GREENBELT ALLIANCE
Open Spaces & Vibrant Places

GROW SMART BAY AREA INFILL RESEARCH: TECHNICAL DETAILS AND RESULTS

INTRODUCTION

The Bay Area will grow by nearly 2 million people in the next thirty years. Some claim this growth means the region's cities need to expand. Others point out that cities and towns have vacant lots that could be developed first. Can the Bay Area accommodate the growth coming to the region as infill development?

To answer this question, Greenbelt Alliance estimated the potential for infill development in the San Francisco Bay Area and compared this to growth projections. The research suggests that the region has enough space within its already-urbanized areas to accommodate the projected growth. If the region's cities and towns adopt smart growth policies that match community visions, over 100% of the housing and jobs needed by 2035 could be provided in existing urban areas.

Growing in this way would protect the natural areas and working farms that are so important to the Bay Area's economy and quality of life. *Golden Lands, Golden Opportunity*, a 2008 report by Greenbelt Alliance, the Bay Area Open Space Council, and Association of Bay Area Governments (ABAG), describes the values of the region's greenbelt. These vital lands provide clean water, food, exercise and recreation, scenic views between communities, and wildlife habitat that support healthy ecosystems.

This document provides technical details and results about Greenbelt Alliance's infill research project. For an introduction and overview to the project, including illustrations, case studies, general information, and acknowledgments of the many people and organizations that made this research possible, see www.growsmartbayarea.org and click on "It's Possible." A printable brochure is found at http://growsmartbayarea.org/heres_how/meeting_the_challenge/index.html.

METHODS

Setting Targets

How many new homes and jobs will the region need in the foreseeable future? ABAG's Projections 2009 predicts that between 2005 and 2035, the region will need 719,700 homes and 1,657,650 jobs, as shown in the table below.

Table 1: The region's growth needs. Source: Association of Bay Area Governments, Projections 2009.

	Jobs	Housing
2005	3,449,640	2,583,080
2035	5,107,290	3,302,780
Growth	1,657,650	719,700

The research examines the growth increment from 2005 to 2035 because regional documents, such as the Bay Area's Regional Transportation Plan, *Transportation 2035: Change in Motion*, look ahead to 2035, and it is the latest date for which regional projections are currently available. The analysis begins at 2005 because the parcel data is from 2006, and since there was no way to know which land had redeveloped between 2006 and the present, a 2005 start date would ensure all parcels considered available were actually available at the start of the research period.

ABAG's Projections 2009 is the latest in a series of demographic forecasts. ABAG produces a 25-year forecast of growth every two years based upon employment forecasts by industry, demographic forecasts of population change, migration for employment and other reasons, land availability, and a set of smart growth policy assumptions.

Estimating Infill Potential: Overview

To estimate the infill potential of Bay Area cities and towns, Greenbelt Alliance's infill research uses two pre-existing datasets: the California Infill Parcel Locator database, which identifies opportunity sites, and the Smart Growth Strategy/Regional Livability Footprint Project, which maps local communities' visions for their neighborhoods.

After estimating growth on individual opportunity sites, the research added "in-law" apartments or "granny" flats throughout the residential neighborhoods where the Smart Growth Strategy/Regional Livability Footprint Project suggested small increases across the neighborhood would occur.

On top of this existing growth potential on private lands, local jurisdictions are actively working to increase the infill potential of certain neighborhoods, both by improving neighborhood conditions and by making available public land like decommissioned military bases. ABAG compiled nominations from local jurisdictions and designated Priority Development Areas (PDAs). Within PDAs, growth estimates created by ABAG and local jurisdictions reflect the higher growth potential that is possible given local efforts and targeted investment. These were substituted for the parcel-based and in-law estimates.

Projecting Future Development: Selecting Opportunity Sites

Greenbelt Alliance's infill research begins by examining opportunity sites—vacant and underused places, like empty strip malls and parking lots—and calculating how many new homes and jobs could be created on each one.

