17%	18%	18%	17%	17%	17%	18%	18%	18%
Travis Air Force Base	99	8%	8%	8%	9%	11%	12%	14%	15%	15%	15%	15%
Marine Corps Logistics Base, Barstow	145	7%	6%	6%	6%	7%	7%	6%	6%	6%	5%	4%
Pt Mugu Naval Air Weapons Station	23	3%	4%	4%	4%	6%	10%	13%	15%	17%	20%	21%
Vandenberg Air Force Base	88	2%	4%	6%	7%	7%	6%	6%	6%	7%	7%	7%
China Lake Naval Air Weapons Station	366	1%	1%	1%	1%	1%	1%	0%	0%	0%	0%	0%
Lemoore Naval Air Station	36	1%	2%	3%	2%	1%	1%	1%	1%	2%	2%	2%
Edwards Air Force Base	73	1%	1%	1%	1%	1%	1%	2%	2%	3%	3%	3%
Marine Corps Combat Center, 29 Palms	0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Norco, the Onizuka Air Station in Sunnyvale, the Naval Postgraduate School in Monterey, and the Seal Beach Naval Weapons Support Facility. (We define immediate urban development as urban land uses falling within a half-kilometer of base boundaries.) Of these nine, only the San Diego Naval Base Complex, the Norco Warfare Station, and the Seal Beach Weapons Support Facility conduct active naval operations.

- Another seven installations were substantially impacted by immediate urban development as of 1996: Naval Base-Coronado, Concord Naval Weapons Support Facility, Fallbrook Naval Weapons Support Facility, Camp Pendleton, Travis Air Force Base, the Marine Corps Logistics Base at Barstow, and Miramar Marine Corps Air Station. All seven of these conduct active military operations. Air operations at Travis and Miramar extend over adjacent developed areas.
- Seven installations were minimally or not impacted by immediate urban development as of 1996: Point Mugu Naval Weapons Station, the Marine Corps Combat Center at Twentynine Palms, Vandenberg Air Force Base, China Lake Naval Weapons Station, Lemoore Naval Air Station, and Edwards Air Force Base. All six conduct active field, naval, or air operations. In addition, artillery and airplane noise impacts generated at Point Mugu, Lemoore NAS, and Edwards AFB extend well into developed areas.

Moving beyond simple adjacency, seven installations were surrounded by extensive urban development in 1996—defined as occurring when more than half of the ten-kilometer base buffer is occupied by urban development.

These seven include the Seal Beach Naval Weapons Facility, the Marine Corps Recruitment Depot at San Diego, the Naval Base Complex at San Diego, Onizuka Naval Air Station, Naval Base Coronado, Miramar Marine Corps Air Station, and the San Bruno Engineering Center. Except for Onizuka and the San Bruno Engineering Center, all conduct active military field, naval, or air operations. Navy Base Coronado, the San Diego Naval Base Complex, and Miramar are actually more impacted by extensive urban development than by immediate development.

- Eight installations are surrounded by moderate extensive development, defined as occurring when more than ten percent but less than fifty percent of the ten-kilometer base buffer is occupied by urban development. The eight moderately impacted installations are located in small metropolitan areas (e.g., The Defense Language Institute and

Naval Postgraduate School, both in Monterey), and at the fringes of large metropolitan areas (Naval Warfare Center at Norco, Port Hueneme Naval Facility, Concord Naval Weapons Station, Pt. Mugu Naval Weapons Station, Camp Pendleton, and Travis Air Force Base). Except for the Concord and Monterey installations, all eight conduct active military operations.

- The remaining seven installations—Fallbrook, Vandenberg, the Marine Corp Logistics Base at Barstow, Edwards, Lemoore Naval Air Station, China Lake Naval Weapons Station, and Ft. Irwin—are all unimpacted by extensive urban development.

The Base Perspective: Projected Changes

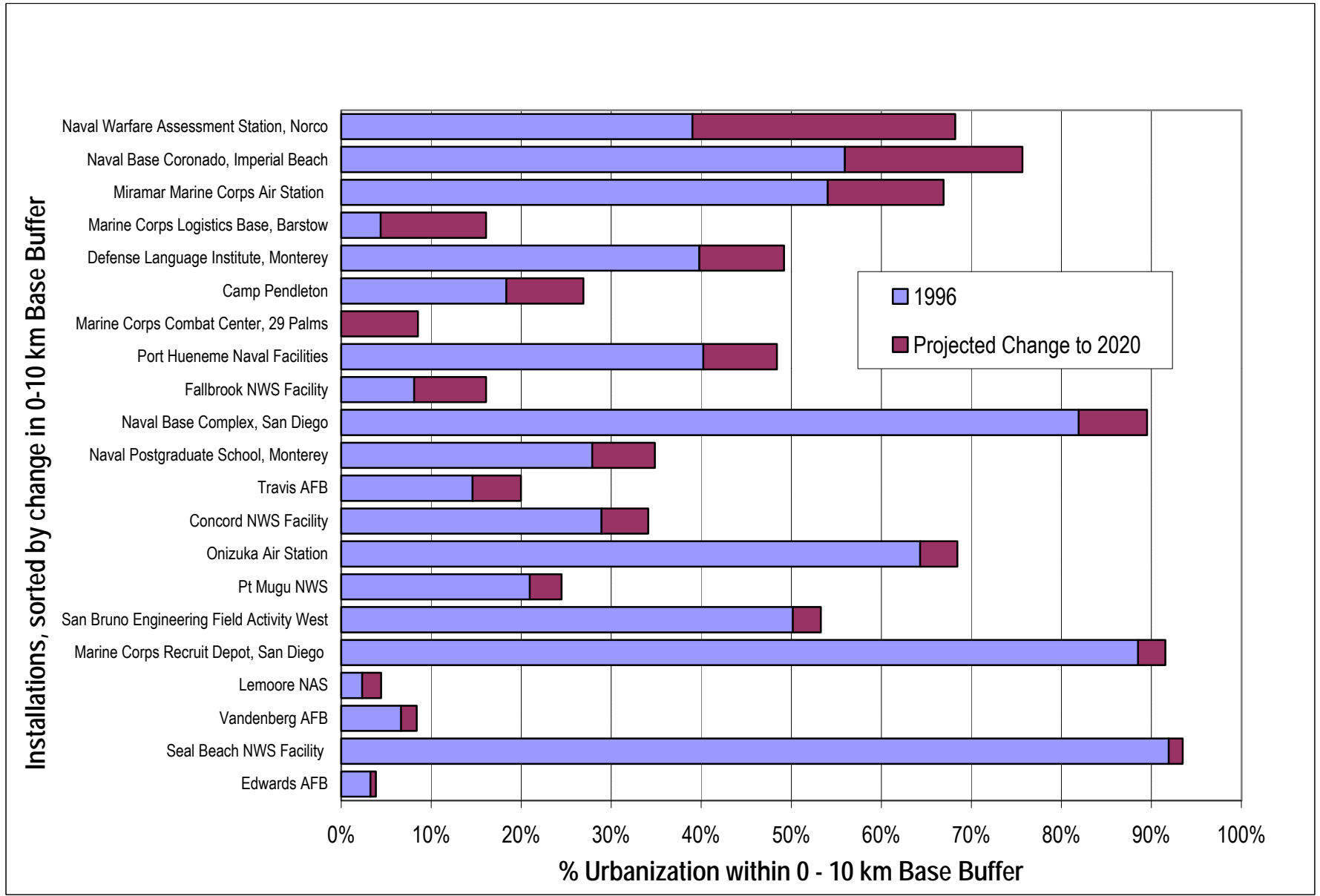
Figures 7 and 8 compare current and projected base encroachment levels from the base, or installation perspective at one-half, one-, five- and ten-kilometer distances. Seven installations are likely to see substantial increases in immediate urban encroachment—that is, the amount of adjacent urban development:

- In the case of Travis Air Force Base, the urban share of the half-kilometer base buffer is projected to rise from 8% in 1996 to 50% in 2020.
- Urban growth will have a similar effect on the Marine Corps Logistics Base near Barstow, as the share of urban development occupying the one-half kilometer base buffer will likely rise from 7% in 1996 to 36% in 2020.
- In the case of Miramar Marine Corps Air Station, the urban share of the one-half kilometer base buffer is projected to rise from 40% as of 1996, to 53% in 2020. Twenty years from now, Miramar will be essentially encircled by suburban development.
- The Naval Warfare Assessment Station at Norco will be almost completely surrounded by urban development, up from 82% in 1996. Naval Base Coronado will be half surrounded by urban development in 2020, up from 38% in 1996. The Point Mugu and Fallbrook Naval Weapons Support Facilities will also see significant increases in adjacent urban development.

Figure 7: Base Buffer Analysis: Proportion of One-half, One, Five, and Ten Kilometer Base Buffers in Urban Use: 1996, 2020 Projected

INSTALLATIONS (sorted by change in urban land area as a proportion of 0 - .5 km base buffer)	Urban Development as a Share of 0 - .5 km Base Buffer		Urban Development as a Share of 0 - 1 km Base Buffer		Urban Development as a Share of 0 - 5 km Base Buffer		Urban Development as a Share of 0 - 10 km Base Buffer	
	<u>1996</u>	<u>2020</u> <u>Projected</u>	<u>1996</u>	<u>2020</u> <u>Projected</u>	<u>1996</u>	<u>2020</u> <u>Projected</u>	<u>1996</u>	<u>2020</u> <u>Projected</u>
	Travis Air Force Base	8%	50%	8%	32%	12%	20%	15%
Marine Corps Logistics Base, Barstow	7%	36%	6%	38%	7%	23%	4%	16%
Miramar Marine Corps Air Station	40%	53%	42%	56%	51%	65%	54%	67%
Naval Warfare Assessment Station, Norco	82%	94%	82%	95%	43%	67%	39%	68%
Naval Postgraduate School, Monterey	65%	76%	56%	72%	45%	58%	28%	35%
Naval Base Coronado, Imperial Beach	38%	49%	36%	49%	47%	68%	56%	76%
Pt Mugu Naval Air Weapons Station	3%	13%	4%	11%	10%	13%	21%	24%
Fallbrook Naval Weapons Support Facility	15%	22%	16%	24%	10%	18%	8%	16%
Camp Pendleton	9%	16%	13%	20%	17%	26%	18%	27%
Onizuka Air Station	76%	82%	72%	77%	71%	72%	64%	68%
Concord Naval Weapons Support Facility	23%	28%	26%	31%	30%	36%	29%	34%
Lemoore Naval Air Station	1%	6%	2%	7%	1%	3%	2%	4%
Naval Base Complex, San Diego	84%	88%	89%	92%	85%	90%	82%	90%
Marine Corps Combat Center Twentynine Palms	0%	3%	0%	4%	0%	6%	0%	9%
San Bruno Engineering Field Activity West	98%	100%	97%	100%	70%	73%	50%	53%
Vandenberg Air Force Base	2%	2%	4%	4%	6%	7%	7%	8%
Defense Language Institute, Monterey	85%	86%	83%	85%	67%	80%	40%	49%
Seal Beach Naval Weapons Support Facility	70%	70%	74%	76%	83%	86%	92%	93%
Port Hueneme Naval Facilities	98%	98%	96%	97%	62%	68%	40%	48%
China Lake Naval Air Weapons Station	1%	2%	1%	2%	1%	1%	0%	0%
Edwards Air Force Base	1%	1%	1%	1%	1%	2%	3%	4%
Marine Corps Recruit Depot, San Diego	98%	97%	99%	96%	91%	92%	89%	92%

Figure 8: Proportion of 0 - 10 km Base Buffer in Urban Use: 1996, 2020 Projected



Five other facilities will see smaller gains in adjacent urban development:

- Camp Pendleton, Lemoore Naval Air Station, Onizuka Air Station, Concord Naval Weapons Station, and the Navy Base Complex at San Diego will be somewhat more impacted by immediate urban development by 2020. Urban growth will be most noticeable around Camp Pendleton and Concord, which currently are only slightly impacted by immediate development. Onizuka Air Station and the San Diego Navy Base Complex are already mostly encircled by urban development.
- Elsewhere, adjacent urban development will increase by 2% to 3% around the Marine Corps Combat Center at Twentynine Palms, and the San Bruno Engineering Center.

In general, the military installations most likely to be immediately impacted by future urban growth are those at the fringe of fast-growing suburban counties. With new suburbanites typically less accustomed to military operations than are long-time residents, localized conflicts over land use, environmental, and noise impacts around these bases are certain to increase.

Installations that are more remote, or those in slower-growing areas are less likely to suffer immediate urban encroachment. For example, new urban growth, although certainly noticeable in the general vicinity, will not encroach physically upon either Edwards Air Force Base or Vandenberg Air Force Base. To the extent that Vandenberg or Edwards conduct off-base operations, regional growth may be more of an issue.

Extensive urban development—urban growth at a distance—also has a substantial effect, again mostly upon those installations currently at the fringes of fast-growing metropolitan areas. As indicated in Figures 7 and 8, extensive urban development will most adversely affect the Naval Warfare Assessment Station at Norco, Naval Base Coronado, Miramar Marine Corps Air Station, the Marine Corps Logistics Base near Barstow, the Defense Language Institute at Monterey, Camp Pendleton, and the Marine Corps Combat Center at Twentynine Palms. Because they are near (but not surrounded by) extensive urban development, many of these installations are likely to feel the brunt of increased and widespread public pressure to limit their operations. Installations that conduct operations that are compatible with surrounding urban development, whether intensive or extensive, are less likely to experience adverse public pressures.

From a Neighbor's Perspective

The preceding analysis was developed from a base-outward perspective. That is, it was conducted from the vantage point of a military installation looking outward at impending urban growth. Another way of looking at the same set of issues is to take the perspective of the installation's urban neighbors. As urban growth extends outward, the distances between existing military installations and population concentrations shrink—making military facilities neighbors to more and more people. Thus, the net effect of urban growth—even when it doesn't directly encroach upon a specific military installation—is for base operations to impact more people and, depending upon where else growth occurs, potentially a larger share of the population. Politically, the extent to which military installations are regarded as good neighbors is likely to be a function of this second type of “encroachment,” rather than the more straightforward type of encroachment analyzed previously.

To analyze this second encroachment form, we generated a series of one- and five-kilometer buffers around all current and projected urban areas and then calculated the share of those buffers occupied by one or more military bases. The higher the share, the greater the level of cumulative urban impact. The results of this analysis are summarized by county in Figure 9. Viewed in a slightly different light, the proportions reported in Figure 9 may be interpreted as the probabilities that a resident of a particular county who travels 1, 5, 10, and 20 kilometers in all directions will encounter a military installation.

Military bases are not omnipresent in most California counties. The six counties in which residents were in the closest average proximity to a military base in 1996 were Solano (in which Travis Air Force Base and the Concord Naval Weapons Support Facility comprised 8.2% of the one-kilometer buffer around all urban areas), Kings (7.6% proximity rate), Santa Barbara (6.3%), San Diego (4.6%), Kern (4.1%), and Ventura (3.3%). Elsewhere, fewer than 1 in 70 residents lived within a kilometer of a military base in 1996.

As the buffer width around urban areas is increased, military base presence generally becomes even less obvious. At ten and twenty kilometers distance, for example, military bases are a noticeable presence in the lives of a significant share of the residents of only Kern (7.2% proximity rate), Orange (6.5% proximity rate), Los Angeles (6.1%), San Diego (5.1%), Santa Barbara (4.9%) and San Bernardino (3.2%) counties. Elsewhere, fewer than 1 in 50 county residents is likely to live within twenty kilometers of a major military base.

Except for San Bernardino, projected urban growth will change these ratios only slightly, and mostly in ways that reduce rather than increase the share of residents living in close proximity to a military installation. Among the counties listed in Figure 9, military bases will occupy an increased share of the one-, five-, ten- and twenty-kilometer buffer areas generated around future urban areas in only San Bernardino and San Diego. Elsewhere, the share of military base-to-buffer area will generally decline. Even in Kern, Orange, Los Angeles, and Santa Barbara—four counties in which military bases installation occupy a significant share of county land area—urban growth, left to its own dynamics, will not tend to favor areas around military installations.

Threatened and Endangered Species Habitat

Almost all of California is critical habitat for at least one threatened or endangered (T & E) species; and so too, are most California military installations. Except for the Naval Air Facility at El Centro, all or essentially all of the land area within all the installations listed in Figure 10 have TESRI scores greater than 0. As noted in Chapter Two, TESRI scores are calculated for each hectare of land area as the sum of the number of T & E species habitats, multiplied by their respective habitat quality ratings. For land-based vertebrates, California TESRI scores range from 0 to 66. Readers should recall that TESRI scores are indicative of habitat quality, not biodiversity or the presence or lack of particular species.

The following discussion evaluates California military installations and their ten- and twenty-kilometer buffers according to three TESRI score levels: (i) scores greater than 0 indicating the presence of critical habitat for at least one T & E species; (ii) scores greater than 20, indicating the presence of critical habitat for multiple T & E species; and (iii) scores greater than 40 indicating the presence of many T & E species.

All California military installations are home to at least one T & E species. One-hundred percent of the land area within 14 of the 25 installations listed in Figure 10 is considered critical habitat—that is, is potentially home to one or more T & E species. Indeed, the only installation listed in Figure 10 in which the entire base is not effectively considered critical habitat is the Naval Air Facility at El Centro.