An Economic Basis for Parcel Selection

Opportunity sites are properties that are likely to redevelop through real estate activity because what stands on the land is less valuable than the land itself. The California Infill Parcel Locator Database (2005) identifies likely infill parcels. It selects those where the ratio of the land's "improvement value" (the value of any structure on the land) to the "land value" (the value of the acreage itself) is less than 1.0. This method was developed by the Institute for Urban and Regional Development (IURD) for the State of California's Business, Transportation, and Housing Agency. IURD worked in partnership with the California Department of Transportation and the Department of Housing and Community Development. The research was made available on a website funded by the Federal Highway Administration, State Research and Planning Program, and the State of California, Department of Transportation.

The California Infill Parcel Locator (CIPL) project used parcel data purchased in June 2004. For Greenbelt Alliance, the Institute for Urban and Regional Development employed the same method and updated the list of Bay Area parcels ripe for infill redevelopment, using 2006 county assessor data and updated improvement and land values.

Exclusions and Modifications

Assessors' parcel data was modified in several ways by the CIPL project. First, according to the study report,[1] the parcel data excludes:

- all public lands as well as undeveloped farm, range, and forestlands owned by public conservancies
- sites with slopes in excess of 25%
- single-family homes for which the assessed structure value was within the top 60% of structure assessments within each county
- cemeteries, private golf courses, and country club parcels
- parcels larger than five acres currently in active resource or agricultural use
- parcels adjacent to Superfund sites
- multiple listings of condominium parcels
- parcels for which the lot size as reported by the county assessor was too big for its physical footprint

It "does not exclude sites for which development is likely to be difficult for regulatory or political reasons or because of lack of community support—wetland sites, sites in flood zones, prime agricultural sites, or sites not slated for development under local general plans." [2]

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[1] Institute of Urban and Regional Development, *The Future of Infill Housing in California: Opportunities, Potential, Feasibility and Demand Volume 1 Study Overview*, September 2005, pp. 6-7.

For more information about the methods of the California Infill Parcel Database, see http://infill.gisc.berkeley.edu/about.html.

In addition, Greenbelt Alliance excluded the following:

- parcels outside "urban and built up land"
  This research focused on infill parcels, so it only included parcels within urban land, as defined and mapped by the Farmland Mapping and Monitoring Program of the State of California's Department of Conservation (2006). The FMMP definition of urban land is "land occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel."[3] To exclude growth in small, outlying rural clusters, anywhere that the FMMP urban polygon was 300 acres or smaller, the parcels were also dropped. Within San Francisco, FMMP data was not available at the time the dataset was being compiled, so the parcels outside FMMP were not removed. This was not later changed because the research team assumed that conditions within the City of San Francisco meant that any privately-owned parcel would qualify.

- single-family properties and residential condominiums
  Real estate valuations are not a perfect predictor for whether single-family homes, in particular, will be sold and redeveloped. A family occupying a home is unlikely to sell that home or redevelop it into a higher-density use solely because of its worth on the real estate market. The homeowner would need to have the option and desire to move to another location.

- any agricultural parcels with current use listed as pasture, agricultural land, animal farm, orchard, truck crops, vineyard, greenhouse, or agriculture NEC[4]
  While the Parcel Locator Database excluded any parcels in agricultural use above five acres, Greenbelt Alliance excluded all agricultural land. Urban and community gardens are important ways that people can get fresh, healthy produce, and even small parcels can make significant contributions to local food production.

- parkland and protected natural areas
  Parcels were excluded if they fell within Protected Lands 2007, a map layer showing regional and city parks and protected open space, produced by the Bay Area Open Space Council and GreenInfo Network, or parcels with current use listed as easement, park, or common area.

- parcels that may currently be open space, including those with current use listed as barren land or forest
- parcels currently used for "utilities"

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[2] Ibid.

[3] It goes on to add that "this land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures, and other developed purposes."

[4] NEC is a common assessors' abbreviation for Not Elsewhere Classified.

- parcels for which current use was left blank in the dataset

Within Priority Development Areas, estimates of growth created by ABAG and local jurisdictions later replace parcel-based estimates for all parcels within PDAs and a fifty-foot buffer.