Most installations are also surrounded by critical habitat. All of the land area within 20 kilometers of the Naval Weapons Station at Fallbrook, Beale Air Force Base in Marysville, the Naval Warfare Assessment

Figure 9: Urban Buffer Analysis: Military Facilities as a Proportion of 1, 5, 10, and 20 km Urban Buffers, by County: 1996, 2020 Projected

COUNTY (Sorted by military base land area as a proportion of 1 km urban buffer in 1996)	Military Base Area as a Share of 1 km Urban Buffer		Military Base Area as a Share of 5 km Urban Buffer		Military Base Area as a Share of 10 km Urban Buffer		Military Base Area as a Share of 20km Urban Buffer	
	<u>1996</u>	<u>2020</u> <u>Projected</u>	<u>1996</u>	<u>2020</u> <u>Projected</u>	<u>1996</u>	<u>2020</u> <u>Projected</u>	<u>1996</u>	<u>2020</u> <u>Projected</u>
	Solano	8.2%	4.8%	1.0%	1.0%	1.1%	1.2%	1.0%
Kings	7.6%	5.1%	4.3%	4.1%	2.5%	2.4%	1.5%	1.4%
Santa Barbara	6.3%	3.5%	11.6%	11.1%	8.2%	8.1%	4.9%	4.9%
San Diego	4.6%	3.1%	8.1%	8.5%	6.7%	7.0%	5.1%	5.4%
Kern	4.1%	1.7%	6.5%	5.4%	7.8%	7.4%	7.2%	7.2%
Ventura	3.3%	3.1%	0.9%	1.1%	0.6%	0.8%	0.4%	0.5%
Monterey	1.4%	1.0%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
Santa Clara	0.9%	0.8%	0.3%	0.3%	0.2%	0.2%	0.1%	0.1%
Contra Costa	0.8%	0.7%	1.8%	1.8%	1.2%	1.3%	0.7%	0.7%
San Bernadino	0.7%	0.3%	1.0%	1.1%	1.5%	2.1%	3.2%	4.7%
Orange	0.4%	0.3%	3.0%	2.9%	4.7%	4.6%	6.5%	6.5%
San Mateo	0.4%	0.4%	0.1%	0.1%	0.5%	0.5%	0.3%	0.3%
Riverside	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5%
Los Angeles	0.0%	0.0%	2.1%	2.1%	3.7%	3.7%	6.1%	6.0%
Alameda	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.1%	0.1%
Fresno	0.0%	0.0%	1.7%	0.0%	1.6%	0.5%	1.0%	1.0%
Napa	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Placer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	1.4%
San Luis Obispo	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.4%	0.9%

Figure 10: Distribution of Critical Habitat within California Military Facilities and their Ten and Twenty Kilometer Buffer Zones

Installation (sorted by percent of base with TESRI score of 40 or higher)	Percent of Land Area with TESRI Score greater than 0			Percent of Land Area with TESRI Score greater than 20			Percent of Land Area with TESRI Score greater than 40		
	within Base Boundaries	within 10 km Base Buffer	within 20 km Base Buffer	within Base Boundaries	within 10 km Base Buffer	within 20 km Base Buffer	within Base Boundaries	within 10 km Base Buffer	within 20 km Base Buffer
Naval Weapons Support Facility, Fallbrook	100%	100%	100%	100%	100%	100%	100%	100%	38%
Beale Air Force Base, Marysville	100%	100%	100%	99%	56%	53%	100%	53%	28%
Naval Warfare Assessment Station, Norco	101%	100%	100%	101%	99%	87%	100%	87%	24%
Naval Air Station, Lemoore	99%	100%	100%	0%	1%	2%	100%	2%	0%
Fort Irwin, Barstow	100%	100%	100%	73%	62%	58%	100%	58%	0%
Marine Corps Combat Center, Twentynine Palms	100%	100%	100%	94%	70%	68%	100%	68%	0%
Edwards Air Force Base, Lancaster	99%	99%	99%	65%	63%	63%	99%	63%	0%
China Lake Naval Air Weapons Station, Ridgecrest	99%	99%	99%	92%	93%	88%	99%	88%	0%
Travis Air Force Base, Fairfield	100%	100%	96%	100%	62%	39%	96%	39%	8%
Marine Corps Logistics Base, Barstow	100%	95%	96%	13%	41%	27%	96%	27%	0%
Naval Postgraduate School, Monterey	99%	96%	93%	99%	92%	92%	93%	92%	55%
Onizuka Air Station, Sunnyvale	100%	92%	93%	100%	90%	92%	93%	92%	18%
Naval Weapons Support Facility, Concord	98%	84%	92%	70%	61%	83%	92%	83%	24%
Miramar Marine Corps Air Station, San Diego	100%	95%	80%	93%	76%	62%	80%	1%	14%
Camp Pendleton, Oceanside	100%	76%	70%	93%	64%	53%	70%	53%	24%
Naval Weapons Support Facility, Seal Beach	99%	70%	66%	0%	0%	1%	66%	1%	0%
Vandenberg Air Force Base, Lompoc	100%	63%	52%	98%	60%	49%	52%	49%	24%
Naval Base Coronado, Imperial Beach	98%	53%	48%	96%	50%	46%	48%	46%	8%
Naval Air Weapons Station, Point Mugu	99%	50%	46%	12%	30%	39%	46%	39%	29%
Naval Facilities, Port Hueneme	102%	50%	45%	102%	21%	25%	45%	25%	7%
Defense Language Institute, Presidio of Monterey	101%	46%	43%	101%	40%	40%	43%	40%	21%
Engineering Field Activity West, San Bruno	98%	65%	42%	98%	64%	42%	42%	42%	10%
Naval Air Facility, El Centro	52%	22%	40%	0%	0%	0%	40%	0%	0%
Naval Base Complex	96%	41%	6%	96%	40%	6%	6%	6%	0%
San Diego Marine Corps Recruit Depot, San Diego	100%			100%			0%		

Station at Norco, Lemoore Naval Air Station, Fort Irwin, and the Marine Corps Combat Center at Twentynine Palms is home to at least one T & E species. China Lake Naval Weapons Station, Travis Air Force Base, the Marine Corps Logistics Base at Barstow, the Naval Postgraduate School in Monterey, Onizuka Naval Air Station, and the Naval Weapons Support Facility at Concord.

Most military installations are home to more than one T & E species. Ninety percent or more of the land area of two-thirds of the installations listed in Figure 10 has a TESRI score of 20—indicating the potential presence of between five and ten T & E species. Indeed, there are only five installations—Lemoore Naval Air Station, the Marine Corps Logistics Base at Barstow, the Naval Weapons Facility at Seal Beach, Pt. Mugu Naval Air Weapons Station, and the Naval Air Facility at El Centro—in which the majority of the installation land area does not have a TESRI score of at least 20.

The real habitat hotspots are those with TESRI scores of 40 or more, indicating the potential presence of as many as a dozen T & E species. There are 13 active military installations in California in which ninety percent or more of the installation area has a TESRI score higher than 40. Generally speaking, the bases with the largest proportions of high TESRI lands are either very large (e.g., Beale Air Force Base), or else located far from large population centers (the Marine Corps Combat Center at Twentynine Palms), or both (Fort Irwin). A few large and very-high TESRI scoring facilities are near large and growing urban centers, most notably Travis Air Force Base, Edwards Air Force Base, Miramar Marine Corps Air Station, Camp Pendleton and Fallbrook Naval Weapons Support Facility. These are precisely the installations where future urban growth will most threaten critical habitat areas, thereby putting increased pressure on military installations as formal and informal species preserves.

Summary

The results of the analyses presented in this chapter point to two conclusions. First, while most California military installations will suffer from increasing urban encroachment, the biggest encroachment impacts will be limited to just a few bases: Miramar Marine Corps Air Station, the Marine Corps Logistics Base at Barstow, Travis Air Force Base, Naval Base Coronado, and the Camp Pendleton/Fallbrook Naval Weapons Support Facility complex. Second, and of equal importance, the nature and extent of encroachment impacts will vary widely among individual installations.

To help put these variations into perspective, we classified 23 of California's 26 active military facilities into four encroachment categories along two dimensions. The two dimensions are: (i) current and projected urban encroachment upon different installations and their vicinities and; (ii) the extent to which different installations and their vicinities encroach upon significant amounts of threatened and endangered species habitat. (See Figure 11.) Along the urban encroachment dimension, we categorized California military installations as:

- Already substantially surrounded by urban development. The list of facilities already substantially surrounded by urban development includes the Defense Language Institute in Monterey, the Marine Recruitment Depot in San Diego, the Naval Postgraduate School in Monterey, the Navy Base Complex in San Diego, the Naval Weapons Station at Norco, Onizuka Naval Air Station, the Port Hueneme Naval Facility, the San Bruno Engineering Center, and the Seal Beach Naval Weapons Facility. Because of their specialized functions, operations at the Defense Language Institute, San Diego Recruitment Depot, Naval Postgraduate School, and San Bruno Engineering Facility are unaffected by nearby urban development. Such is not the case for the Navy Base Complex in San Diego, the Norco Naval Weapons Station, Onizuka NAS, the Port Hueneme Naval Facility, or the Seal Beach Naval Weapons Facility.

Six of the nine installations in this category neither contain, nor are surrounded by significant amounts of critical habitat. The three facilities that either include or are adjacent to significant critical habitat areas are the Defense Language Institute and the Naval Postgraduate School, both in Monterey, and the Norco Naval Weapons Station.

- Facing significant projected urban encroachment by 2020. The list of facilities facing substantial urban encroachment pressures at their existing boundaries by 2020 includes the Marine Logistics Base at Barstow, Navy Base Coronado, Travis Air Force Base, Miramar Marine Corps Air Station, and the Concord Naval Weapons Facility. Additional encroachment would compromise some operations at all five installations except Concord NWS, but especially at the Marine Logistics Base at Barstow, Travis AFB, and Miramar MCAS.

Two of the five facilities in this category, Miramar MCAS and Concord NWF, also contain or are surrounded by significant amounts of critical habitat.

Figure 11: Base Classification According to Urban Encroachment Threats and Critical Habitat Issues

	Installation and 20km encroachment zone DO NOT contain large amounts of substantially threatened & endangered species habitat (TESRI > 40)	Installation and 20km encroachment zone DO contain large amounts of substantially threatened & endangered species habitat (TESRI > 40)
INSTALLATION AREA ALREADY URBANIZED: Urban development already adjacent to 50% or more of the installation.	Marine Recruitment Depot, San Diego Navy Base Complex, San Diego Onizuka Naval Air Station Port Hueneme Naval Facility San Bruno Engineering Center Seal Beach Naval Weapons Facility	Defense Language Institute, Monterey Naval Postgraduate School, Monterey Norco Naval Weapons Station
INSTALLATION AREA FACING INCREASED URBANIZATION: Urban growth projected to substantially impact base boundaries by 2020	Marine Logistics Base, Barstow Navy Base Coronado Travis Air Force Base	Miramar Marine Corps Air Station Concord Naval Weapons Facility
ENCROACHMENT ZONE FACING INCREASED URBANIZATION: Urban growth projected to substantially impact 10 km encroachment zone	Marine Logistics Base, Barstow Navy Base Coronado	Camp Pendleton Fallbrook Naval Weapons Facility Miramar Marine Corps Air Station Norco Naval Weapons Station
INCREASED REGIONAL URBANIZATION: Noise and other activities from base operations expected to impact a growing nearby population	Edwards Air Force Base complex Marine Combat Center 29 Palms Marine Logistics Base, Barstow Travis Air Force Base	Miramar Marine Corps Air Station Pt. Mugu Naval Weapons Station Vandenberg Air Force Base

- Facing significant urban encroachment pressures within ten kilometers of facility boundaries. The list of facilities facing substantial urban encroachment pressures within ten kilometers of their boundaries by 2020 includes the Marine Logistics Base at Barstow, Navy Base Coronado, the Naval Weapons Station at Norco, Miramar Marine Corps Air Station, Camp Pendleton, and the Fallbrook Naval Weapons Facility. Note that Norco NWS is already more than half surrounded by urban development, and that the Marine Logistics Base at Barstow, Navy Base Coronado, and Miramar MCAS are also facing significant urban growth pressures at their boundaries. Additional urban development within a ten-kilometer encroachment buffer would especially compromise operations at the Marine Logistics Base at Barstow, the Fallbrook Naval Weapons Facility, and Camp Pendleton.

Four of the six facilities in this category—the Naval Weapons Station at Norco, Miramar MCAS, Camp Pendleton, and the Fallbrook NWF Facility—also contain or are surrounded by significant amounts of critical habitat. Camp Pendleton and Fallbrook NWF are especially noteworthy in this respect.

- Facing increased regional concern over facility impacts. Seven facilities are sufficiently close to large or growing urban centers such that they are likely to face additional concerns over the noise impacts of base operations. The seven are: Edwards Air Force Base, the Marine Combat Center at 29 Palms, the Marine Logistics Base at Barstow, Travis Air Force Base, Miramar Marine Corps Air Station, Pt. Mugu Naval Weapons Station, and Vandenberg Air Force Base. Note that the Marine Logistics Base at Barstow, Travis AFB, and Miramar MCAS are also facing significant urban growth pressures at their boundaries.

Of the seven facilities in this category, Miramar MCAS, Pt. Mugu NWS, and Vandenberg AFB are also surrounded by significant amounts of critical habitat.

The recognition that the encroachment issue varies so widely complicates the task of taking a comprehensive approach to identifying and administering effective encroachment management policies—a point we again pick up in Chapter 5.

A Final Caveat

It is worth noting that all projections listed in this chapter are just that—projections. Or to be more accurate, they are the result of statistically-identified trends. Our site-specific estimates of future development probabilities, for example, are based on observations of urban land use change between 1984 and 1996. To the extent that future urban development is influenced by other factors or driven by different forces than in the past, future urbanization patterns may look very different. Likewise, depending on the particular county and how it undertakes future land use planning efforts, our use of historical infill shares and densities may either understate or overstate the amounts of undeveloped land needed to accommodate future population growth. Thus, while our estimates of future growth locations and patterns are certainly more comprehensive and explicit than any others published to date, they are not necessarily any more accurate. Only time will tell.

Chapter Four: Case Study Analysis

So far, we have considered urban encroachment impacts at a very general level—almost as if the detailed circumstances and conditions at each installation don't matter. Which, of course, they do. In this chapter, we undertake a more fine-grained analysis of encroachment issues at four large military installations located in rapidly growing urban counties. The four case study bases are Camp Pendleton in San Diego County, Edwards Air Force Base, the Marine Corps Air Station at Miramar (also in San Diego County), and Travis Air Force Base in Solano County. Three sets of issues are of special concern. The first is the likely extent of future urban growth adjacent to each installation. The second is how and whether future urban growth in the general vicinity of each installation will affect its role as critical habitat reserve, especially for threatened and endangered species. A final issue concerns whether and how projected urban growth will increase the number of nearby residents impacted by noise from base operations.

Camp Pendleton

Located at the northwestern corner of San Diego County, and home to six different commands, Marine Corps Camp Pendleton occupies approximately 125,000 acres of land, of which nearly 10,000 acres is developed. Camp Pendleton provides training facilities for active duty and reserve Marine, Navy, Army, Air Force, and National Guard units. Nearly 60,000 personnel train at Camp Pendleton every year, with 35,000 service members actually assigned to the base. Camp Pendleton currently has more than 5,000 buildings and structures, 500 miles of roads, and nearly 1,000 miles of utility lines. Aside from a portion of the base's borders that is shared with the San Mateo Wilderness Area and Fallbrook Naval Weapons Station, surrounding land uses include urban development, rural residential development, and agricultural farming and ranching.

Camp Pendleton's semi-arid Mediterranean climate, varied topography, diverse soil types, and high fire frequency are reflected in the types and distribution of plant communities and wildlife species present. The vast majority of the land within Camp Pendleton is classified as grasslands, coastal scrub, or chaparral (Figure 12). Camp Pendleton also contains a disproportionate amount of ecologically important Montane Riparian and Valley-Foothill Riparian habitat, mostly in the areas around the Santa Margarita River. Over 800 plant species and more than 50 mammalian, 30

reptilian, 10 amphibian, 300 avian, and 60 fish species have been identified on Camp Pendleton, including 18 federally listed threatened or endangered species (Camp Pendleton Integrated Natural Resources Management Plan 2001).

Roughly nine percent of the land area adjacent to Camp Pendleton was in urban use in 1996. Based on current projections as outlined in Chapter Three, this percentage is likely to increase to 16% by the year 2020.

These percentages understate the effects of urban growth on the base and its mission. Just under 20% of the land area within five miles of Camp Pendleton is currently in urban use; a percentage that will likely increase to over 25% by 2020. Of even greater importance, as continuing urban development in northern San Diego and southern Orange counties consumes remaining native habitats, numerous species will seek out the large patches of habitat that remain—many of which are located in Camp Pendleton and the Fallbrook Naval Weapons Center. In short, environmental and conservation pressures on Camp Pendleton can only increase.

How important is Camp Pendleton as a multi-species habitat reserve? Using the California Department of Fish and Game's Wildlife Habitat Relationship (WHR) system, the California Gap Analysis Project rates every meso-scale habitat patch in California for its vertebrate habitat suitability. The resulting ratings, which vary between 0 and 5, combine the percentage of each patch suitable as habitat, with an assessment of habitat quality for every vertebrate species. An index value of 0 indicates that no suitable habitat is present while a value of 5 indicates that most of the patch is highly suitable for that species. Map 11 adds together the individual ratings for all federally-listed threatened and endangered species into a single index, and presents the results for western San Diego County. Camp Pendleton is outlined in maroon. It is immediately apparent that Camp Pendleton represents the only sizable chunk of high-quality endangered species habitat along the San Diego County coast.

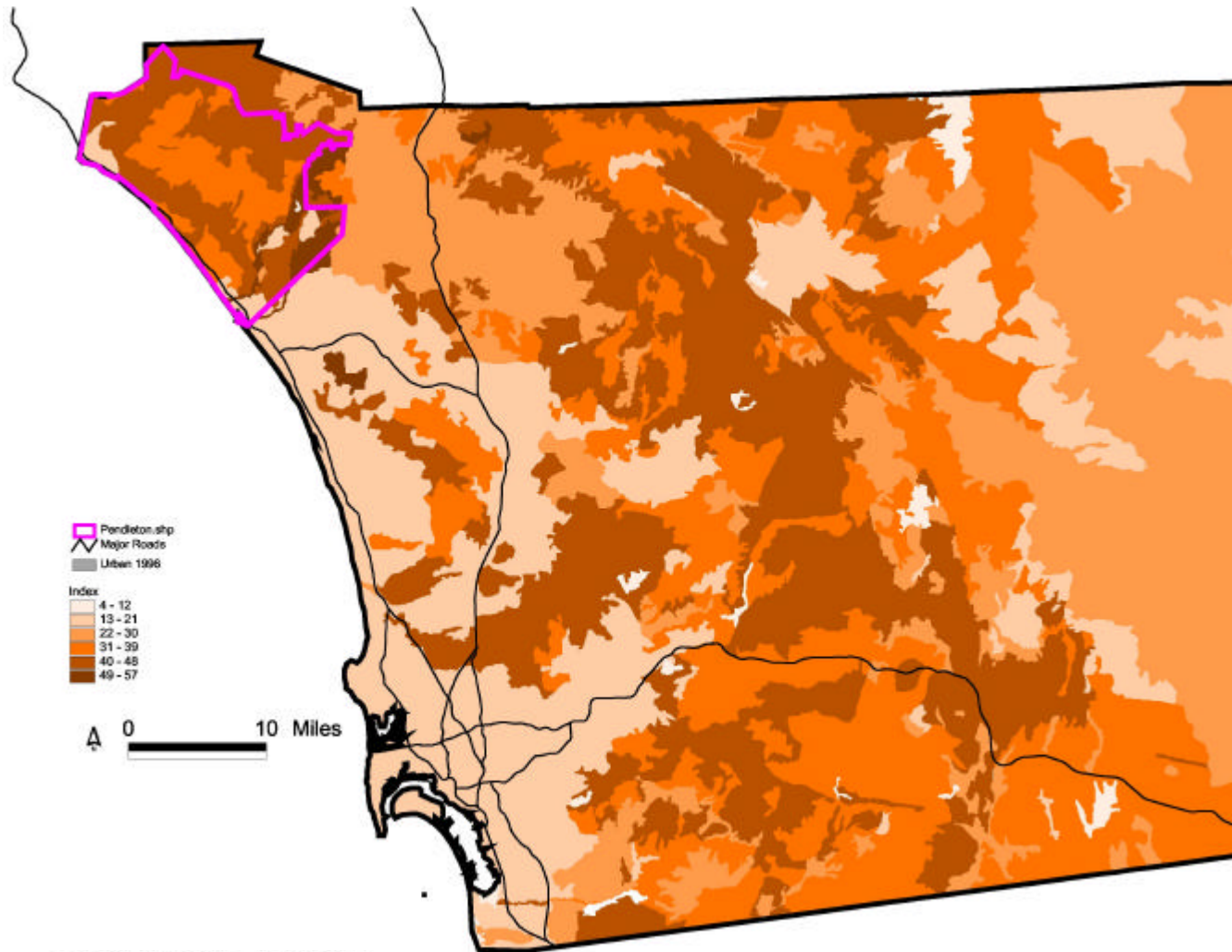
Which individual species face the greatest pressure? There are twelve threatened and endangered species for which Camp Pendleton accounts for more than five percent of the available habitat in San Diego County (Figure 13). For the Willow Flycatcher, Lark Sparrow, and Bell's Vireo, Camp Pendleton currently accounts for more than two-thirds of the available San Diego County habitat. All else being equal, endangered species lacking substitutable habitat outside Camp Pendleton are in a much more precarious position than species for which comparable habitat is more widely available.

Figure 12: Camp Pendleton WHR Habitat Types

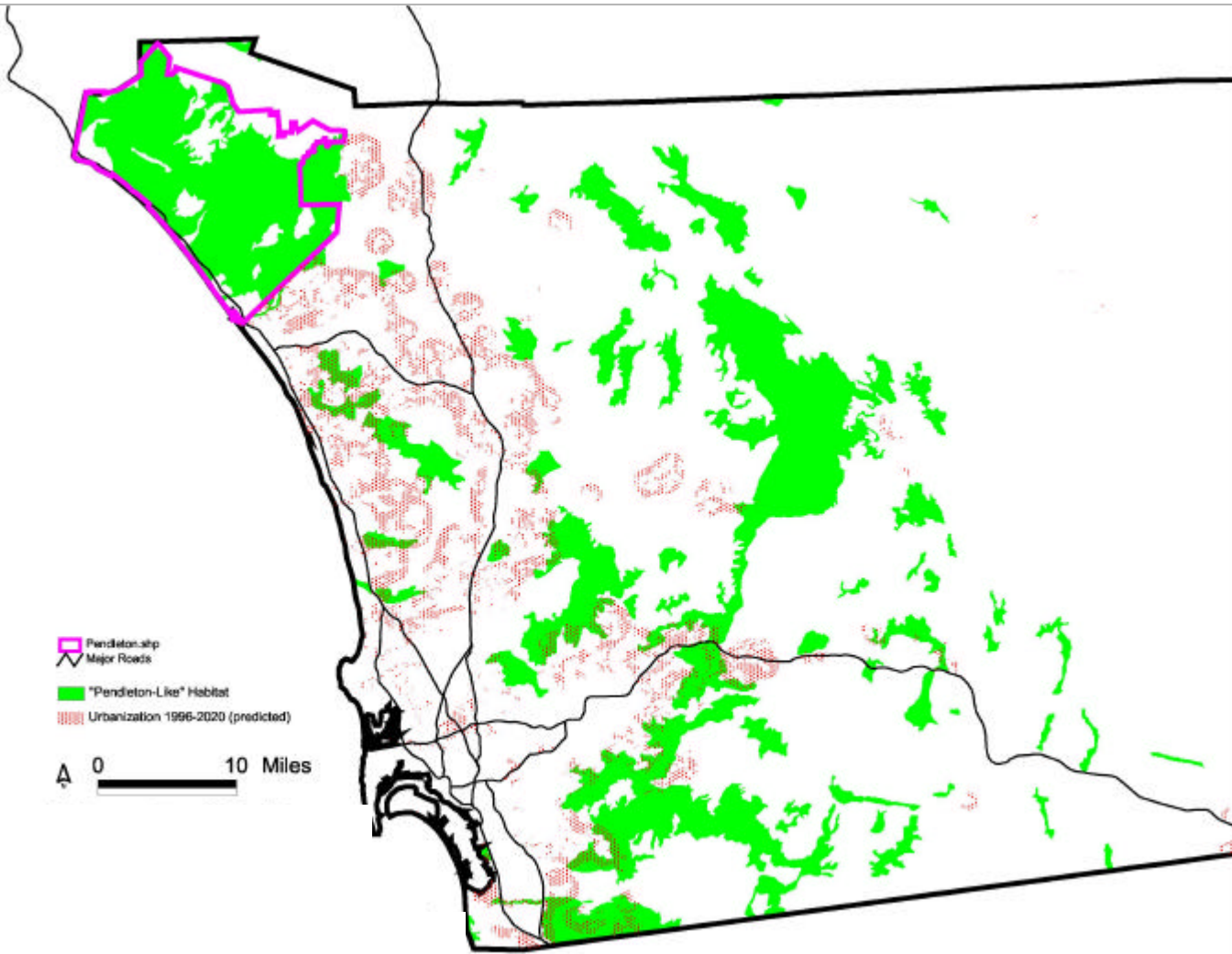
WHR Habitat Type	Code	Hectares of Habitat in Camp Pendleton	Percentage of San Diego County WHR Habitat Type in Camp Pendleton
Annual Grassland	AGS	15,614	38.69%
Coastal Oak Woodland	COW	1,610	4.88%
Chamise-Redshank Chaparral	CRC	4,351	3.01%
Cropland	GRP	407	2.53%
Coastal Scrub	CSC	23,095	22.79%
Lacustrine	LAC	59	2.20%
Mixed Chaparral	MCH	29	0.01%
Montane Riparian	MRI	488	57.82%
Orchard and Vineyard	OVN	177	0.29%
Urban	URB	3,493	2.17%
<u>Valley-Foothill Riparian</u>	VRI	<u>1,147</u>	<u>71.29%</u>
Total		50,470	6.51%

Figure 13:
Habitat Area in Camp Pendleton and San Diego County for Selected Endangered Species, 1996 and 2020

Endangered Species Name	Hectares of Endangered Species Habitat in Camp Pendleton, 1996	Hectares of Endangered Species Habitat in San Diego County, 1996	Camp Pendleton Share, 1996	San Diego County Endangered Species Habitat Projected to be Lost to Urbanization by 2020	Percent of Remaining 2020 Habitat in Camp Pendleton
Willow Flycatcher	1,205	1,611	74.8%	39	76.7%
Lark Sparrow	15,014	21,855	68.7%	1,426	73.5%
Bell's Vireo	889	1,347	66.0%	260	81.8%
Southwestern Toad	948	4,026	23.5%	261	25.2%
Red-Legged Frog	37,659	161,379	23.3%	10,660	25.0%
Western Shovelnose Snake	22,237	147,738	15.1%	3,187	15.4%
Little Pocket Mouse	16,974	136,718	12.4%	6,430	13.0%
California Vole	42,758	362,790	11.8%	35,011	13.0%
Brush Rabbit	50,127	724,097	6.9%	410,818	16.0%
Sage Sparrow	24,222	380,460	6.4%	13,381	6.6%
California Legless Lizard	25,369	444,368	5.7%	13,768	5.9%
Loggerhead Shrike	19,938	383,374	5.2%	7,775	5.3%



Map 11: San Diego County Threatened and Endangered Species Richness Index



Map 12: Willow Flycatcher, Lark's Sparrow, and Bell's Vireo:
Existing and Threatened Habitat in San Diego County

Projected urbanization will only increase Camp Pendleton's importance, particularly for the Bell's Vireo, Lark Sparrow, and Brush Rabbit. Camp Pendleton's share of Bell's Vireo habitat, for example, is projected to rise from 66% to 82%. Its share of Lark Sparrow habitat is projected to grow from 69% to 74%, and its share of Brush Rabbit Habitat is projected to grow to 16%, up from 7% in 1996.

Map 12 graphically summarizes the increased threat of urbanization, and the increased importance of Camp Pendleton as habitat for the Willow Flycatcher, Lark Sparrow, and Bell's Vireo. The green-shaded polygons indicate these three species' prime habitat areas. The red-shaded polygons indicate those land areas predicted to become urbanized by 2020. The locations where the two polygons intersect represent the precious and rare habitat areas most likely to be lost to urbanization. The more of this land there is, the greater the pressure on Camp Pendleton to function as a habitat preserve.

This analysis presents merely a brief sketch of the methods and data that may prove useful in understanding the complex nexus between urban growth, habitat loss and military base planning. A more complete analysis would also pay attention to the entire ecological region—not just San Diego County—as well as to habitat shape and fragmentation. These caveats aside, this analysis clearly indicates Camp Pendleton's current and future importance as San Diego County's principal coastal habitat conservation area; and suggest that San Diego County's current Multiple Species Conservation Planning (MSCP) initiative should be expanded to incorporate Camp Pendleton.

Edwards Air Force Base

Located on the western side of the Mojave Desert, Edwards Air Force Base encompasses more than 300,000 acres of land. Edwards runway facilities include more than 28,000 feet of paved runways and 68 miles of dry lakebed runways. Officially known as the Edwards Flight Test Range, the airspace in which aircraft based at Edwards operate is even bigger. Roughly 140 by 110 nautical miles, the Edwards Flight Test Range includes three supersonic corridors and four aircraft spin areas. The Test Range's low-altitude corridor is the only place in the United States where overland supersonic flight is permitted below 10,000 feet without special authorization.

Set far to the east of Highway 14, the nearest freeway, only one percent of the land area directly adjacent to Edwards Air Force Base was in urban

use in 1996. Within ten kilometers of the installation, only three percent of the land area was urbanized in 1996. Based on the projections outlined in Chapter Three, by 2020, these percentages are likely to increase by less than one percentage point. Were it not for the fact that supersonic aircraft, including the Space Shuttle, regularly take off and land on its runways, Edwards AFB would have only a minimal impact on its urban neighbors; and they on it.

The Edwards Flight Test Range is part of the R2508 Complex, which makes up a large portion of Southern California (Map 13). The R2508 Complex is used by multiple service branches and is managed in conjunction with the Fort Irwin, and China Lake Installations, the Naval Air Warfare Center Weapons Division, the Air Force Flight Test Center and the National Training Center. Divided into Military Operations Areas (MOAs), airspace is shared with commercial and general aviation uses in the Bishop, Saline, Owens, Panamit, Porterville, Bakersfield, Isabella, Shoshone, Barstow and Buckhorn MOAs, but restricted in MOAs R2502N, R2502E, R2505, R2506, R2515, R2524, and R2502. Policies covering restricted areas are determined by the respective commanders, and day-to-day operations are under the management of the Complex Control Board, made up of representatives of each command. Air operations are allowed over most of Complex 2508 to within 200 feet of the surface, although pilots are discouraged from low flights over inhabited areas. Boundary coordinates for the MOAs and various sub-zones are contained with the R2508 documents and Air Space Management documents supplied by Edwards AFB staff.

Military operations in the R2508 Complex and its MOAs are impacted on several sides. The Complex's eastern margin and northwestern corners are over national parks (Death Valley National Monument to the east, and the John Muir Wilderness Area, Kings Canyon and Sequoia National Parks to the west) while large-scale suburban development lies to the south. As the resident populations of northwestern Los Angeles and northeastern San Bernardino counties increase, so too does the likelihood that additional restrictions may be placed on the use of the R2508 Complex.

Both low- and high-altitude noise impacts are of concern. Noise from low-level flights is mostly contained within MOA boundaries. Depending on the flight path, high-altitude noise impacts can extend far beyond MOA boundaries.

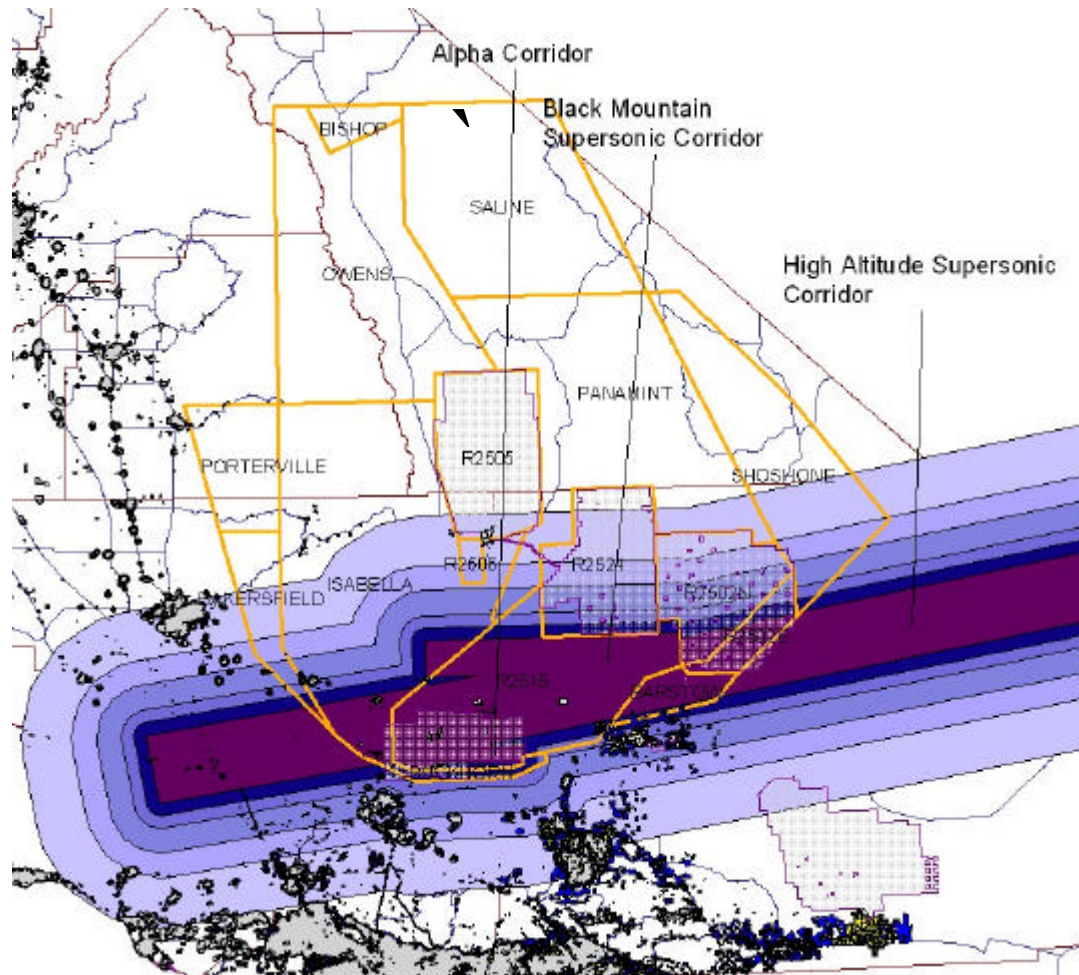
The amount of urban development currently within the Isabella and R2515 MOA boundaries—and thus subject to low level noise—is about 6,600 hectares. Assuming a gross population density of 5 to 8 persons per

hectare, we estimate that between 30,000–50,000 residents of Los Angeles and San Bernardino counties are currently affected by low-altitude flights in the Isabella and R2515 MOAs. Based on the growth projections developed in Chapter Three, we anticipate that the number of persons affected by such operations will increase to 65,000–90,000 by 2020 (Figure 14). This is not say that everyone in the Isabella and R2515 MOAs will be affected by noise from every flight. Rather, the impacts will more likely be occasional.

To estimate the current and future populations likely to be exposed to supersonic and high-altitude noise, we first digitized the three sub-zones north of Edwards designated for supersonic flight; these included the High Speed Supersonic Corridor, the Black Mountain Supersonic corridor and the Alpha Corridor (Map 13). There are various low-altitude limitations within these zones (as determined for each MOA), but no high-altitude limitations. From conversations with Edwards staff, we determined that the noise impacts of high-altitude supersonic flights would radiate outward from the zone boundaries at rate of one mile per 1000 feet of altitude. This rule of thumb was used to generate a series of 5, 10, 20, and 50 kilometer maximum noise buffers as shown in Map 13.

Figure 14 summarizes the amount of urbanized land and estimated total population for 1996 and 2020 for each successive noise buffer. Currently, somewhere between 15,000 and 28,000 residents live in the core noise zone, or high-altitude flight path; a number likely to increase to between 25,000 and 39,000 by 2020. Moving outward, between 20,000 and 35,000 persons currently reside inside the 5-kilometer high-altitude noise buffer. By 2020, we project that the number of residents living in the 5-kilometer buffer could approach 80,000. Moving outward, by 2020, the number of residents living in the 10-, 20-, and 50-kilometer buffers could approach 175,000, 470,000, and 1.6 million, respectively. These estimates all assume that new development will occur at an average density of eight persons per hectare. This is currently the average density of San Bernardino County. As with the low-altitude analysis, not every high-altitude flight will impact all residents all the time. Rather, these population estimates indicate the total number of residents likely to be able to hear one or more high-altitude flights at some point during the year. Obviously, the closer a resident lives to the core high-altitude flight zone, the more frequently and loudly they will be impacted.

Because the core landing zone is so large, and because it is used by many different types of aircraft (including the Space Shuttle), to develop more precise estimates of how many residents are impacted how often by what



Map 13: R2508 Complex, MOA, and Supersonic Flight Zone Boundaries;
and Adjacent Urban Development (Projected 2020)

Figure 14:
Urbanized Area and Population Impacted by Low- and High-Altitude Flight
Operations at Edwards Air Force Base, 1996, 2020 Projected

	Urbanized Land (ha)		Estimated Urban Population (evaluated at 8 persons/ha)	
	#	2020 Projected	1996	2020 Projected
<u>Potentially Affected by Low-Altitude Noise</u>				
R2515 MOA	#	4,523	21,240	36,184
Isabella MOA	#	6,833	31,304	54,664
R2515 and Isababella MOAs	#	11,356	52,544	90,848
<u>Potentially Affected by High-Altitude Noise</u>				
Core Zone	#	4,929	28,032	39,432
5 km Buffer	#	9,935	34,520	79,480
10 km Buffer	#	21,819	54,408	174,552
20 km Buffer	#	58,809	159,056	470,472
50 km Buffer	#	199,246	639,632	1,593,968

Figure 15:

Urbanized Area and Population Impacted by Aircraft Operations at MCAS Miramar, 1996, 2020 Projected

Community Noise Equivalent Level (CNEL)	Land Area within CNEL (ha)	Urbanized Land (ha)		Estimated Urban Population (evaluated at 22 persons/ha)		
		1996	2020 Projected	1996	2020 Projected	Percent Change
80 decibels	1,400	247	247	5,434	5,434	0%
75 decibels	2,100	327	331	7,194	7,282	1%
70 decibels	3,800	333	481	7,326	10,582	44%
68** decibels	4,200	344	497	7,568	10,934	44%
65 decibels	6,600	921	1,200	20,262	26,400	30%
60 decibels	10,000	2,350	3,139	51,700	69,058	34%

Note: * refers to the center portion of the airfield which is less than 70 but greater than 65

Figure 16:

Urbanized Area and Population Impacted by Aircraft Operations at Travis AFB, 1996, 2020 Projected

Community Noise Equivalent Level (CNEL)	Land Area within CNEL (ha)	Urbanized Land (ha)		Estimated Urban Population (evaluated at 18 persons/ha)		
		1996	2020 Projected	1996	2020 Projected	Percent Change
85 decibels	9,619	64	118	1,152	2,596	125%
80 decibels	11,283	721	1,147	12,978	25,234	94%
75 decibels	21,197	1,019	1,519	18,342	33,418	82%
70 decibels	27,239	1,249	1,954	22,482	42,988	91%
65 decibels	29,692	1,493	2,351	26,874	51,722	92%
60 decibels	31,363	2,414	3,363	43,452	73,986	70%

level of noise would require a more detailed analysis of particular aircraft and flight operations.

In summary, although Edwards Air Force Base itself is only minimally impacted by urban development, current and future supersonic operations in Edwards's three supersonic corridors are likely to generate significant noise impacts over rapidly suburbanizing parts of Los Angeles and San Bernardino counties. Depending on the aircraft and flight path, it is not inconceivable that by 2020, upwards of half a million residents of the greater Los Angeles region could occasionally be inconvenienced by noise generated from supersonic flights taking off or landing at Edwards Air Force Base. Exactly how many residents are likely to be impacted how severely and how often will depend on the density of future development, on the frequency of high-noise, high-altitude operations, and on how supersonic aircraft approach and departure paths are designated.