Table 2: Potential infill parcels.

	Parcel Locator Sites*	Greenbelt Alliance Sites (after parcel exclusions)
Inside PDAs**	22,465	18,428
Outside PDAs	47,839	32,555
Total	70,304	50,983

* Source: Institute for Urban & Regional Development. California Parcel Infill Locator Database method, 2006 parcel data.

** Infill estimates within PDAs are later replaced by estimates from ABAG and local jurisdictions. Parcels inside and within 50' of PDAs are generally not used in calculating infill projections or statistics about Opportunity Sites.

Evaluation of Assumptions

The following are important assumptions that this project made:

- Fundamentally, the ratio of improvement value to land value indicates which properties are economically available for redevelopment.
- The estimate limits itself to properties that, in 2006, are economically available for redevelopment. Between now and 2035, as property values rise, other properties are likely to become economically available. Limiting this research to only the parcels available as of 2006 makes this a conservative estimate. As neighborhoods improve, land might increase in value more quickly than structures, making additional properties available.
- Not all properties in this database are likely to redevelop. The project does not include a correction factor for those that do not redevelop and instead assumes that an equivalent number of parcels that are not included in the dataset will also redevelop. This was supported by groundtruthing done while creating the case studies, which found several likely infill sites that were not included.
- This project categorically excludes a number of current uses, such as single-family homes, and the others aforementioned, although some of these properties are likely to redevelop.
- The economic basis for selecting parcels means that the data would systematically undercount any places where cities are making efforts to improve the value of the land (particularly former brownfields or industrial areas).
- The data relies on county assessors' valuations. County assessment methods do vary in a way that might somewhat affect the balance between different counties.
- As time passes since an assessment, the land and improvement values are assumed to generally maintain the ratio they had when originally assessed. Land and structure values are assumed to increase or decrease proportionately. In reality, however, this may not be true. A structure may be repaired or be allowed to fall into disrepair. County assessor offices reassess properties when a parcel undergoes significant improvements, as well as when it is bought, sold, subdivided, or combined. But not all improvements to parcel structures trigger re-assessment. The research assumes that for every parcel that is repaired and no longer available, a parcel outside the dataset has fallen into disrepair and become available.

More information on the research assumptions is available in the audit by Strategic Economics (see www.growsmartbayarea.org and click on "other research").

Projecting Future Neighborhood Conditions

To calculate how many new homes and jobs could be built on opportunity sites, the research needed descriptions of what that neighborhood might look like in the future and what could be built on those properties.

A Future-Oriented Vision

To determine how these sites could redevelop in the coming decades, Greenbelt Alliance looked to the Smart Growth Strategy/Regional Livability Footprint Project. This dataset was chosen for several reasons:

- it is a unified regional vision with the same categories applied throughout the region
- its geographies—main streets, transit nodes, and neighborhood districts—reflect the geographies used in planning more than other datasets such as the U.S. Census do
- the project looked to the future in a visionary way and therefore reflects the future *potential* of local neighborhoods rather than looking at current densities, land-use plans, or other indicators of neighborhoods' current trajectory.

Extensive Community Participation

The Footprint Project was initiated in 1999 and completed in 2002**.** It was led by the Bay Area's five regional agencies—the Association of Bay Area Governments (ABAG), the Metropolitan Transportation Commission, the Bay Area Air Quality Management District, Bay Conservation and Development Commission, and the Regional Water Quality Control Board—and by the nonprofit Bay Area Alliance for Sustainable Communities (known at the time as the Bay Area Alliance for Sustainable Development).

The project asked residents to look to the region's 2020 land use. Through two rounds of public workshops, this project generated a single region-wide vision. As the project's report describes:

> "Over …two years, elected officials, business and community leaders, environmentalists, social equity advocates, planners, analysts, mapmakers, agency representatives and interested citizens devoted thousands of hours to the project. They organized, met, planned, debated, generated ideas, drew maps, made projections and analyzed outcomes. More than 2,000 residents from throughout the region attended daylong Saturday workshops held in each of the Bay Area's nine counties in fall 2001 and spring 2002. Participants conceptualized how future growth should occur in their individual neighborhoods and counties, and in the region as a whole."[5]

For more information about the methods and results of the Smart Growth Strategy/Regional Livability Footprint Project, see http://www.abag.ca.gov/planning/smartgrowth/.

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[5] *Smart Growth Strategy/Regional Livability Footprint Project: Shaping the Future of the Nine-County Bay Area*, Final Report, October 2002, p. 2.

The resulting map, a vision for improved growth patterns based on smart growth principles, is composed of more than twenty-five "place-types." Each place-type describes the neighborhood's future land use (residential, mixed use, downtown, or employment center) and average or minimum building heights.

Exclusions and Modifications

The Smart Growth Strategy/Regional Livability Footprint Project includes three types of place-types. One group of place-types describes what the neighborhood may look like in the future (e.g., 3C: Downtown Medium-High Density: "Five-story average of mixed use buildings with some high-rise buildings, surrounded by one- to four-story residential buildings"). One group indicates that a small proportional increase would occur (the "dial-up" place-types, e.g., +R, "5% Residential Increase"). A third group indicates that the neighborhood would stay the same (e.g., Residential, Employment Center). These categories were used by the Smart Growth Strategy/Regional Livability Footprint Project in its analysis of neighborhood-wide change.

For Greenbelt Alliance's infill project, which focuses on the redevelopment of individual parcels, the descriptive vision of the neighborhood's future was needed. Therefore, for neighborhoods assigned dial-up place-types such as "+R" or no-change place-types such as "Employment Center," descriptive place-types were assigned.

Properties that fell within the no-change place-types "Non-Urban" and "Residential" were removed. Non-Urban neighborhoods were removed because their future was projected to be not urban, and Residential neighborhoods were removed because these unchanging residential areas were politically likely to fill in vacant properties more slowly than other neighborhoods.

Evaluation of Assumptions

The following are important assumptions that this project made:

- This project assumes that the place-type assignments in the Smart Growth Strategy/Regional Livability Footprint Project represent the potential future of a particular parcel within that neighborhood.
- The Smart Growth Strategy/Regional Livability Footprint Project asked participants to look ahead to the year 2020. Greenbelt Alliance's infill research looks ahead to the year 2035. Presumably, in the 15 years between 2020 and 2035, some places will grow taller or become more compactly developed. Using the Smart Growth Strategy/Regional Livability Footprint Project's future projections may mean an underestimation of the potential development intensity in neighborhoods around the region.
- The project assumes that every opportunity site within a place-type develops at its average height and building description, or that the redeveloping properties, taken together, add up to the place-type's characteristic assignment.
- The project assumes that at some point during the thirty years from 2005 to 2035, development of the building types at the given heights will be economically feasible. Currently, some building heights are difficult to develop without city subsidies. For example, once a building crosses the height threshold that requires steel-frame construction, the amount of revenue from developing that building does not match the costs of its construction until the building becomes a fair amount taller.

More information on the research assumptions is available in the audit conducted by Strategic Economics (see www.growsmartbayarea.org and click on "other research").

Assigning Densities to Future Neighborhood Types

Based on the description of what new buildings could look like found in the place-types, researchers assigned densities to buildings of that size and shape. Both job densities (employees/acre) and housing densities (dwelling units/acre) were assigned for each place-type. Densities were created with significant input from urban design and planning consultants, particularly Calthorpe & Associates.

Floor-Area Ratios

To create densities, researchers first assigned floor-area ratios (FARs), which is a ratio of the square footage inside a building to the size of the property.[6] Floor-area ratios were assigned by examining existing buildings and also the place-types from other regions, as compiled by Calthorpe & Associates for the Vision California project.

To ensure adequate sunlight and air, limits were placed on buildings' FARs based upon the average height of each place-type. Researchers imagined a hypothetical rectangular building of a particular height and asked what percentage of the lot would be covered to achieve the FAR. (In reality, most buildings taper as they rise, so the building's footprint would likely be larger.) For residential place-types, this lot coverage would generally be 50% or less (one was 51% after rounding) of the lot; for mixed-use building types, this lot coverage would generally be 55% or less (one was 58% after rounding); and for employment buildings, this lot coverage would be 60% or less (one was 62% after rounding). Most properties would have much lower lot coverages, particularly the lower density place-types.