Marine Corps Air Station Miramar

Approximately 23,000 acres in size, the Marine Corps Air Station at Miramar is located in central San Diego County and is bisected north-to-south by Kearney Villa Road and Interstate 15. The area west of Kearney Villa Road, the Main Station and South/West Miramar, supports the military need for commercial, administrative, operations, and residential facilities. The area east of Kearney Villa Road (East Miramar) is primarily undeveloped, but is used for military training and operational exercises and supports the military need for encroachment and access control. Land use controls for lands underlying the flight paths prevent certain types of land uses that would be incompatible because of the noise level and safety considerations associated with aircraft operations. In addition, these undeveloped lands are used for land navigation training, troop maneuvers, bivouacking/overnight camping, aircraft/personnel support exercises, and weapons instruction training

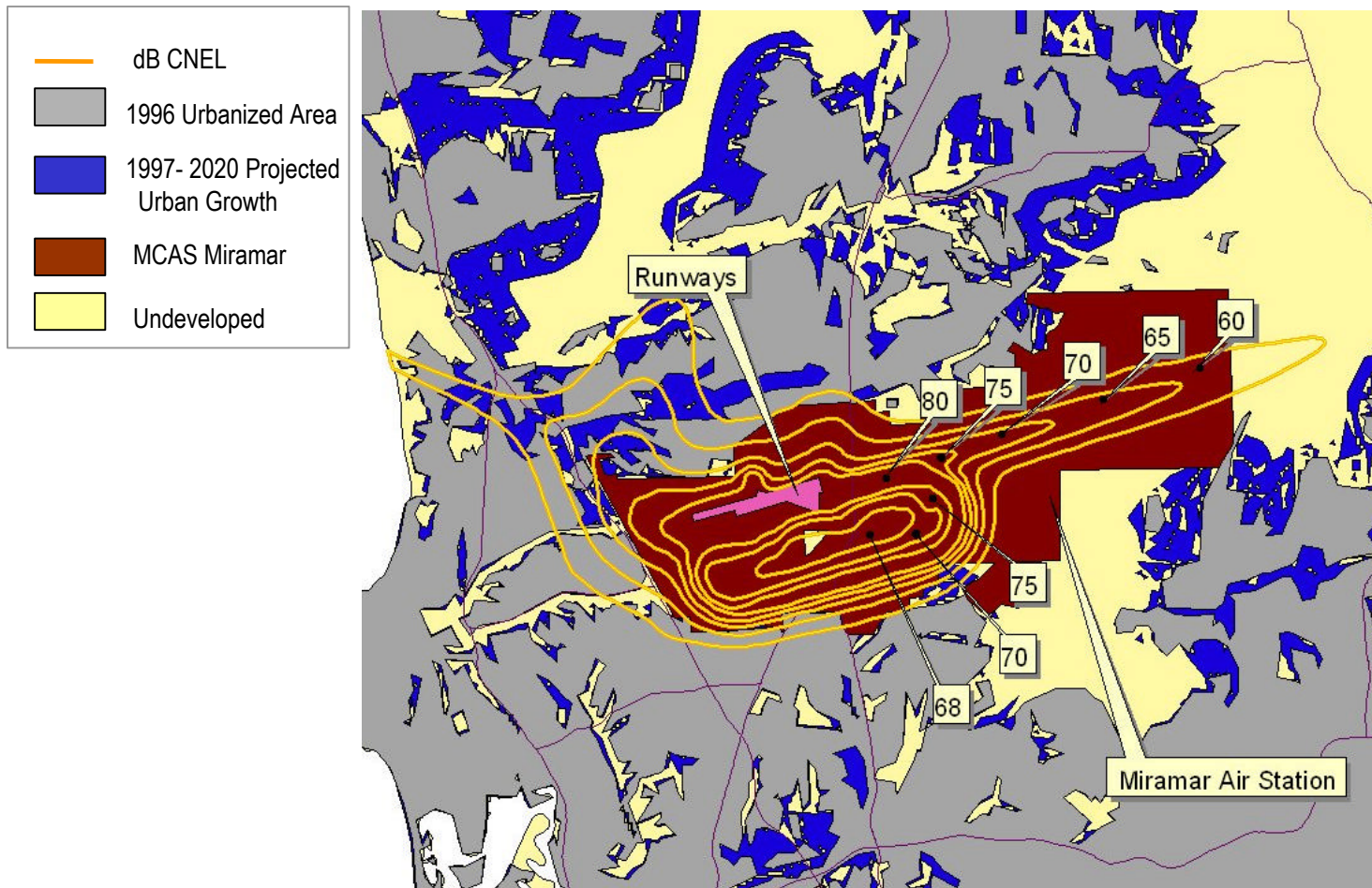
Previously a naval air station, Miramar officially became MCAS Miramar in October 1997 with the closure of MCAS El Toro and MCAS Tustin. Home to three commands—the 3d Marine Aircraft Wing, the Marine Corps Air Bases Western Area, and the Marine Aircraft Group-46—MCAS Miramar employs approximately 12,500 Marines, sailors, and civilians. Developed areas within the boundaries of MCAS Miramar cover 3,619 acres and include aircraft operation and maintenance facilities, administrative and residential buildings, storage, supply and research facilities, recreation areas, and civilian out-leases.

The western side of MCAS Miramar (the area between Interstates 805 and 15) is almost entirely surrounded by urban development. On the eastern side, urban development is most intense along Miramar's northern and southwestern boundaries. Steep hills lie along Miramar's eastern boundary, mitigating against intense urban development. Governmentally, Miramar is bounded to the north, south, and west by the City of San Diego, and to the east by unincorporated San Diego County. Altogether, 40% of the land area adjacent to Miramar was in urban use in 1996. More than half of the land area within five miles of Miramar's boundaries is currently urbanized.

With San Diego County projected to add another million residents by 2020, Miramar will be further impacted by urban development in coming years. Based on the growth projections developed in Chapter Three, we estimate that by the year 2020, 53% of adjacent lands and 67% of the land area within five miles of Miramar's boundaries will have been developed. Most new development in the Miramar vicinity will be to the north and southwest (Map 14).

Chaparral and coastal sage scrub are the most common vegetation types on MCAS Miramar, and they support a wide variety of fauna, particularly reptiles. According to the Miramar Integrated Natural Resource Management Plan (2000), Miramar provides habitat to 8 species of amphibians, 21 species of reptiles, and 31 species of mammals. The primary east-west wildlife corridors on MCAS Miramar are Rose and San Clemente Canyons. Two other corridors link western Miramar to Los Penasquitos Canyon Preserve. MCAS Miramar is home to eight plant species listed under the Federal Endangered Species Act as threatened or endangered, two species of fairy shrimp, and the quino checkerspot butterfly. Miramar is also home to the Golden Eagle, which although not listed as endangered or threatened, is federally protected. In addition, Miramar is home to 13 plant species and 23 animal species of "Special Concern" (Miramar Integrated Natural Resource Management Plan 2000).

Because of its different location, smaller size, and long-standing proximity to urban development, MCAS Miramar does not face the same level of "species squeeze" problem as Camp Pendleton. Except for its vernal pools, Miramar's combination of vegetation cover and species habitat—although under general threat throughout Southern California—are not directly substitutable with areas threatened by imminent urban development. While Miramar should take care to manage its own environmental and biological resources, its role as a regional biodiversity preserve is much smaller than Camp Pendleton's.



Map 14: MCAS Miramar Adjacent 1996 and 2020F Urbanized Areas, and 60, 65, 70, 75, and 80 dB Community Noise Equivalent Levels (CNEL)

MCAS Miramar's principal runways are oriented to the northeast, and most aircraft takeoff and landing operations occur over the base's uninhabited east side. Aircraft noise is still an issue, however, particularly for residents living immediately to Miramar's south. To more precisely estimate the geographic area and number of residents impacted by noise from Miramar operations now and in the future, we digitized six sets of community noise equivalent level (CNEL) contours, as identified in the Comprehensive Land Use Plan NAS Miramar (San Diego Association of Bay Area Governments 1990). Based on the locations of noise sources and the surrounding topography, CNEL contours indicate the spatial extent of noise of a given loudness, as measured in decibels. CNEL contours for MCAS Miramar are shown in Map 14. By way of popular comparison, noise levels of 60–70 decibels correspond to standing in a noisy office or store. Noise levels of 80 decibels correspond to hearing a powerful (unsilenced) vacuum cleaner from a distance of one meter. Although based on readings that are now more than a decade old, aircraft operations and the types of aircraft deployed at Miramar today are comparable to those of the early 1990s.

Figure 15 summarizes the amount of urbanized land and estimated total population for 1996 and 2020 for each five-decibel CNEL between 60 and 80 dB. Excluding on-base personnel and residents, we estimate that approximately 5,000 San Diegans are regularly exposed to 80 dB of noise from aircraft operations at Miramar. This estimate, which is based on the amount of urbanized land within the 80 dB CNEL contour and the average population density of San Diego County, is not projected to increase by 2020.

Such is not the case for the other CNEL contours. The lower the noise level, and thus the bigger the CNEL contour, the greater the number of residents impacted, both now and in the future. Based on our prior urban growth projections and current population densities, we estimate that the number of residents living in the 60 dB CNEL contour will increase from just over 50,000 in 1996 to nearly 70,000 by 2020. For higher noise levels, the numbers of current and projected residents living within the CNEL are much smaller. The number of residents living within the 65 dB CNEL contour will likely exceed 25,000 by 2020, up from about 20,000 currently. By 2020, the number of residents living within the 70 dB and 75 dB CNEL contours will likely reach 10,500 and 7,300, respectively, up from about just over 7,200 in 1996.

Considering its location in heart of San Diego County, MCAS Miramar's ability to balance its own operational requirements with those of its

suburban neighbors has been quite impressive. That ability will be further tested in the future as new urban development encroaches upon Miramar's northern and eastern edges. Increasing urban development along Miramar's northwestern boundary will also lead to a modest increase in the number of residents impacted by aircraft takeoff noise.

Travis Air Force Base

Located in central Solano County, due east of the city of Fairfield, Travis Air Force Base is home to three Air Force Commands: the 15th Air Force, the 60th Air Mobility Wing, and the 349th Air Mobility Wing. Travis AFB itself occupies 7,174 acres of land, including two 11,000-foot runways, Travis's workforce includes 10,200 military personnel and approximately 2,100 civilians. Travis building facilities include more than 1,850 structures including 2,500 housing units for active duty personnel and their families. According to the Travis website (www.travis.af.mil/news/factsheets), more than 25,000 military retirees live in the immediate vicinity of the base.

To the west, Travis is connected to Fairfield via Air Base Parkway, a four-lane boulevard. Farm land lies to Travis's south and east, and the city of Vacaville lies three miles to the north, across a buffer of open space and farm land. Only eight percent of the land area adjacent to Travis was in urban use in 1996.

According to the California Department of Finance, Solano County is projected to add another 170,000 residents by the year 2020, and most of the county's growth will occur along the I-80 diagonal between Cordelia to the southwest and Dixon to the northeast. Developers in Solano County favor sites close to highways and existing cities, making the areas around Fairfield and Vacaville—including Travis—extremely attractive to development. So attractive, in fact, that the spatial projections developed in Chapter Three suggest that by the year 2020, upwards of fifty percent of the land area adjacent to Travis AFB could conceivably be developed. In essence, Travis would be encircled by urban growth (see Map 4).

This is perhaps alarmist. The planning areas to the east and north of Travis are designated as Special Study Phasing Areas D and E under the Fairfield General Plan, and their development, if and when it occurs, must be preceded by a diligent and careful master planning effort with the issue of encroachment issues at its core. For the foreseeable future, and unless growth patterns in the central Solano County shift unpredictably, large-scale residential development in the Fairfield vicinity will mostly be

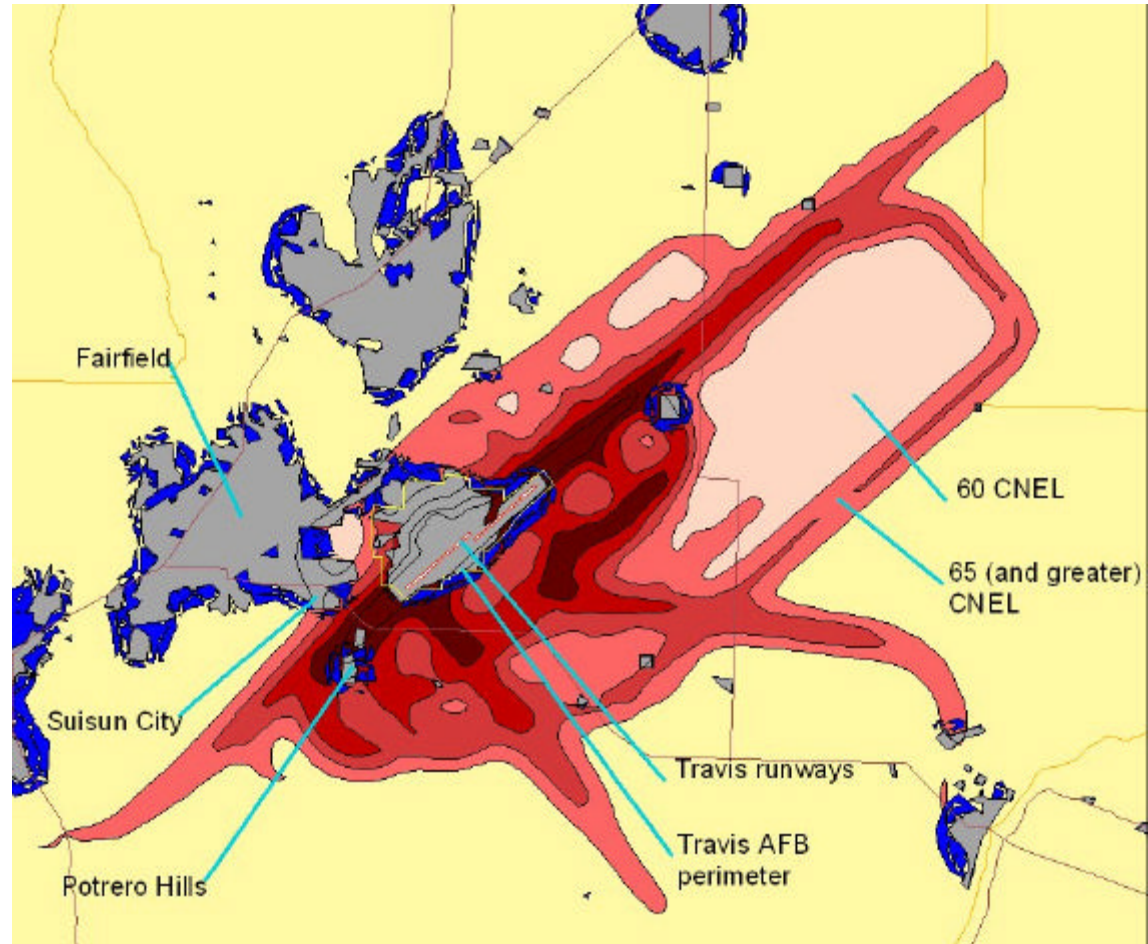
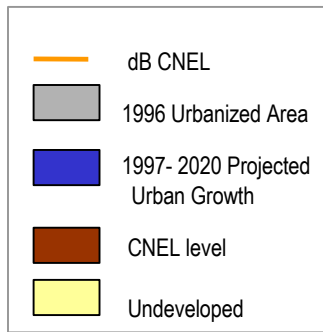
directed to the areas north of Interstate 80.

Like most large military installations in California, Travis is home to a significant number of threatened and endangered species: 96% of the land area within Travis has a TESRI score of 40 or more indicating the presence of high-quality habitat for five or more protected species. Owing to their use for agriculture and urban development, sites adjacent to Travis have lower TESRI scores than the base itself. Unless large numbers of threatened and endangered species are displaced from elsewhere in Solano County, Travis should not need to take on the role of a regional habitat preserve.

This brings us to the issue of noise. None of the aircraft assigned to Travis AFB are supersonic, and the base's two major runways are oriented along the northeast-southwest diagonal, away from existing urban development. Nonetheless, based on an analysis and identification of Travis's community noise equivalent levels (CNELs) undertaken by the Solano County Planning Department, we estimate that as many as 40,000 residents are periodically exposed to noise levels from Travis of 60 dB (Map 15 and Figure 16). This number could potentially increase to as many as 75,000 residents by 2020, but is more likely to stay in the 40,000 to 50,000 range. (These estimates do not include Travis residents.) Sixty decibels is a moderate level of noise. Far fewer residents are exposed to elevated noise levels. Excluding Travis residents and workers, we estimate that upwards of about 10,000 Solano County residents are currently exposed to noise levels of 80 dB from Travis operations. Were additional residential development to be allowed around Travis—as simulated in Chapter 3—this estimate could conceivably increase to 25,000 residents by 2020. More likely, however, the number of affected residents will stay in the realm of 10,000–15,000.

In sum, operations at Travis AFB today are only mildly impacted by nearby urban development. This will continue to be the case for the foreseeable future, assuming that the current Fairfield and Solano County general plan designations for lands adjacent to Travis AFB remain in force. Nor is continued urban growth in Solano County likely to put substantially greater ecological pressures on Travis. Lastly, incremental urban growth at the base's western edge will likely lead to modest increases in the number of residents impacted by aircraft noise.

Of course, all of this could change should Fairfield and Solano County change their development policies and encourage rather than restrain additional urban development adjacent to Travis AFB.



Map 15: Travis AFB Adjacent 1996 and 2020F Urbanized Areas, and 60, 65, 70, 75, and 80 dB Community Noise Equivalent Levels (CNEL)

Chapter Five: Encroachment Zone Planning and Policy Options

This chapter explores different statewide policy options for dealing with the encroachment impacts of projected urban growth. As the preceding chapters suggest, the nature and extent of the encroachment problem differs widely across the state. In some cases, most notably Travis Air Force Base, the Marine Corps Logistics Station at Barstow, and Miramar Marine Corps Air Station, urban growth is steadily proceeding up to and around the installation gates. In other cases, including Naval Base Coronado, Camp Pendleton, the Fallbrook Naval Weapons Support Facility, Point Mugu Naval Air Weapons Support Facility, Concord Naval Weapons Support Facility, and Lemoore Naval Air Station, urban encroachment will increase noticeably but probably not to the point where existing operations are threatened. Elsewhere, at the Naval Warfare Assessment Station at Norco, the Naval Postgraduate School and Defense Language Institute in Monterey, Onizuka Air Station, Seal Beach Naval Weapons Station, the Port Hueneme Naval Facility, and the Marine Corps Recruitment Depot at San Diego, the encroachment genie is already long out of the bottle. Still elsewhere, future urban growth will occur too far away from base boundaries to have much of an effect.

Urban growth need not occur near an air base or artillery range to be affected by its operations. Expected population growth in San Diego County, Orange County, Los Angeles County, Solano County, and especially in San Bernardino County will mean that many more ears will be impacted by aircraft and artillery-based noise in 2020 than currently. Figure 10 which classifies installations by impact type, indicates how different installations fall into different categories.

The fact that the encroachment problem is really several problems in one complicates the task of developing and administering effective encroachment management policies. Another complicating consideration is the fact that the encroachment problem—while occurring in many locations throughout the state—is principally perceived as a local land use issue, not as a matter of statewide impact or importance. Indeed, only in San Diego County is base encroachment even a significant county-wide issue. Unless the case can be made that base encroachment is a systematic problem, or one that cumulatively threatens either California's economy or its environment, the likelihood of getting the legislature to adopt significant statewide land use planning and permitting reforms is

extremely remote. More likely, although by no means assured, is the possibility that the legislature might enact laws or requirements targeted towards those counties and cities most impacted by encroachment issues.

Before considering what the legislature should or might do in the future, we review current state and local policy approaches to regulating urban development. Next, we present and discuss a series of ten policy alternatives intended to deal with different facets of the encroachment issue. Last, we review the ten approaches according to different effectiveness and feasibility criteria.

Current Approaches

Except for a select few locations—the coastal zone, the San Francisco Bay shoreline, and Lake Tahoe—growth and land use issues in California are managed almost exclusively at the local level. In terms of planning for future urban land uses, all California cities and counties are required to adopt general plans, designating which particular land uses are designated for which locations. Under the consistency requirement adopted by the California legislature in 1971, local zoning designations, which are the basis for permitting, must match local general designations. Any subsequent zoning change must be accompanied by a general plan amendment.

General plan land use designations are intended to be long-term, and indeed, the courts often refer to general plans as a sort of “constitution” for local development issues. As such, the general plan is meant to provide some degree of certainty to all local residents and stakeholders regarding the future land use and development vision for the entire community and its environs. In preparing or updating the general plan, local governments are obligated to try to match long-term population, job, and housing growth projections with available land supplies and long-term capital infrastructure needs. State law does not require that local general plans be updated on a regular schedule, only that they be current. Nor does state law require local governments to consider development issues and conflicts beyond their current sphere-of-influence boundaries.⁶ Thus, to the extent that a military facility falls outside its neighboring cities’ sphere(s) of influence, issues of urban growth encroachment may never be addressed in municipal general plans. Even when a military base falls within a local sphere of influence, state law does not require local general plans to consider encroachment issues. Nor does state law require that the general plan process treat military bases any differently than other public or private land owners. In short, the degree to which California cities and

counties account for current or future military base operations in their general plans is totally a matter of local discretion.

Except in rare cases, there is no such thing as “as-of-right” development in California. Every proposed project, even those which are consistent with local plans, must go through some type of discretionary review process. Two types of reviews predominate: (i) subdivision reviews, such as occurs when a property is subdivided; and (ii) environmental reviews, as required under the California Environmental Quality Act (CEQA). Except for projects which are categorically exempt, all public and private development projects are required to undergo one or more levels of CEQA review. CEQA requires that project sponsors and review agencies research and disclose all anticipated or potential environmental impacts and, where possible, mitigate such impacts. If the first level of CEQA review, known as an Initial Study, finds that a proposed project might generate significant negative environmental impacts, the project sponsor may be required to undertake a more detailed assessment, known as an EIR, or Environmental Impact Report. The issues and impacts to be addressed in an EIR are determined as part of a process known as “scoping.”

CEQA guidelines list suggested impact areas and thresholds to be included in initial studies and scoping. Current CEQA guidelines do not include encroachment upon military bases as an issue of concern. Thus, it is entirely possible that the individual or cumulative impacts of proposed development projects upon nearby military facilities might never be considered as part of the local permitting process. On the other hand, CEQA does not prevent local governments from considering encroachment issues. As in the case of general plan-making, consideration of encroachment issues is entirely a local option.