Floor-area ratios and other assumptions for each place-type are found in Appendix A.

Building Uses

After assigning floor-area ratios, researchers determined what proportion of that space would be used for residential purposes and what proportion would be used for commercial purposes. This ensured that the research would not double-count building space as supplying jobs and housing simultaneously.

For each one of the four categories of place-types, a ratio of residential to commercial space was created, as follows:

[6] A one-story building that covered the entire property would have a FAR of 1.0, and a two-story building that covered half of the property would also have a FAR of 1.0.

Table 3: Building space allocations for each future place-type land use category.

	Residential	Non-residential
Residential	95%	5%
Mixed-Use	80%	20%
Town Center / Downtown	30%	70%
Employment Center	0%	100%

The floor-area ratios, land acreage, and percentage of space devoted to residential / commercial use were multiplied together to calculate the residential / commercial square footage of each parcel.

Building use allocations and other assumptions for each place-type are found in Appendix A.

Residential Unit Sizes and Common Areas

To calculate the number of homes in a building of a given size, the buildings' residential square footage had to be split into a number of residential units.

But first, in place-types with a significant amount of multifamily structures, a portion of building space was first assigned to common space, like elevators, mailboxes, storage lockers, laundry facilities, exercise gyms, and childcare centers. This percentage was generally 20%, except in place-types that would have a relatively low number of multifamily buildings. Since multifamily buildings have smaller unit sizes, many activities occur in shared indoor spaces.

The remaining space will be used for private residential units. To calculate this number, each place-type was assigned an average residential unit size. To translate residential square footage (per acre) into the number of dwelling units (per acre), researchers divided the amount of private residential space by the unit size needed.

Larger unit sizes were assigned to both the highest- and lowest-density place-types. Taller buildings were assumed to need larger units to reflect the "luxury condominium" or "penthouse" phenomenon, and more spread-out neighborhoods were also assumed to include larger homes.

The minimum unit size used in this project was 1,000 square feet. Considering the units envisioned to be built (gross units), the average size of units built will be over 1,250 square feet. Over 20% of units built will be 1,800 square feet or larger.

Residential unit sizes, common area percentages, and other assumptions for each place-type are found in Appendix A.

Space Needed Per Employee

To calculate the number of employees a building could accommodate, the non-residential building space was divided by the average employment density (square feet per employee) for parcels within that place-type.

To assign densities, researchers compiled and consulted studies of existing employment densities. A summary of studies is available in Appendix B. To better understand employment densities in buildings of different heights and in different locations, particularly in Bay Area cities, researchers

consulted the Building Owners and Managers Association (BOMA) International *2004 Experience Exchange Report* (2003 data).[7] Employment densities were revised in collaboration with the consulting firm Strategic Economics.

Employment densities were assigned primarily based on general assumptions about the type of commercial and industrial activities that could occur in different neighborhood types. In residential neighborhoods, commercial space may primarily be occupied by retail uses. In mixed-use and downtown place-types, commercial activities may primarily use office space. Employment center place-types, particularly in the lower densities, would mostly consist of industrial and manufacturing uses. These assumptions meant that mixed-use and downtown place-types had the highest employment densities, residential place-types had medium employment densities, and the more spread-out employment center place-types that were suitable for industrial uses had lower employment densities.

Employment densities also varied by building height. They were highest in buildings of medium density. As building sizes decreased, employment densities become somewhat less intense. As building sizes increased, employment densities also decrease, perhaps since they include more luxury suites that require more space per employee.[8]

Employment densities (square feet per employee) and other assumptions for each place-type are found in Appendix A.