From the military’s perspective, there are at least four sets of circumstances under which this local option approach to encroachment planning is likely to prove ineffective. The first is when a base is near or adjacent to two or more municipalities and neither takes a comprehensive view. The second is when a local general plan is obsolete and/or new development occurs in a different form than anticipated in the general plan. The third is when the local planning or permitting agency takes such a narrow view of encroachment that it considers the issue only when new development is finally knocking at a base’s door. And the fourth is simply when local government doesn’t care.

It is far beyond the scope of this study to evaluate the effectiveness or ineffectiveness of local encroachment planning or permitting. Nonetheless, the fact that so many base commanders consider

encroachment an important issue suggests that the military sees the problem as far more severe and systematic than do local officials.

Alternative Policy Approaches

Assuming that current approaches to encroachment planning and permitting are in fact deficient, what alternatives are available in their stead? Multi-jurisdictional planning problems like encroachment are not all that uncommon in California and the United States. (See, for example, Daniel J. Curtin's *California Land Use Planning*, 2001). On the one hand, our political heritage has led us to vest land-use decisions at the lowest level of government, so-called "home rule." On the other hand, many planning problems are of a greater-than-local nature and require the balancing of local and extra-local interests.

There are many examples of land-use planning and regulatory structures that have been crafted over the years to attempt to solve similar problems. As discussed below and summarized in Figure 17, these range from simply requiring that local planning agencies consider encroachment issues when developing plans or issuing permits, all the way up to creating entirely new regional planning and permitting institutions. Among the different alternatives:

1. Revisions to state general plan law requiring consideration of military base encroachment issues. As noted previously, state law requires every California city and county to adopt a general plan setting forth anticipated and desired development patterns. State general plan statutes (and guidelines) could be amended to require jurisdictions encompassing or abutting military bases to consider and address encroachment issues, including urban development, noise and/or other environmental issues. This change would leave planning decisions where they are now—entirely in the hands of local government. As such, it would insure that encroachment issues are considered in local planning efforts, but not necessarily that they be resolved in favor of the military.

The advantages of this approach lie in its limited and incremental nature. This alternative, of all the ones presented, would involve the fewest agencies and represent the least change from the status quo. The legislature would be required to amend the state code, and the Governor's Office of Planning and Research would need to issue updated guidelines. On the downside, because it leaves all planning and permitting responsibilities in the hands of local government, the

Figure 17: Alternate Policy Approaches for Dealing with Military Facility Encroachment Planning & Permitting Issues

Approach	Details	Examples	Geographic Scope	Changes to state law or new agencies required?	Principal Advantages	Principal Disadvantages	
Revisions to Existing Local Planning & Permitting	1. Revisions to state general plan law	Local general plan & zoning designations limit development.	Within municipal boundaries and/or spheres-of-influence.	Changes to state law required.	Politically feasible; locally flexible.	Potential inconsistencies between jurisdictions. Efficacy unknown.	
	2. Revisions to CEQA	Projects within affected areas subject to expanded environmental review.	Within municipal boundaries and/or spheres-of-influence.	Changes to state law required.	Politically feasible; locally flexible.	Efficacy unknown.	
Increased State Planning and Permitting Responsibility	3. State Review of Local Plans	State agency reviews local plans for consistency with state goals.	Initial Coastal Commission planning efforts	Within designated encroachment zone.	Changes to state law required.	Politically feasible? Review consistency.	Potential for ongoing political conflict.
	4. State Appeal of Local Permitting Decisions	Military could appeal local land use permitting decisions to state agency.	California Surface Mining and Reclamation Act	Within designated encroachment zone.	Changes to state law required.	Middle-ground approach.	Some controversy inevitable.
	5. State Review of Local Permitting	State agency reviews local permitting decisions for consistency with state goals.		Within designated encroachment zone.	Additional agency(s) required.	Review consistency.	Expensive to organize and implement.
	6. Add-on State Permitting	State permitting in addition to local permitting.	SF Bay Conservation and Development Commission	Within designated encroachment zone.	Additional agency(s) required.	Review consistency, adherence to state principles.	Politically difficult and potentially expensive to implement.
	7. Pre-emptory State Planning and/or Permitting	State permitting instead of local permitting.		Within designated encroachment zone.	Additional agency(s) required.	Review consistency, adherence to state principles.	Politically difficult and potentially expensive to implement.
Multi-jurisdictional Planning & Permitting	8. Multi-jurisdictional Planning & Permitting	Joint powers authorities established for planning and permitting.	Joint Powers Authorities	Within designated encroachment zone.	Additional agency(s) required, albeit with limited roles.	Builds on existing political and administrative institutions.	Consistency unclear, potential downstream implementation difficulties.
Multi-jurisdictional Planning & Permitting	9. Inter-governmental Planning & Permitting	Intergovernmental state commission established for planning and permitting.	Tahoe Regional Planning Agency	Within designated encroachment zone.	Additional agency(s) required.	Comprehensiveness and long-term capacity-building.	Dubious practicality.
	10. Intergovernmental Land Conservancies	Intergovernmental land conservancies chartered to acquire/manage land and development rights in encroachment zones.		Within designated encroachment zone.	Additional agency(s) required, albeit with limited roles.	Flexible and politically unthreatening	Efficacy unclear, potentially expensive.

willingness and ability of local officials to deal constructively with encroachment issues would continue to vary widely. Because general plans are revised infrequently, this approach would be limited in its ability to respond to changing development circumstances and/or base needs. Lastly, given the lack of incentives for intergovernmental planning and coordination, the potential effectiveness of this approach would be open to question when dealing with large bases surrounded by multiple units of government, such as Travis AFB or Camp Pendleton.

2. Revisions to the California Environmental Quality Act (CEQA) to require that potential encroachment impacts be considered in the conduct of initial studies and environmental impact reports be undertaken for land development projects located within a specific distance of a military base. As with the previous approach, this change would leave local planning and permitting decision in the hands of local government. So while it would insure that potential encroachment impacts are actively considered as part of the local permitting process, and would require some level of impact mitigation, it would not guarantee that every potential encroachment impact would be resolved in favor of the military.

As with the previous approach, this one would involve only minor and targeted approaches to existing state law—perhaps enhancing its political acceptability. The advantages of this approach lie in its flexibility, “action-forcing” nature, and emphasis on mitigation. In terms of flexibility, encroachment issues would be dealt with on a case-by-case basis, with every local government and military base free to “fine-tune” the result to local circumstances. Because CEQA is tied to permitting, all resulting decisions would be binding. Lastly, CEQA’s emphasis on impact mitigation would require that positive steps be taken to deal with specific encroachment issues.

On the downside, CEQA-based decisions can be fairly ad hoc. Impact standards and thresholds are rarely applied consistently or comprehensively. Assessment procedures and required mitigations can and do vary widely. And because lead agencies, upon making “finding of over-riding consideration,” can allow projects which generate unmitigated impacts to go forth, there is no guarantee that potential encroachment issues would be consistently resolved in a manner favorable to the military. Still, if the goal of encroachment planning is for the military and local stakeholders to actively engage in a discussion of all the relevant issues, it’s difficult to beat a CEQA-

based approach.

3. State review of local plans. Broadly based on the California Coastal Commission model, this approach would require state-level review of local general plans for cities and counties encompassing or abutting military bases. A designated state agency would first identify and map geographic areas or zones around each military base where encroachment would potentially threaten base operations. Next, the state would issue encroachment area planning guidelines listing appropriate and inappropriate land uses, conditions of approval, and required mitigations. Local governments would be required to abide by such guidelines when developing or updating their general plans. Finally, the state would actively review draft general plans for their adequacy in incorporating state policy issues and guidelines. General plans found to be inadequate would be declared invalid, making it impossible for jurisdictions to grant permit approvals in the designated zones. Alternately, for local governments with inadequate plans, permitting jurisdiction could revert back to the state. Once a local encroachment plan was certified by the state, all subsequent permitting would be undertaken at the local level.

This approach would require substantial changes to state law. It also would require the establishment of a new plan review function in an appropriate state agency. The attraction of this approach is that it maintains local control while providing limited state oversight. It provides local governments the freedom to deal with specific encroachment issues in the context of an overall framework, thereby insuring a certain level of statewide policy consistency. In terms of dealing systematically with multiple encroachment issues—noise, urban development, and environmental protection—this approach has much to recommend it. On the downside, it would occasionally pit local governments on one side against the state and the military on the other.

Thus, for this type of approach to work it must enjoy the support of most impacted jurisdictions. A similar review function, undertaken of general plan housing elements by the California Department of Housing and Community Development, does not enjoy broad support, and accordingly, is fairly ineffective. In the case of the Coastal Commission, having previously certified locally-developed coastal plans, the Coastal Commission also acts as a sort of periodic “bad cop,” denying inappropriate projects, thus allowing the local government to act as the “good cop.”

4. State appeal of local permitting decisions. Based on the model of the California Surface Mining and Reclamation Act (SMARA), this approach would graft state-level review guidelines onto the existing framework of strong local planning and permitting control. Development permitting under this framework would have four components, similar to the previous approach. The state would first designate geographic areas or zones around each military base where encroachment would potentially threaten base operations. Second, the state would issue permitting guidelines for use in local reviews of projects falling within the designated zones. These guidelines could list appropriate and inappropriate land uses, conditions of approval, and required mitigations. Third, local governments would be required to consider guideline provisions when issuing development permits. Last, the military would retain the right to appeal locally-approved projects to a state agency on the grounds that state guidelines were not adequately followed.

This approach keeps most permitting authority in local hands, yet requires that local reviews be undertaken consistent with state goals and guidelines. And to help keep local governments in line, it offers the possibility of state-level appeal. Like the previous approach, this one would require substantial changes to state law. To the extent that such changes would affect relatively few jurisdictions and have little impact on local budgets, they might very well be acceptable to the legislature. This is a good “middle-ground” approach. On the one hand, it would promote a much greater degree of inter-jurisdictional planning and review consistency than alternatives (1) and (2). On the other hand, because the state would actively intervene only in the case of appeals, it would be less heavy-handed than alternative (3).

5. State review of local permitting. Procedurally, this approach would be similar to the previous two except that the state would be required to review every locally-granted zoning and/or subdivision permit issued within a designated encroachment zone.

Because it would involve the state in every potential encroachment permitting decision, this approach would be both heavy-handed and expensive. On the positive side, it would insure that military base encroachment issues were dealt with comprehensively and systematically across the state. On the downside, it would forever pit the state and the military interests against those of local government, even when they don't conflict.

6. Add-on state permitting. Under this approach, broadly based on the model of the San Francisco Bay Conservation and Development Commission, developments and subdivisions in designated encroachment zones would require a permit first from local government, but then also, de novo, from a special state agency or commission charged with protecting potential encroachment areas from inappropriate development.

This approach is similar to the previous one, except that it leaves local planning issues entirely to local government. Its principal advantage is that it doesn't burden the local permitting process with trying to balance local land use issues against statewide policy needs. Instead, that balancing is undertaken at the state level. Thus, at least in theory, it provides for a high level of planning and permitting consistency across different areas and circumstances. The downside of this approach is that it is likely to be expensive, and in some circumstances duplicative. Unhappy local officials are also likely to try to use political means to influence state permitting decisions.

7. Pre-emptory state permitting. Under this approach, for which there is no existing state model, planning and/or permitting authority within designated encroachment zones would be transferred from local government to an appropriate state agency or commission charged with protecting such areas from inappropriate development.

On the positive side, this approach would insure that encroachment conflicts are treated in a consistent manner throughout the state and would facilitate, although not guarantee, taking a comprehensive approach to encroachment mitigation. It would also make it easier to deal with multi-jurisdictional issues such as noise and habitat conservation. Additionally, it would insure that the perspectives of the military might be more consistently represented.

On the downside, there is little in the way of precedent for this approach, and it would almost assuredly promote conflict over even the smallest of issues between representatives of local government and state regulators—with state legislators standing in the middle.

8. Mandatory multi-jurisdictional planning and permitting responsibility. Under this approach, jurisdictions adjacent to military installations would be mandated to form encroachment zone joint powers authorities (EZJPAs) for the purpose of coordinated planning and land preservation/acquisition. A different EZJPA would be formed around each military installation, with the maximum spatial extent of each

EZJPA determined under state law. Representatives of each military installation would serve, ex officio, on their respective EZJPA. Following the Coastal Commission model mentioned earlier, each EZJPA would be required to develop its own specific planning guidelines and documents, which, for the areas covered, would supercede local general plans. Local permitting would continue to be undertaken by individual local governments, but would be required to be consistent with EZJPA guidelines and/or plans.

This approach has both advantages and disadvantages. On the advantage side, joint powers authorities provide a workable framework for addressing multi-jurisdictional planning and financing issues. As JPA members, existing governments would maintain a significant amount of discretion and control. Lastly, once an EZJPA plan is developed, the resources required to administer the JPA would be relatively small. On the disadvantage side, some local governments may be reluctant to give up planning authority. Others might find it difficult to administer a plan they didn't directly develop.

9. Intergovernmental planning and permitting responsibility. Under this alternative, a single statewide commission would be established to undertake all planning and permitting responsibilities within all designated encroachment areas. This approach would probably be similar in some respects to that undertaken by the Tahoe Regional Planning Agency (TRPA). Established in 1968, TRPA incorporates local, state, and federal representatives in a single agency and vests them with comprehensive land use and environmental planning and permitting authority for a designated area—in this case, the Lake Tahoe Basin.⁷ Although it experienced significant teething pains early in its life, TRPA has established itself as a valuable intergovernmental forum for resolving local land use conflicts involving state and federal interests. Similar multi-jurisdictional collaborative approaches are underway outside of California, in the Chesapeake Bay region and the Pinelands area of New Jersey.

The advantage of this approach lies in its ability to comprehensively combine long-term planning considerations with shorter-term permitting issues, and to do it in such a way that involves multiple stakeholders. As powerful as this model is for confronting a common problem (the impacts of over-development in an environmentally fragile region) in a confined area, its potential for dealing with a more diffuse set of issues in a variety of locations is less clear. Nor is it clear how one might structure a single agency or commission incorporating

so many stakeholders from different areas. Finally, and from a purely political perspective, it is not clear that the encroachment issues are sufficiently acute to justify such a significant departure from California's strong home-rule tradition.

10. Multi-jurisdictional land conservancies: Under this more limited version of the previous option, federal, state, and local government agencies would combine to charter and fund encroachment zone land conservancies (EZLC) around military installations. EZLCs would have two responsibilities: (i) to acquire private lands and/or the development rights to private lands within encroachment zones; and (ii) to actively manage those lands as needed. Funds for land acquisition could be provided through government revenues and/or through private (tax exempt) donations. Note that this approach is not an exclusive one. It could be used in concert with any of the other nine approaches.

As with all the previous approaches, this one has both advantages and disadvantages. Its advantages lie in the fact that it would work entirely through the private land market, and would not require the heavy hand of government regulation. Moreover, to the extent that many encroachment zones include sensitive habitats and landscapes, this approach would insure their continued management. The disadvantages of this approach lie in its potential costliness. Buying land and/or development rights is expensive, especially in fast-growing metropolitan areas. Active land management also requires large ongoing expenses. Moreover, to the extent that many potential landowners might be unwilling to sell their land or development right at the offered price, the efficacy of this approach is uncertain. Indeed, the greater the amount of land a particular EZLC was able to acquire or control, the greater the incentive for the remaining landowners to increase their asking prices.

Evaluating the Alternatives

Each of the above alternatives has distinct pros and cons. To better identify those approaches that are consistently superior, we subjectively rated the different alternatives according to five sets of criteria (see Figure 18):

1. Comprehensiveness. Two types of comprehensiveness were considered: the ability of an alternative to address encroachment issues at all installations; and the ability of an alternative to deal with a

Figure 18: Outline Evaluation of Alternate Policy Approaches

Approach	Comprehensiveness		Efficacy	Consistency and Flexibility	Political Tractability		Cost and Resource Requirements		
	Deals with All Installations	Deals with All Issues			Difficulty of Enacting	Likelihood of Downstream Conflicts			
Revisions to Existing Local Planning & Permitting	1. Revisions to state general plan law	Local general plan & zoning designations limit development.	High	Low	Likely to vary by jurisdiction	High on flexibility	Low-to-moderate	Moderate	Low
	2. Revisions to CEQA	Projects within affected areas subject to expanded environmental review.	High	Low	Likely to vary by jurisdiction	High on flexibility	Low-to-moderate	Moderate	Moderate for some projects.
	3. State Review of Local Plans	State agency reviews local plans for consistency with state goals.	High	Moderate	Moderate	Moderate on both	Moderate	Moderate	Low-to-moderate
	4. State Appeal of Local Permitting Decisions	Military could appeal local land use permitting decisions to state agency.	High	Low	Moderate	Moderate on both	Moderate	Low	Moderate
Increased State Planning and Permitting Responsibility	5. State Review of Local Permitting	State agency reviews local permitting decisions for consistency with state goals.	High	Low	Moderate	Moderate on both	Low-to-Moderate	Low	
	6. Add-on State Permitting	State permitting in addition to local permitting	High	Moderate	High	High on consistency, moderate on flexibility	High	Potentially high	Moderate
	7. Pre-emptory State Planning and/or Permitting	State permitting instead of local permitting	High	Moderate	High	High on consistency, moderate on flexibility	High	Unknown	High
	8. Multi-jurisdictional Planning & Permitting	Joint powers authorities established for planning and permitting.	Moderate	High	Likely to vary by jurisdiction	High on flexibility	Unknown	Moderate	Moderate
Multi-jurisdictional Planning & Permitting	9. Inter-governmental Planning & Permitting	Intergovernmental state commission established for planning and permitting.	High	High	Unknown	Unknown	Unknown	Unknown	Unknown
	10. Intergovernmental Land Conservancies	Intergovernmental land conservancies chartered to acquire/manage land and development rights in encroachment zones.	Low	Moderate	Likely to vary by jurisdiction	High on flexibility.	Low	Moderate	Potentially high

comprehensive set of encroachment issues, including urban development, noise, and habitat protection. Assuming appropriate state enabling legislation is enacted, almost all of the alternatives have the potential to deal with encroachment issues at all military installations; the only ones that do not are (8) and (10). Joint powers authorities (alternative 8) are established by local option. Conservancies (alternative 10), likewise, are a local-option approach.

With respect to issue-comprehensiveness, the more locally-based a particular approach, the greater the potential that it will confront locally important issues (e.g., urban development and noise), yet potentially short-change regional and state issues (e.g., habitat preservation). The only alternatives that score highly on this criteria are (8), and potentially (10). To the extent that pre-emptory state permitting is also accompanied by pre-emptory state planning, alternative (7) also would score highly on this criteria.

2. Efficacy refers to the likelihood that an approach would work as intended—that it would minimize inappropriate urban development in encroachment zones, that it would minimize noise and other spillover effects on nearby residents, and that it would promote critical habitat protection and conservation. Alternatives (6) and (7) score highly on this criteria by virtue of their strong reliance on state oversight. Alternatives (3), (4), and (5), the three weaker state oversight alternatives, score more moderately on this criteria. The efficacy of alternatives (1), (2), (8), and (10) are likely to vary by jurisdiction. Depending on how it was implemented, alternative (9) could be very effective or completely ineffective.
3. Consistency measures the extent to which encroachment issues are dealt with in a consistent and non-ad hoc way across different municipalities and installations. Some measure of consistency is generally important when policies are enacted for the purpose of promoting a statewide interest. Alternatives (6) and (7), which both involve ongoing state oversight, are likely to achieve the highest levels of policy consistency. Alternatives (3), (4), and (5), which provide for more limited state oversight, are likely to achieve more moderate levels of policy consistency. Because they lack state oversight, the other alternatives, including (1), (2), (8), and (10), have the potential to be more ad hoc when viewed from a statewide perspective.

Flexibility reflects the ability of a policy approach to respond or adapt to unique or changing circumstances. From a policy perspective,

consistency and flexibility are generally opposites. Too much policy flexibility degenerates into ad hoc-ness, but too little results in policy solutions ill-suited to the particular problem or issue. Because they are mostly locally based, alternatives (1), (2), (8), and (10) are likely to prove the most flexible and capable of being adapted to local circumstances. The other alternatives are more moderate when rated with respect to flexibility. Because even the most stringent state oversight would have to allow for some local flexibility, none of the alternatives are rated as completely inflexible.

4. Political Tractability. Two types of political tractability were considered: the difficulties likely to be associated with the initial adoption of necessary enabling legislation or changes in state law; and the likelihood that an alternative would continue to generate local and intergovernmental conflicts once implemented. Almost all policy changes generate both benefits and costs. In a state as large and diverse as California, except in times of crisis, policy changes will tend to be resisted unless they can be demonstrated to generate a large and widespread benefit—or else avert a large and widespread cost. (This is because those who must bear the costs of any policy change have an incentive to organize to stop it.) Conversely, policy changes that generate large yet highly focused benefits, but small and/or widely distributed costs, are more likely to be enacted.

Strong anti-encroachment policies, while of intense interest to the military and some state agencies, are unlikely to generate large or statewide benefits. Conversely, strong anti-encroachment policies, particularly those that substitute state planning or oversight for local discretion, are likely to generate strong resentment on the parts of local policymakers and landowners. This suggests that policy approaches—whether changes to existing law or new enabling legislation—which mandate greater state involvement and oversight will be more difficult to enact than policy changes which are viewed as incremental. By this logic, approaches (1), (2), (5), and (10) are likely to be less controversial than approaches (3) and (4), and much less controversial than approaches (6) and (7), both of which substitute state planning and permitting authority for local discretion. From a political standpoint, the most interesting alternatives are (8) and (9), because they offer the possibility of creating new local and regional constituencies, thereby diffusing purely local opposition.

Political opposition and conflict do not end once a new law is enacted or an old one is changed. Two types of downstream conflicts are of

special concern: interjurisdictional conflicts, which occur between neighboring jurisdictions; and intergovernmental conflicts, which occur between different levels of government, particularly state and local government.

Some planning and permitting processes tend to generate additional and subsequent conflicts while others tend to diffuse them. Processes which pit different levels of government against each other on an ongoing basis fall in the former category of conflict generators. Processes which structure or reward multi-jurisdictional collaboration fall in the latter category. Alternatives (1), (2), and (3), because they require individual local governments to address encroachment issues but leave open questions of how to do so, reduce but do not minimize the potential for later interjurisdictional or intergovernmental conflicts. Alternatives (4) and (5), by giving veto and approval authority to state decision-makers—thereby making them the “bad cop” in local encroachment debates—have the potential to defuse or at least short-circuit local land use conflicts at the expense of introducing occasional disagreements between state and local agencies. Assuming such disagreements are rare—that is, assuming that state agencies mostly ratify local decisions, and that local governments learn to respond to state concerns—the effect of alternatives (4) and (5) should be to reduce the number of downstream conflicts. Alternatives (6) and (7), by requiring additional state permitting and planning reviews on top of local decisions, for every local decision regardless of outcome, have the potential to generate and exacerbate state–local conflicts. Multi-jurisdictional planning processes, such as Alternative 8, allow for the resolution of land use conflicts but they don’t eliminate them. Quite the opposite. Because every local decision is now also multi-jurisdictional, the potential for conflicts between jurisdictions could actually increase. At the same time, the likelihood that those conflicts could be resolved could also increase. Alternative 10 provides an additional mechanism for dealing with encroachment issues and conflicts but by itself does little to resolve them. Lastly, given the lack of comparable models, the potential for Alternative 9 to minimize downstream conflicts is simply unknowable.

5. Cost and resource requirements. The more complicated and extensive a planning process, the greater the level of resources required to sustain it. Alternative (1) would require that local governments conduct additional analysis and commit additional resources when revising their general plans, something that happens infrequently. Alternative (2), because it is tied to more frequently project-based

reviews, would be somewhat more costly. Alternative (3) would also add additional cost, this time at the state level, but given the small number of affected jurisdictions and infrequency of local plan revisions, this cost would be small. The cost of providing for ongoing state review authority, as would be the case for alternatives (4), (5), and (6), would be considerably higher. Because they are duplicative of local permitting and planning functions and would require the establishment of whole new agencies and staffs, the costs of administering alternatives (7) and (8) would be also considerable. The total cost of alternative (10) would also be high, but only because of the high costs of land acquisition. Depending on the level of cost-sharing between existing agencies, the resources required to administer alternative (9) could range from low to high.

Yet another way to evaluate the different policy alternatives is to consider their effectiveness at dealing with different types of encroachment issues. Toward this end, we compared the different policy alternatives according to the encroachment typology presented in Figure 17. The results of those comparisons are summarized in Figure 19. The policy alternatives likely to be the most effective for dealing with encroachment issues at facilities already surrounded by urban development (e.g., the Navy Base Complex in San Diego or the Defense Language Institute in Monterey) are those which require the fewest changes to existing state planning law. These are: (1) revisions to general plan law to account for encroachment issues; (2) revisions to CEQA to account for encroachment issues; and (3) possible state review of local plans. The issue in these cases is not whether urban development is to be allowed adjacent to a facility—as it already is—but rather, which forms of development are deemed most or least appropriate, and how specific conflicts can be avoided or mitigated. To the extent that local jurisdictions are already considering such issues, no further policy changes are need. To the extent that local jurisdictions should do more to consider them, changes to state planning laws requiring general plan updates and CEQA reviews requiring the explicit consideration of encroachment issues and conflicts should be sufficient. In the event that it is not, allowing the state to review local general plans would serve as a good check and balance.

The policy alternatives likely to be most effective for dealing with encroachment issues at facilities facing urban development at their boundaries (e.g., Travis AFB, the Concord Naval Weapons Station), are those requiring local jurisdictions to take a consistent and “big

Figure 19: Match Between Alternate Policy Approaches and Facility Encroachment Issues

	Installation and 20km encroachment zone DO NOT contain large amounts of substantially threatened & endangered species habitat (TESRI > 40)	Installation and 20km encroachment zone DO contain large amounts of substantially threatened & endangered species habitat (TESRI > 40)
INSTALLATION AREA ALREADY URBANIZED: Urban development already adjacent to 50% or more of the installation.	<ol style="list-style-type: none"> 1. Revisions to GP law 2. CEQA revisions 3. State review of local plans 	<ol style="list-style-type: none"> 1. Revisions to GP law 2. CEQA revisions 3. State Review of Local Plans
INSTALLATION AREA FACING INCREASED URBANIZATION: Urban growth projected to substantially impact base boundaries by 2020.	<ol style="list-style-type: none"> 1. Revisions to GP law 2. CEQA revisions 3. State review of local plans 4. State appeal of local permitting 5. State review of local permitting 	<ol style="list-style-type: none"> 1. Revisions to GP law 2. CEQA revisions 3. State review of local plans 4. State appeal of local permitting 5. State review of local permitting 10. Intergovernmental conservancies
ENCROACHMENT ZONE FACING INCREASED URBANIZATION: Urban growth projected to substantially impact 10 km encroachment zone	<ol style="list-style-type: none"> 3. State review of local plans 4. State appeal of local permitting 5. State review of local permitting 6. State permitting 7. Pre-emptory state planning/permitting 	<ol style="list-style-type: none"> 3. State review of local plans 4. State appeal of local permitting 5. State review of local permitting 6. State permitting 7. Pre-emptory state planning/permitting 10. Intergovernmental conservancies
INCREASED REGIONAL URBANIZATION: Noise and other activities from base operations expected to impact a growing nearby population	<ol style="list-style-type: none"> 5. State review of local permitting 7. Pre-emptory state planning/permitting 8. Multi-jurisdictional planning/permitting 9. Intergovernmental planning/permitting 	<ol style="list-style-type: none"> 5. State review of local permitting 7. Pre-emptory state planning/permitting 8. Multi-jurisdictional planning/permitting 9. Intergovernmental planning/permitting 10. Intergovernmental conservancies

picture” look at encroachment trends and threats. In addition to alternatives (1), (2), and (3), these include alternatives: (4) State-level appeal of local permitting decisions; and (5) State-level review of local permitting decisions. By allowing the military to appeal local permitting decisions to the state agency, alternative (4) would provide a “consistency check” to insure that facility-related issues were being appropriately addressed. Alternative (5) would extend permitting consistency a step further. In locations where there were also significant amounts of critical habitat, these approaches could be supplemented by the establishment of multi- and inter-governmental land conservancies (Alternative 10).

The more physically distant the encroachment threat, the more the problem is likely to be a lack of interjurisdictional planning coordination. While one jurisdiction may be actively involved in encroachment planning, its neighbors may not be. The Marine Corps Logistics Base at Barstow, Camp Pendleton and Miramar MCAS all fall into this category. In addition to alternatives (3), (4), and (5), the most appropriate alternatives for dealing with extensive encroachment issues are: (6) add-on state-level permitting; and, (7) pre-emptory permitting and planning. Involving the state in local planning and permitting decisions, while perhaps contrary to the principle of local control, would make it possible to consider and evaluate long-term encroachment challenges, and to address the encroachment challenge before it becomes acute. In locations where there were also significant amounts of critical habitat, these various approaches could be supplemented by the establishment of multi- and inter-governmental land conservancies (Alternative 10), possibly involving state funding.

More extensive multi- and inter-governmental coordination may be necessary where base operations impact urban development at a county or regional scale. This is the case for Edwards, Travis, and Vandenberg Air Force Bases, the Marine Combat Center at Twentynine Palms, and the Marine Logistics Base at Barstow. In addition to alternatives (5), and (7), the most effective—albeit sure to be controversial—policy approaches for dealing with region-scale impacts would be alternatives: (8) establishing a multi-jurisdictional planning and permitting approach; and, (9) establishing an inter-governmental planning and permitting approach.

Conclusions and Recommendations

The purpose of this chapter is to identify general policy options. It is not to recommend or endorse specific policy approaches or changes to state planning law. A few general conclusions regarding the desirability of

particular policy approaches do emerge:

1. Current policy approaches for dealing with encroachment issues—specifically local general plans and CEQA permitting reviews—are inadequate with respect to timeliness, geographic scope, and responsiveness to military concerns.
2. Encroachment is a varied and localized problem, and while of statewide concern, cannot be addressed via a single statewide policy approach. Rather, the function of state policy should be to insure that encroachment issues are adequately researched and understood, and that the military's perspectives and concerns are appropriately incorporated into land use planning and permitting activities.
3. Where urban development already surrounds a military facility, the function of state policy should be to insure that local officials incorporate the concerns of the military into their existing plans and permitting procedures so as not to further compromise the ability of the military to achieve its mission.
4. Where projected urban growth threatens a military facility, the function of state policy should be to encourage and require local planners to actively consult with appropriate military personnel regarding the permanent establishment of development-free buffer zones adjacent to facility boundaries. Whether such activities occur on a single- or multi-jurisdictional basis should reflect the circumstances at individual facilities and not be a matter of state preference.
5. Where projected urban growth threatens the buffer areas around a military facility, the function of state policy should be to insure that neighboring jurisdictions undertake the development of long-term land use plans incorporating the operational needs of individual military facilities; and to insure that subsequent permitting decisions are consistent with the such plans.
6. Where military operations impose noise or other impacts on growing urban populations, the function of state policy should be to mitigate and resolve the resulting conflicts in ways amenable to all parties.

Endnotes

- ¹ California Technology, Trade, and Commerce Agency.
- ² Buffer widths were chosen to catch significant changes between 1996 and 2020. Buffer widths that are too large will tend to under-measure small but nearby changes. Conversely, buffer widths that are too large may exaggerate small changes.
- ³ California Resources Agency, Department of Fish and Game.
- ⁴ Terrestrial vertebrate species include mammals, reptiles, birds, and amphibians.
- ⁵ There are no plans for any installation to expand its boundaries.
- ⁶ Sphere-of-influence boundaries are determined by county Local Agency Formation Commissions, or LAFCOs. They are intended to indicate each city's ultimate planned build-out area.
- ⁷ Because the Lake Tahoe Basin includes both California and Nevada, TRPA operates under an interstate compact, something that would not be necessary in the current case. TRPA is composed of officials from each of the two states, and from the local governments in the region, plus one non-voting federal representative appointed by the President of the United States.

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APPENDIX A

Senate Bill No. 1099

CHAPTER 425

An act to add and repeal Article 3.7 (commencing with Section 15346) of Chapter 1 of Part 6.7 of Division 3 of Title 2 of the Government Code, relating to defense conversion.

[Approved by Governor September 16, 1999. Filed
with Secretary of State September 16, 1999.]

LEGISLATIVE COUNSEL'S DIGEST

SB 1099, Knight. California Defense Retention and Conversion Act of 1999.

Existing law provides for various activities in regard to defense conversion and military base retention and reuse efforts in the state.

This bill would enact, until January 1, 2007, the California Defense Retention and Conversion Act of 1999, to establish the California Defense Retention and Conversion Council in the Trade and Commerce Agency. The bill would set forth the membership and duties of the council in regard to defense retention and conversion and military base reuse activities in the state, including specified activities developed by the former California Defense Conversion Council. This bill would require the council to prepare a study considering strategies for the long-term protection of lands adjacent to military bases and to submit to the Governor and the Legislature a report on the study with any recommendations. It would require the Trade and Commerce Agency to establish a Defense Retention Grant Program, with input and assistance from the council.

The people of the State of California do enact as follows:

SECTION 1. Article 3.7 (commencing with Section 15346) is added to Chapter 1 of Part 6.7 of Division 3 of Title 2 of the Government Code, to read:

Article 3.7. California Defense Retention and Conversion Act of
1999

15346. This article shall be known and may be cited as the California Defense Retention and Conversion Act of 1999.

15346.1. The Legislature finds and declares as follows:

(a) For over half a century, California's industries, universities, businesses, and workers have contributed to our nation's defense, utilizing their capital, talents, and skills to develop and bring to



production important new technologies and advanced weapons systems, aircraft, and missiles.

(b) Defense spending in California peaked at sixty billion dollars (\$60,000,000,000) in 1988. Since then, it has decreased by 16 percent with the resulting loss of 126,000 jobs. The Commission on State Finance projected a further 22 percent reduction to thirty-seven billion dollars (\$37,000,000,000) in 1997, with a loss of another 81,000 jobs. California is expected to experience the most severe impact of defense cuts since 1994.

(c) California has experienced four rounds of base closures resulting in the closure or realignment of 29 bases since 1988. Additional bases may be considered for closure in future closure rounds.

(d) California lost more federal payroll jobs from its 29 military base closures under rounds one to four, inclusive, than all of the rest of the states put together. The reduced military payroll, including military and civilian employees, in California is approximately 101,000 jobs. About 300,000 private sector defense industry jobs in California have been lost.

(e) California needs a focused, coordinated defense retention and conversion program within the state in order to protect the existing defense installations and facilities within the state and to assist those communities that have experienced an installation's closing.

(f) Currently, there are over 300,000 active duty and civilian defense personnel in California.

(g) The direct Department of Defense expenditures in California are over thirty billion dollars (\$30,000,000,000) for employees, contracts, and capital investment.

(h) California has over 36 major and 25 minor active military installations.

(i) The Department of Defense pays ten million dollars (\$10,000,000) annually in fees, permits, and licenses within the state.

(j) Having been the leader in the nation's defense effort, the state must now also assume the role as leader in defending existing military installations within its borders. That role will require a coordinated effort to ensure that California promotes the necessity of existing defense facilities, assist local governments and organizations in planning retention efforts, and design and implement a single unified plan for active defense retention efforts on the federal level.

(k) It is the intent of the Legislature that the state's role in defense retention, conversion, and military base reuse be consolidated in the Trade and Commerce Agency.

15346.2. The Legislature recognizes the potential for federal legislation to close additional military installations nationwide. In an effort to be proactive in retaining these facilities within California that are necessary for the defense of the nation and to provide for a single, focused defense of these installations, the California Defense



Retention and Conversion Council is hereby created in the Trade and Commerce Agency.

15346.3. The California Defense Retention and Conversion Council shall consist of the following members, who shall be appointed as follows:

(a) The Governor shall have 11 appointees, who may include, but are not limited to, the following:

- (1) The Secretary of Trade and Commerce, or his or her designee.
- (2) The Secretary of Environmental Protection, or his or her designee.
- (3) The Director of Employment Development, or his or her designee.
- (4) The Director of Planning and Research, or his or her designee.
- (5) The Director of the Energy Resources, Conservation and Development Commission, or his or her designee.
- (6) The Director of Transportation, or his or her designee.
- (7) The Director of the Employment Training Panel, or his or her designee.
- (8) The Secretary of Resources, or his or her designee.
- (9) A member who is an elected public official from local government representing a community with an active defense installation.
- (10) A member who is an elected public official from local government representing a community with a closed defense installation.

(11) A public member selected at large.

(b) The Speaker of the Assembly shall have two appointees who may include, but are not limited to, members representing labor, business, or local government.

(c) The Senate Committee on Rules shall have two appointees who may include, but are not limited to, members representing labor, business, or local government.

(d) Nonvoting members, to consist of all of the following:

- (1) At his or her option, the President of the University of California, or his or her designee.
- (2) The Chancellor of the California State University, or his or her designee.
- (3) The Chancellor of the California Community Colleges, or his or her designee.
- (4) The Speaker of the Assembly, or his or her designee.
- (5) The President pro Tempore of the Senate, or his or her designee.
- (6) A representative from each branch of the United States Armed Forces within California, appointed by the Governor.

15346.4. (a) The members of the council shall elect a member to be the chairperson of the council.



(b) The Office of Military Base Retention shall provide staff support to the council.

(c) It shall be the purpose of the council to provide a central clearinghouse for all defense retention, conversion, and base reuse activities in the state.

15346.5. The council shall do all of the following:

(a) Develop and recommend to the Governor and the Legislature a strategic plan for state and local defense retention and conversion efforts. The plan shall address the state's role in assisting communities with potential base closures and those impacted by previous closures. The council may coordinate with other state agencies, local groups, and interested organizations on this strategic plan to retain current Department of Defense installations, facilities, bases, and related civilian activities. The opportunity shall be provided for public review and comments on the strategic plan prior to submission to the Governor and the Legislature. Notwithstanding Section 7550.5, the plan shall be submitted to the Governor and the Legislature on or before December 1, 2000.

(b) Conduct outreach to entities and parties involved in defense retention and conversion across the state and provide a network to facilitate assistance and coordination for all defense retention and conversion activities within the state.

(c) Help develop and coordinate state retention advocacy efforts on the federal level.

(d) (1) Conduct an evaluation of existing state retention and conversion programs and provide the Legislature recommendations on the continuation of existing programs, including, but not limited to, the possible elimination or alteration of those programs. Notwithstanding Section 7550.5, this evaluation shall be transmitted to the Legislature on or before November 1, 2000, and again on or before November 1, 2003.

(2) The council may provide recommendations to the Legislature on the necessity of new programs for defense retention and adequate funding levels.

(e) Utilize and update the plan prepared by the Defense Conversion Council as it existed on December 31, 1998, to minimize California's loss of bases and jobs in future rounds of base closures. This plan shall include, but not be limited to, all of the following:

(1) Identification of major installations in California.

(2) Determination of how best to defend existing bases and base employment in this state.

(3) Coordination with communities that may face base closures.

(4) Development of data and analyses on bases in this state.

(5) Coordination with the congressional delegation, the Legislature, and the Governor. With the consent of the appropriate authority, the council may temporarily borrow technical, policy, and



administrative staff from other state agencies, including the Legislature.

(f) Where funds and resources are available, the council may undertake all of the following activities:

(1) Provide a central clearinghouse for all base retention or conversion assistance activities, including, but not limited to, employee training programs and regulation review and permit streamlining.

(2) Provide technical assistance to communities with potential or existing base closure activities.

(3) Provide a central clearinghouse for all defense retention and conversion funding, regulations, and application procedures for federal or state grants.

(4) Serve as a central clearinghouse for input and information, including needs, issues, and recommendations from businesses, industry representatives, labor, local government, and communities relative to retention and conversion efforts.

(5) Identify available state and federal resources to assist businesses, workers, communities, and educational institutions that may have a stake in retention and conversion activities.

(6) Provide one-stop coordination, maintain and disseminate information, standardize state endorsement procedures, and develop fast-track review procedures for proposals seeking state funds to match federal defense conversion funding programs.

(7) Maintain and establish data bases in such fields as defense-related companies, industry organization proposals for the state and federal defense industry, community assistance, training, and base retention, and provide electronic access to the data bases.

15346.8. (a) The council shall meet at the times and in places it deems necessary, but no less than once a quarter. Whenever possible, meetings shall be held in Sacramento in state facilities.

(b) Under no circumstances shall the council permit absentee or proxy voting at any of its proceedings. However, a vote by a designee, as provided in paragraphs (1) to (8), inclusive, of subdivision (a), and paragraphs (1) to (5), inclusive, of subdivision (d), of Section 15346.3, shall not be construed to be an absentee or proxy vote under this subdivision.

(c) Council members may receive reimbursement for travel costs directly related to council attendance if funding is available.

(d) The council shall apply for grants and may seek contributions from private industry to fund its operations.

(e) The council shall actively solicit and accept funds from industry, foundations, or other sources to promote and fund research and development of dual technologies, to identify alternative applications of military technologies, to initiate market research for identifying possible defense conversion products, to establish worker and business training programs, and to operate pilot projects to



evaluate and demonstrate useful approaches. These efforts should be coordinated with the regional technology alliances.

15346.9. In addition to the duties specified in Section 15346.5, the council shall do all of the following:

(a) At the request of a council member, the council may review actions or programs by state agencies that may affect military base retention and reuse and offer comments or suggest changes to better integrate these actions or programs into the overall state strategic plan required pursuant to subdivision (a) of Section 15346.5.

(b) The council shall prepare a study considering strategies for the long-term protection of lands adjacent to military bases from development that would be incompatible with the continuing missions of those bases. The study shall include the effects of local land use encroachment, environmental impact considerations, and population growth issues. The study shall recommend basic criteria to assist local governments in identifying lands where incompatible development may adversely impact the long-term missions of these bases. The study shall also identify potential mechanisms, including recommendations for changes in law at the local or state level, to address these issues. In conducting this study, the council may use the Naval Air Station at Lemoore and Edwards Air Force Base as case studies.

The council shall hold public hearings on this study, including at least one in the vicinity of either Lemoore or Edwards. Notwithstanding Section 7550.5, the council shall prepare and submit to the Governor and the Legislature by November 30, 2000, a report on this study with any recommendations.

15346.10. The Trade and Commerce Agency, with input and assistance from the council, shall establish a Defense Retention Grant Program to grant funds to communities with military bases to assist them in developing a retention strategy. The agency may use grant criteria similar to those for existing defense conversion grant programs as a basis for developing the new grant program. To discourage multiple grant applications for individual defense installations in a region, the criteria shall be drafted to encourage a single application for grant funds to develop, where appropriate, a single, regional defense retention strategy. The structure, requirements, administration, and funding procedures of the grant program shall be submitted to the Legislature for review at least 90 days prior to making the first grant disbursement. The agency may make no grant award without the local community providing at least 50 percent or more in matching funds or in-kind services.

15346.12. The Trade and Commerce Agency shall adopt regulations to implement the programs authorized in this chapter. The agency shall adopt these regulations as emergency regulations in accordance with Chapter 3.5 (commencing with Section 11340) of Part 1, and for purposes of that chapter, including Section 11349.6, the



adoption of the regulations shall be considered by the Office of Administrative Law to be necessary for the immediate preservation of the public peace, health and safety, and general welfare. Notwithstanding subdivision (e) of Section 11346.1, the regulations shall be repealed within 180 days after their effective date, unless the agency complies with Chapter 3.5 (commencing with Section 11340) of Part 1 as provided in subdivision (e) of Section 11346.1.

15346.13. This chapter shall remain in effect only until January 1, 2007, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2007, deletes or extends that date.



APPENDIX B

Appendix B: Results of Logistic Regression Models of Urban Land Use Change, 198x-96 by County and Region

County	Concordance (% of Outcomes Correctly Predicted)	Intercept	Distance to Initial Urban			Distance to City Boundary			Distance to Highway			Is Site Prime Farmland(0/1)?		
			Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio
Alameda County	96	-5.282	-0.0198	-0.356	0.98	0.00619	0.137	1.006	0.00301	0.0403	1.003	ns	ns	ns
Amador County	96.2	-3.882	-0.0391	-0.905	0.962	-0.00616	-0.165	0.994	0.00391	0.158	1.004	ns	ns	ns
Butte County	94.9	-5.155	-0.0273	-0.889	0.973	ns	ns	ns	-0.00265	-0.159	0.997	ns	ns	ns
Colusa County	84.1	-6.811	0.0135	0.525	1.014	-0.014	-0.626	0.986	ns	ns	ns	ns	ns	ns
Contra Costa County	94.7	-3.979	-0.0411	-0.582	0.96	-0.00237	-0.047	0.998	ns	ns	ns	ns	ns	ns
Eldorado County	94.1	-4.345	-0.00972	-0.269	0.99	ns	ns	ns	-0.00461	-0.163	0.995	ns	ns	ns
Fresno County														
Glenn County	87.3	-7.982	-0.044	-2.254	0.957	ns	ns	ns	0.0313	1.686	1.032	ns	ns	ns
Imperial County	96.2	-3.882	-0.0391	-0.905	0.962	-0.00616	-0.165	0.994	0.00391	0.158	1.004	ns	ns	ns
Kern County	95.7	-5.071	-0.00237	-0.226	0.998	-0.00455	-0.317	0.995	-0.00229	-0.182	0.998	-0.405	-0.086	0.667
Kings County	98.1	-6.121	ns	ns	ns	-0.00654	-0.314	0.993	0.00196	0.096	1.002	0.218	0.046	1.243
Los Angeles County	97	-4.185	-0.009	-0.45	0.991	ns	ns	ns	-0.00564	-0.367	0.994	0.337	0.0407	1.401
Marin County	94.1	-7.844	-0.0658	-0.646	0.936	0.0139	0.256	1.014	0.0172	0.304	1.017	1.311	0.0801	3.709
Merced County	96.1	-5.063	ns	ns	ns	-0.00386	-0.149	0.996	-0.0063	-0.255	0.994	ns	ns	ns
Monterey County	97.5	-4.098	-0.0969	-3.009	0.908	-0.00555	-0.384	0.994	ns	ns	ns	-0.294	-0.0591	0.745
Napa County	92.5	-6.081	-0.0374	-0.444	0.963	0.00309	0.0455	1.003	0.00622	0.268	1.006	-0.548	-0.107	0.579
Nevada County	96.2	-3.882	-0.0391	-0.905	0.962	-0.00616	-0.165	0.994	0.00391	0.158	1.004	ns	ns	ns
Orange County	95.5	-4.785	-0.0161	-0.228	0.984	0.002	0.0469	1.002	0.00511	0.0959	1.005	0.73	0.107	2.075
Placer County	96.8	-4.451	ns	ns	ns	-0.0106	-0.256	0.989	ns	ns	ns	ns	ns	ns
Riverside County	96.2	-4.43	-0.00967	-0.402	0.99	ns	ns	ns	-0.00074	-0.0388	0.999	0.348	0.0645	1.415
Sacramento County	97.7	-5.291	-0.0108	-0.267	0.989	0.00243	0.0716	1.002	-0.00792	-0.287	0.992	ns	ns	ns
San Benito County	98.3	-2.999	-0.113	-5.699	0.893	ns	ns	ns	-0.00453	-0.194	0.995	ns	ns	ns
San Bernardino County	96.9	-4.568	-0.00692	-0.257	0.993	-0.00251	-0.142	0.997	0.00141	0.0793	1.001	0.396	0.0446	1.485
San Diego County	93.7	-3.905	-0.00216	-0.2	0.998	0.00126	0.114	1.001	-0.00242	-0.214	0.998	ns	ns	ns
San Joaquin County														
San Luis Obispo County	97.3	-4.577	-0.0611	-1.665	0.941	-0.00189	-0.137	0.998	ns	ns	ns	ns	ns	ns
San Mateo County	94.9	-4.527	ns	ns	ns	-0.011	-0.151	0.989	ns	ns	ns	ns	ns	ns
Santa Barbara County	97.1	-5.421	-0.0179	-0.403	0.982	ns	ns	ns	-0.00518	-0.433	0.995	ns	ns	ns
Santa Clara County	95.2	-4.852	-0.104	-3.957	0.901	-0.00427	-0.183	0.996	0.0135	0.466	1.014	0.813	0.159	2.255
Santa Cruz County	94.5	-3.971	-0.38	-3.127	0.684	ns	ns	ns	0.00997	0.312	1.01	-0.964	-0.176	0.382
Shasta County	95.8	-4.964	ns	ns	ns	0.00769	0.661	1.008	-0.0161	-1.306	0.984	ns	ns	ns
Solano County	97	-4.836	-0.0338	-0.594	0.967	ns	ns	ns	ns	ns	ns	ns	ns	ns
Sonoma County	95.9	-5.48	-0.0511	-0.593	0.95	ns	ns	ns	ns	ns	ns	0.543	0.0831	1.721
Stanislaus County	96.2	-5.707	-0.0385	-1.455	0.962	ns	ns	ns	ns	ns	ns	0.731	0.2	2.077
Sutter County	95.2	-6.92	-0.0225	-0.773	0.978	-0.00691	-0.243	0.993	0.0187	0.63	1.019	ns	ns	ns
Tehama County	90.4	-5.901	-0.0263	-1.48	0.974	ns	ns	ns	0.00729	0.586	1.007	ns	ns	ns
Tulare County	94.3	-5.736	-0.00894	-0.359	0.991	0.00513	0.211	1.005	-0.00097	-0.0588	0.999	ns	ns	ns
Ventura County	95.2	-5.563	-0.0161	-0.226	0.984	ns	ns	ns	0.00234	0.0538	1.002	0.385	0.091	1.47
Yolo County	96.8	-5.309	-0.0065	-0.343	0.994	-0.0142	-0.821	0.986	ns	ns	ns	0.235	0.0647	1.265
Yuba County	92.5	-7.166	0.0117	0.368	1.012	ns	ns	ns	-0.00336	-0.213	0.997	ns	ns	ns
Regional Models														
Bay Area Regio	95.9	-4.765	-0.0307	-0.632	0.97	ns	ns	ns	-0.00122	-0.044	0.999	0.242	0.0473	1.273
Los Angeles Area	96.5	-4.524	-0.00783	-0.321	0.992	-0.00055	-0.0307	0.999	-0.00153	-0.085	0.998	0.372	0.06	1.45
Sacramento Area	97.1	-4.464	-0.00993	-0.392	0.99	-0.00143	-0.0624	0.999	-0.00615	-0.209	0.994	ns	ns	ns
Central Coast	97.4	-4.949	-0.0451	-1.595	0.956	-0.00128	-0.0959	0.999	-0.00236	-0.15	0.998	-0.135	-0.0224	0.874
San Joaquin Valley														
N. Central Valley	93.3	-6.111	-0.0089	-0.502	0.991	ns	ns	ns	-0.00438	-0.325	0.996	ns	ns	ns
N. Central Valley (no flood)	94.4	-6.071	-0.0122	-0.666	0.988	ns	ns	ns	-0.00433	-0.311	0.996	ns	ns	ns

Appendix B: Results of Logistic Regression Models of Urban Land Use Change, 198x-96 by County and Region

County	Site Slope			Avg. Slope within 2 cell Radius			Avg. Slope within 2-5 cell Radius			In Floodzone (0/1)?			Floodzone within 2 cell Radius		
	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio
Alameda County	0.0277	0.0686	1.028	0.0903	0.278	1.095	-0.123	-0.343	0.884	-0.668	-0.112	0.513	2.336	0.321	10.342
Amador County	ns	ns	ns	ns	ns	ns	-0.135	-0.267	0.874	1.013	0.196	2.755	ns	ns	ns
Butte County	-0.0441	-0.1	0.957	ns	ns	ns	0.0421	0.156	1.043	na	na	na	na	na	na
Colusa County	ns	ns	ns	ns	ns	ns	-0.125	-0.351	0.883	ns	ns	ns	-6.793	-1.635	0.001
Contra Costa County	-0.0207	-0.0517	0.98	ns	ns	ns	0.0375	0.095	1.038	-0.14	-0.0318	0.869	ns	ns	ns
Eldorado County	-0.0482	-0.121	0.953	ns	ns	ns	-0.0576	-0.14	0.944	ns	ns	ns	ns	ns	ns
Fresno County															
Glenn County	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Imperial County	ns	ns	ns	ns	ns	ns	-0.135	-0.267	0.874	1.013	0.196	2.755	ns	ns	ns
Kern County	ns	ns	ns	-0.212	-0.63	0.809	0.094	0.318	1.099	-0.461	-0.0939	0.631	0.839	0.139	2.313
Kings County	0.123	0.143	1.131	-0.226	-0.312	0.798	0.109	0.156	1.115	0.791	0.185	2.206	-1.322	-0.262	0.267
Los Angeles County	-0.00948	-0.0208	0.991	ns	ns	ns	0.0212	0.06	1.021	-0.325	-0.0577	0.722	ns	ns	ns
Marin County	-0.0518	-0.139	0.95	0.0954	0.347	1.1	ns	ns	ns	ns	ns	ns	0.808	0.14	2.243
Merced County	ns	ns	ns	-0.34	-0.683	0.712	0.15	0.319	1.162	-0.579	-0.137	0.561	ns	ns	ns
Monterey County	0.0457	0.11	1.047	ns	ns	ns	-0.0429	-0.125	0.958	ns	ns	ns	0.37	0.0385	1.448
Napa County	-0.0476	-0.123	0.953	ns	ns	ns	ns	ns	ns	-0.384	-0.0772	0.681	ns	ns	ns
Nevada County	ns	ns	ns	ns	ns	ns	-0.135	-0.267	0.874	1.0132	0.196	2.755	ns	ns	ns
Orange County	-0.0203	-0.05	0.98	0.0752	0.179	1.078	-0.0299	-0.0658	0.971	-0.66	-0.0949	0.517	0.544	0.0454	1.723
Placer County	ns	ns	ns	ns	ns	ns	ns	ns	ns	-0.712	-0.102	0.491	-2.682	-0.246	0.068
Riverside County	-0.0305	-0.067	0.97	0.0231	0.0555	1.023	-0.00855	-0.0203	0.991	ns	ns	ns	ns	ns	ns
Sacramento County	0.229	0.136	1.258	-0.646	-0.283	0.524	0.404	0.158	1.498	-0.606	-0.161	0.546	0.514	0.115	1.673
San Benito County	ns	ns	ns	-0.0937	-0.287	0.911	ns	ns	ns	-0.376	-0.0495	0.687	ns	ns	ns
San Bernardino County	-0.0674	-0.117	0.935	0.0995	0.193	1.105	-0.0236	-0.053	0.977	-0.797	-0.0976	0.451	0.905	0.0749	2.471
San Diego County	-0.00838	-0.0186	0.992	-0.0127	-0.0299	0.987	0.0237	0.0584	1.024	na	na	na	na	na	na
San Joaquin County															
San Luis Obispo County	ns	ns	ns	ns	ns	ns	ns	ns	ns	-0.628	-0.0787	0.984	1.154	0.0803	3.171
San Mateo County	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Santa Barbara County	ns	ns	ns	0.0404	0.124	1.041	ns	ns	ns	-0.492	-0.0675	0.611	2.677	0.203	14.548
Santa Clara County	-0.0351	-0.0936	0.966	0.0808	0.309	1.084	-0.0599	-0.212	0.942	-0.21	-0.0395	0.811	ns	ns	ns
Santa Cruz County	-0.0732	-0.183	0.929	0.128	0.434	1.137	-0.238	-0.761	0.789	ns	ns	ns	2.477	0.236	11.903
Shasta County	-0.0427	-0.102	0.958	-0.173	-0.533	0.841	0.0955	0.303	1.1	-1.049	-0.1	0.35	ns	ns	ns
Solano County	-0.0787	-0.136	0.924	0.0858	0.175	1.09	0.0265	0.0536	1.027	-0.597	-0.148	0.55	0.832	0.164	2.297
Sonoma County	ns	ns	ns	0.0298	0.093	1.03	0.0389	0.112	1.04	ns	ns	ns	ns	ns	ns
Stanislaus County	ns	ns	ns	ns	ns	ns	0.675	0.296	1.963	-0.758	-0.105	0.468	1.797	0.185	6.033
Sutter County	-0.307	-0.344	0.736	0.436	0.615	1.546	-0.398	-0.536	0.672	ns	ns	ns	ns	ns	ns
Tehama County	ns	ns	ns	-0.275	-0.828	0.76	-0.281	-0.916	0.755	ns	ns	ns	ns	ns	ns
Tulare County	-0.134	-0.267	0.874	ns	ns	ns	-0.0611	-0.21	1.062	ns	ns	ns	-1.569	-0.215	0.208
Ventura County	-0.0221	-0.0568	0.978	ns	ns	ns	0.0313	0.0954	1.032	-0.936	-0.163	0.392	0.795	0.0853	2.214
Yolo County	ns	ns	ns	-0.879	-2.064	0.415	0.461	1.151	1.586	ns	ns	ns	ns	ns	ns
Yuba County	-1.347	-3.011	0.26	ns	ns	ns	ns	ns	ns	-1.031	-0.225	0.357	1.868	0.277	6.474
<u>Regional Models</u>															
Bay Area Regio	-0.017	-0.0429	0.983	0.0179	0.0605	1.018	ns	ns	ns	-0.287	-0.0579	0.751	0.505	0.0816	1.657
Los Angeles Area	-0.0274	-0.0593	0.973	0.0338	0.0856	1.034	ns	ns	ns	-0.695	-0.0903	0.499	0.582	0.0532	1.789
Sacramento Area	-0.0207	-0.0413	0.98	-0.0402	-0.107	0.961	0.0164	0.0497	1.017	-0.497	-0.111	0.609	ns	ns	ns
Central Coast	ns	ns	ns	ns	ns	ns	ns	ns	ns	-0.403	-0.0565	0.669	1.104	0.0949	3.017
San Joaquin Valley															
N. Central Valley	-0.046	-0.101	0.955	-0.18	-0.523	0.835	0.144	0.447	1.155	-0.8	-0.15	0.45	0.671	0.103	1.957
N. Central Valley (no flood)	-0.0421	-0.0931	0.959	-0.105	-0.311	0.901	0.113	0.364	1.119	na	na	na	na	na	na

Appendix B: Results of Logistic Regression Models of Urban Land Use Change, 198x-96 by County and Region

County	Floodzone within 2-5 cell Radius			Neighborhood Urbanization Gradient (2 cell Radius)			Neighborhood Urbanization Gradient (0-1 km)			Neighborhood Urbanization Gradient (1-2 km)			Simultaneous Urbanization within 2 cell Radius		
	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio	Coeff.	St. Coeff.	Odds Ratio
Alameda County	-1.032	-0.112	0.356	-0.042	-0.665	0.959	0.0743	0.955	1.077	-0.0231	-0.263	0.977	0.147	0.79	1.158
Amador County	ns	ns	ns	-0.0178	-0.145	0.982	ns	ns	ns	-0.0394	-0.176	0.961	0.334	0.411	1.396
Butte County	na	na	na	-0.0284	-0.157	0.972	0.054	0.271	1.055	-0.034	-0.146	0.967	0.195	0.25	1.215
Colusa County	4.233	0.94	68.938	ns	ns	ns	0.0731	0.13	1.076	0.204	0.243	1.227	0.452	0.239	1.572
Contra Costa County	0.38	0.0639	1.462	-0.0363	-0.571	0.964	0.0483	0.596	1.049	-0.00515	-0.0555	0.995	0.115	0.863	1.122
Eldorado County	6.302	0.0584	545.622	-0.0254	-0.211	0.975	0.0471	0.272	1.048	ns	ns	ns	0.136	0.443	1.145
Fresno County															
Glenn County	-5.491	-0.696	0.004	-0.025	-0.0657	0.975	0.0609	0.122	1.063	ns	ns	ns	0.846	0.248	2.329
Imperial County	ns	ns	ns	-0.0178	-0.145	0.982	ns	ns	ns	-0.0394	-0.176	0.961	0.334	0.411	1.396
Kern County	-0.325	-0.0437	0.723	-0.0457	-0.226	0.955	0.0748	0.305	1.078	-0.0231	-0.0817	0.977	0.198	0.349	1.219
Kings County	ns	ns	ns	-0.0468	-0.204	0.954	0.0654	0.22	1.068	-0.0332	-0.0839	0.967	0.185	0.668	1.203
Los Angeles County	ns	ns	ns	-0.0352	-0.299	0.965	0.0479	0.351	1.049	-0.00861	-0.0592	0.991	0.121	0.653	1.129
Marin County	1.312	0.148	3.715	-0.00708	-0.0874	0.993	-0.0486	-0.565	1.05	ns	ns	ns	0.293	0.648	1.641
Merced County	0.726	0.142	2.066	-0.0278	-0.1	0.973	0.0665	0.206	1.069	-0.0214	-0.066	0.979	0.178	0.354	1.195
Monterey County	ns	ns	ns	-0.00934	-0.0305	0.991	0.0484	0.16	1.05	-0.0264	-0.0845	0.974	0.181	0.271	1.198
Napa County	1.28	0.135	3.596	-0.0164	-0.14	0.984	0.0472	0.311	1.048	-0.0113	-0.0653	0.989	0.209	0.441	1.233
Nevada County	ns	ns	ns	-0.0178	-0.145	0.982	ns	ns	ns	-0.0394	-0.176	0.961	0.334	0.411	1.396
Orange County	-0.846	-0.0486	0.429	-0.0486	-1.055	0.953	0.0587	1.097	1.06	-0.0126	-0.201	0.987	0.118	1.164	1.125
Placer County	ns	ns	ns	-0.0378	-0.326	0.963	0.0694	0.474	1.072	-0.0104	-0.0588	0	0.117	0.652	1.124
Riverside County	-3.218	-0.0178	0.04	-0.0404	-0.462	0.96	0.0558	0.52	1.057	-0.0112	-0.0882	0.989	0.119	0.885	1.126
Sacramento County	0.413	0.0759	1.512	-0.0491	-0.626	0.952	0.0736	0.825	1.076	-0.0229	-0.233	0.977	0.149	0.719	1.161
San Benito County	-1.608	-0.0767	0.2	-0.0248	-0.0591	0.976	0.0502	0.1	1.051	-0.0317	-0.0488	0.969	0.143	0.184	1.154
San Bernardino County	ns	ns	ns	-0.0399	-0.432	0.961	0.057	0.55	1.059	-0.0106	-0.0991	0.989	0.119	0.862	1.126
San Diego County	na	na	na	-0.0303	-0.491	0.97	0.0378	0.352	1.039	ns	ns	ns	0.113	0.854	1.119
San Joaquin County															
San Luis Obispo County	ns	ns	ns	-0.0164	-0.0725	0.984	0.0454	0.178	1.046	-0.0299	-0.0946	0.97	0.169	0.298	1.184
San Mateo County	ns	ns	ns	-0.00534	-0.0709	0.995	0.0621	0.812	1.064	-0.0147	-0.176	0.985	0.137	0.808	1.147
Santa Barbara County	-1.937	-0.105	0.144	-0.0288	-0.181	0.972	0.0604	0.345	1.062	-0.0119	-0.0599	0.988	0.205	0.372	1.227
Santa Clara County	-0.889	-0.0982	0.411	-0.0329	-0.6	0.968	0.0543	0.782	1.056	-0.01	-0.138	0.99	0.156	0.487	1.169
Santa Cruz County	-3.102	-0.199	0.045	-0.0274	-0.187	0.973	0.0244	0.165	1.025	-0.0202	-0.118	0.98	0.344	0.397	1.41
Shasta County	-1.204	-0.0404	0.3	-0.0271	-0.127	0.973	0.0357	0.153	1.036	ns	ns	ns	0.181	0.334	1.198
Solano County	ns	ns	ns	-0.0453	-0.453	0.956	0.0714	0.538	1.074	-0.0284	-0.179	0.972	0.143	0.599	1.154
Sonoma County	ns	ns	ns	-0.0313	-0.313	0.969	0.0658	0.538	1.068	-0.0142	-0.0991	0.986	0.154	0.518	1.166
Stanislaus County	-0.944	-0.0735	0.389	-0.0282	-0.177	0.972	0.0615	0.355	1.063	-0.0197	-0.113	0.981	0.151	0.428	1.163
Sutter County	-4.674	-0.665	0.009	-0.0364	-0.149	0.964	0.0629	0.212	1.065	-0.0201	-0.0586	0.98	0.212	0.329	1.236
Tehama County	ns	ns	ns	ns	ns	ns	0.0401	0.0793	1.041	ns	ns	ns	0.27	0.17	1.31
Tulare County	1.027	0.101	2.793	-0.026	-0.116	0.974	0.0598	0.209	1.062	-0.0226	-0.0735	0.978	0.216	0.354	1.241
Ventura County	1.286	0.0773	3.618	-0.0356	-0.449	0.965	0.0511	0.546	1.052	-0.00543	-0.0457	0.995	0.141	0.688	1.151
Yolo County	ns	ns	ns	-0.034	-0.174	0.967	0.076	0.306	1.079	-0.0191	-0.079	0.981	0.157	0.293	1.17
Yuba County	ns	ns	ns	-0.021	-0.0574	0.979	0.0538	0.112	1.055	0.0435	0.108	1.044	0.0936	0.301	1.098
<u>Regional Models</u>															
Bay Area Regio	ns	ns	ns	-0.0328	-0.437	0.968	0.0602	0.654	1.062	-0.0113	-0.112	0.989	0.138	0.642	1.148
Los Angeles Area	ns	ns	ns	-0.0409	-0.492	0.96	0.0555	0.577	1.057	-0.011	-0.104	0.989	0.122	0.852	1.129
Sacramento Area	0.604	0.0948	1.829	-0.041	-0.38	0.96	0.0683	0.529	1.071	-0.02	-0.138	0.98	0.139	0.561	1.149
Central Coast	-0.517	-0.0296	0.596	-0.0204	-0.0897	0.98	0.0545	0.224	1.056	-0.0231	-0.0843	0.977	0.181	0.29	1.198
San Joaquin Valley															
N. Central Valley	ns	ns	ns	-0.0255	-0.082	0.975	0.0444	0.119	1.045	ns	ns	ns	0.214	0.217	1.238
N. Central Valley (no flood)	na	na	na	-0.0269	-0.101	0.973	0.0488	0.16	1.05	-0.0151	-0.0432	0.985	0.208	0.222	1.231

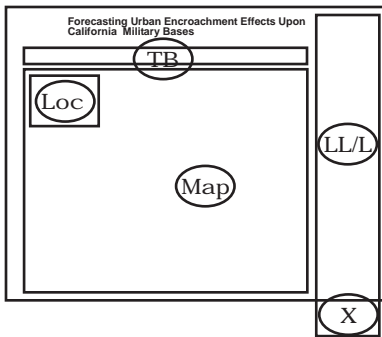
Appendix B: Results of Logistic Regression Models of Urban Land Use Change, 198x-96 by County and Region

County	Simultaneous Urbanization within 2 cell Radius			County Dummy Variable (Regional Model Only)
	Coeff.	St. Coeff.	Odds Ratio	
Alameda County	ns	ns	ns	
Amador County	ns	ns	ns	
Butte County	0.0499	0.0334	1.051	
Colusa County	-0.681	-0.176	0.506	
Contra Costa County	-0.0214	-0.0894	0.979	0.0718
Eldorado County	0.024	0.044	1.024	0.208
Fresno County				
Glenn County	ns	ns	ns	-0.25
Imperial County	ns	ns	ns	
Kern County	-0.0494	-0.0533	0.952	
Kings County	0.0245	0.0418	1.025	
Los Angeles County	-0.0284	-0.0912	0.972	0.0469
Marin County	ns	ns	ns	
Merced County	-0.0679	-0.0953	0.934	
Monterey County	-0.0874	-0.0679	0.916	0.12
Napa County	ns	ns	ns	0.381
Nevada County	ns	ns	ns	
Orange County	-0.0211	-0.107	0.979	
Placer County	-0.0127	-0.0454	0.987	
Riverside County	-0.0206	-0.0905	0.98	
Sacramento County	-0.0498	-0.143	0.951	-0.354
San Benito County	ns	ns	ns	0.299
San Bernardino County	-0.0244	-0.117	0.976	-0.0695
San Diego County	ns	ns	ns	
San Joaquin County				
San Luis Obispo County	-0.036	-0.0329	0.965	
San Mateo County	ns	ns	ns	0.866
Santa Barbara County	-0.0439	-0.0408	0.957	0.579
Santa Clara County	0.0417	0.0648	1.043	-0.12
Santa Cruz County	0.163	0.107	1.177	-0.354
Shasta County	-0.0534	-0.0602	0.948	0.896
Solano County	-0.0271	-0.061	0.973	-0.162
Sonoma County	ns	ns	ns	
Stanislaus County	-0.034	-0.0594	0.967	
Sutter County	0.0699	0.0642	1.072	
Tehama County	0.11	0.0383	1.116	0.338
Tulare County	ns	ns	ns	
Ventura County	0.0101	0.0263	1.01	-0.133
Yolo County	-0.0298	-0.0277	0.971	-0.717
Yuba County	0.018	0.0571	1.018	
<u>Regional Models</u>				
Bay Area Regio	-0.026	-0.0645	0.974	above
Los Angeles Area	-0.0216	-0.0919	0.979	above
Sacramento Area	-0.0311	-0.0766	0.969	above
Central Coast	-0.0489	-0.042	0.952	above
San Joaquin Valley				
N. Central Valley	-0.121	-0.0738	0.886	above
N. Central Valley (no flood)	-0.0775	-0.0482	0.925	not shown

APPENDIX C

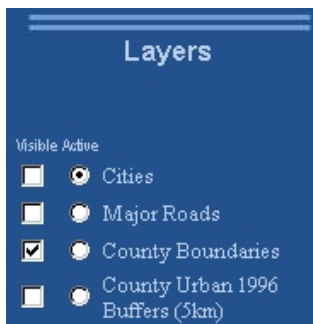
Appendix C: Tour of Online Mapping Capabilities for Investigating Conflict between Military Bases and Urbanization

This brief tour first provides an overview of your mapping environment, shows how to make particular map layers visible or active, and helps you zoom into a particular part of the state. Then it will guide you through picking a particular base, measuring the distance around it, buffering it, and printing out your results. Finally, an example will show you how to assess whether or not encroachment is a problem at Miramar NAS.



What you're looking at

- Map: Map Window where you view the map
- LL/L: Layer List or Legend that shows the map layers (note that this may scroll off the bottom of the screen as indicated by the X)
- Loc: Locator Window has a red box that shows the area of California covered by the Map Window
- TB: A toolbox with tools that lets you change the way your screen looks, zoom, identify or query map features, measure distances, select map features, and build buffers. Holding the cursor over these tools shows text with their names.



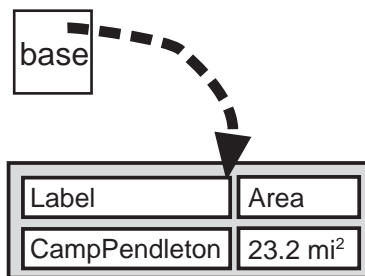
Listing and viewing layers

In order to change which layers you can see or to examine one in depth, you must first make the Layer List visible by clicking on the Legend/Layer List button (☰) until the title at the top of the right-hand column reads "Layers."

If you wish to see a particular layer on your map, you must check the box next to that layer under the title "Visible" and then click the "Refresh Map" button at the bottom of the Layer List. At the left, only County Boundaries are set as visible.

Activating a layer and info

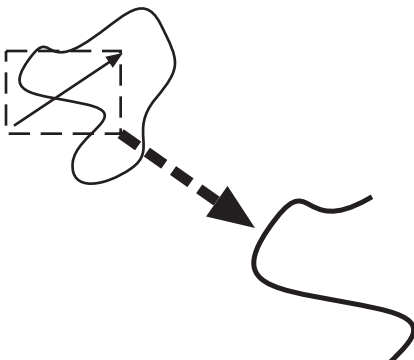
When you want to "do something" (such as query or buffer map features) you must first make that layer active. This is done by clicking on the button next to the layer of interest under the title "Active." At the above-left, the Cities layer is active.

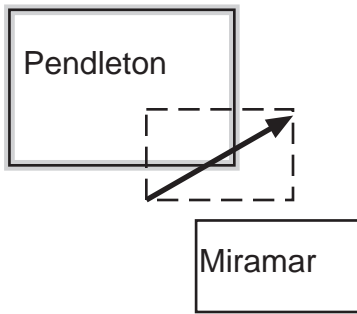


Once a layer is active, you can get information about a feature on the screen. For instance, if you have the Military Bases layer active, you can select the Info tool (ℹ) and then click on a base. A new window will appear with data about that base—here showing that the map feature clicked on is Pendleton and it has an area of 23.2 mi².

Zooming in and out

You will usually want to look at a particular region of the state instead of all of California. You can do this by zooming in with the Zoom-In button (🔍). While this tool can be used by clicking multiple times until you're close enough, the easiest way is to use it to draw a zoom window by clicking at the lower left of the area you're interested in and then dragging until you're at the upper right and then releasing the button. You can zoom out by clicking multiple times on the Zoom-Out button (🔍) or by clicking the Zoom-to-Full-Extent Button (🌐) which again shows the entire state.

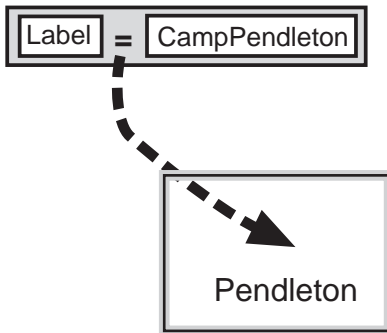




Selecting a feature

To begin your analysis of a particular base, you need the Military Bases layer to be active. Then use the Select-by-Rectangle tool (☒) to choose your base of interest by dragging a box over part of the base. It should change colors and the view will automatically zoom in once it is selected.

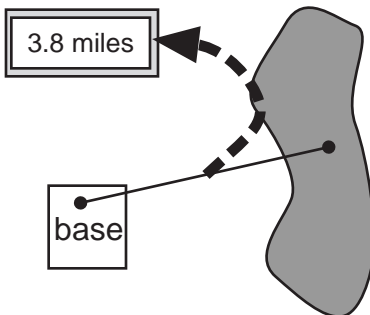
The other way to select a base is by...



Querying the data

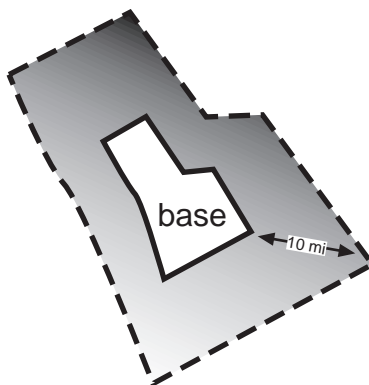
Here we begin by making sure the Military Bases Layer is active and then by clicking on the Query button (☒). Up pops a window where we set up a selection equation that tells the computer to select bases that meet our criteria. For example, if you want to work with Camp Pendleton, you would build the equation LABEL = "Camp Pendleton" and then click add to query string. When you are done building your query or question, you push "Execute" and the bases matching your criteria will be selected.

Now you are ready to explore the area around your base of interest.



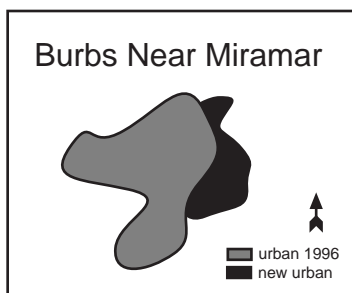
Measuring distances

You can begin to explore the area around a base by measuring the distance from the base to various other features shown on your map. To do this, make sure the base and the other feature are visible within your view. Then select the Measure tool (☒) and click once on the base. Move the mouse out to the location of the other feature and click once. The distance is indicated in the "Total" window above the Locator Window. To stop measuring, click on the "Clear Selection" tool (☒).



Building buffers

Buffering offers a more thorough way to analyze what is in the vicinity of your selected base. When you click on the Buffer button (☒), a new window pops open where you select the size of the buffer and the other layer you are interested in. For instance, if you want to see how much urbanization is within 10 miles of Camp Pendleton, you would first make sure Pendleton is still selected, choose Urban 1996 from the "Highlight features from" list, type in 10 in next box, and then click "Create Buffer." A graphic showing the buffer is generated and the features it intersects with in the other layer are selected.

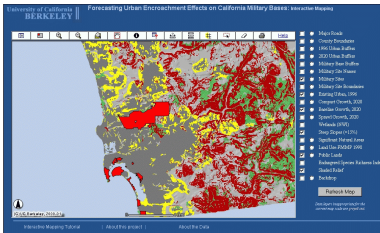


Printing

Finally, to output your selected base, other visible layers, and any buffers you may have built, click on the Print button (☒) and a nicely laid out page will be generated which you can then print by using your browser's print command.

Assessing Encroachment

This section provides a step-by-step guide to assessing whether or not urban encroachment is likely to cause problems at Miramar NAS, first directly and then by displacing high quality habitat.

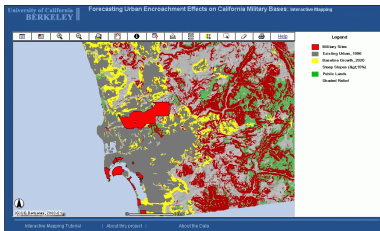


1) Zoom in to Miramar NAS

Use the Zoom-In tool to draw a rectangle around Miramar NAS and land in its vicinity.

2) Set the visible layers

Make sure that the following layers have checkmarks in the squares in the visible column: Military Sites, Existing Urban, Baseline Growth, Steep Slopes, Public Lands, and Shaded Relief.

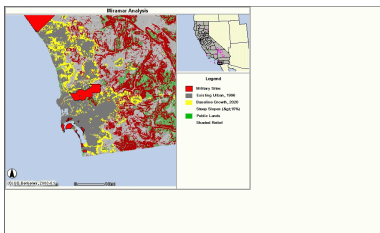


3) Change to legend view

Click on the Legend/Layer-List toggle button to switch the Layer List (with the check boxes) to the Legend, which helps you identify things on the map by putting the layer name next to the color used to represent it on the map.

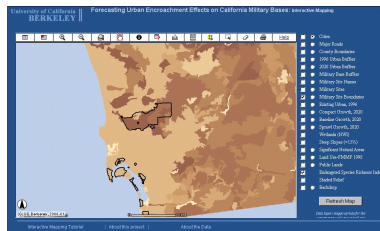
4) Print out your map

Once you've set up your map so that you are zoomed in to the area of interest and the layers you need to do the analysis are visible, you may wish to prepare an output page by clicking the Print button.



analysis: is encroachment a problem?

Miramar NAS was already hemmed in by urbanization along most of three of its borders and by 2020 new urbanization is expected to fill in along these areas and to reach Miramar's southeast corner. Clearly, future urbanization has the potential to threaten the Station's operations. Note that the areas shown in maroon (Steep Slopes) and green (Public Land) are unlikely to ever urbanize.



5) Switch back to the layer list

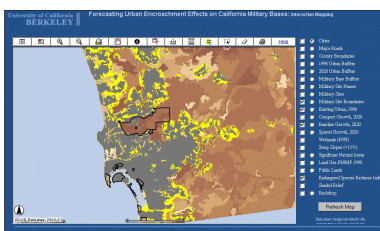
You need to hit the Legend-Layer List toggle button again so that you can see the checkmarks and change which layers are visible.

6) Set visible habitat layers

Make only the Military Site Boundaries and Endangered Species Richness Index layers visible so you can assess potential conflict relating to high-quality habitat.

analysis: is Miramar high-quality habitat?

Observe that the land within Miramar is generally at the browner end of the scale meaning that it has more land of higher quality for more endangered species than most land around it.



7) Make urban growth visible

Now make the Baseline Growth layer visible and, as it draws, observe the general quality of the habitat that will be displaced.

analysis: will habitat loss be a problem?

Expected urban growth makes Miramar stand out even more as a large patch of contiguous high-quality habitat surrounded by a sea of urbanization offering low-quality habitat. The Station looks like a great nature preserve to the conservationist of the future.