Evaluation of Assumptions

In addition to those listed above, the following are important assumptions that this project made in assigning densities:

- Public amenities such as parks, streets, schools, town halls, and fire stations are available throughout the city already. The densities in the model are net densities and reflect what could be built on single parcels of privately owned land.
- These floor-area ratios will be made possible through forward-looking planning and zoning policies. Many of these floor-area ratios are not allowed currently by city planning and zoning laws. Maximum building heights and densities should be increased, and minimum building heights and densities should be established. Similarly, parking requirements need to be reduced. Parking policies should set no minimum parking requirements, and should even establish a maximum amount of allowable parking. Creative parking solutions that reduce building space used for parking, such as parking lifts, should be encouraged. Parking should be built underground whenever possible. A strong public transportation system needs to make it possible to get around without driving, and local governments should encourage a wide range of strategies such as bike lanes, pedestrian greenways, and free or reduced-cost transit passes that

[7] It reports that in 2003, in office buildings in downtown San Francisco, the average space per office worker was 313 square feet (N=58). Suburban San Francisco (322 sq.ft/worker, N=6) and suburban San Jose were similar (343 sq.ft./worker, N=7). Suburban Oakland (295 sq.ft./worker, N=46) and downtown San Jose (230 sq.ft./worker, N=4) were substantially more dense, whereas downtown Oakland was less dense (462 sq.ft./worker, N=4).

[8] Building Owners and Managers Association (BOMA) International *2004 Experience Exchange Report* (2003 data).

could reduce the need to drive. Parking should be priced to reflect the cost of these measures, and only those using the parking should pay this cost.

- Developing homes that fit each neighborhood type will allow for a range of housing sizes, types, and ownership options—including apartments, single-family homes, condominiums, townhomes, and other options—in appropriate locations, at costs that are affordable to a range of income groups. The research allocates housing by neighborhood type, and it does not attempt to balance unit size, household size, and shifts in regional demographics; regional incomes, housing prices, and affordability; or other factors. It would have been beyond the scope of this project to re-assign neighborhood types to balance these factors. Greenbelt Alliance supports efforts to create a diversity of housing options and to promote affordable housing.
- Developing jobs that fit each neighborhood type will allow for a range of employment types within the region—including industrial, retail, office, and other jobs—in appropriate locations, at wages that would support a family. This research allocated jobs by neighborhood type, and it does not attempt to balance jobs by industry, occupation, and worker education level; shifts in regional competitiveness; wages and costs of living; or other factors. It would have been beyond the scope of this project to re-assign neighborhood types to balance these factors. Greenbelt Alliance supports efforts to create a range of employment options and to promote job training and local hiring.

More information on the research assumptions is available in the audit produced by Strategic Economics (see www.growsmartbayarea.org and click on "other research").

Identifying What is New Growth by Subtracting Current Uses

After estimating the number of new homes or jobs that could be found on any given property, the research needed to subtract the amount of homes or jobs that may be found there now, as those would need to be relocated into the new buildings being built.

Residential: existing dwelling units

To know how many additional homes infill projects could add to the region, researchers had to subtract the number that infill sites are already providing. Estimates for these units were generated in two ways. The CIPL dataset identified duplexes, triplexes, and quadruplexes, so for properties with four or fewer units, the actual number of units was known. Rural home sites and mobile homes were assigned one current dwelling unit. Parcels with non-residential uses, vacant parcels, or $0 of improvement value had their current number of dwelling units set at zero.

On parcels with multifamily or group housing, census data were employed to make estimates. The census reports the number of units contained in different building sizes. Data is grouped in clusters (5-9 units; 10-19 units; 20-49 units; and 50+ units). For each census block, a weighted average of the possible high and low number of dwelling units per structure was created. An average of the high and low estimates was then attributed to any infill site within that census block that had a multifamily use.

The method for estimating the residential units essentially assumes that all multifamily properties within a census block have the same number of units. Since infill sites are the less-utilized and less-valuable within an area, this method should overestimate the number of current units and underestimate the number of new units.

This method was also applied to parcels with the following current uses: apartment, cabin, co-op, frat/sorority house, mobile home co-op, mobile home park, multi family dwelling, nursing home, Planned Unit Development (PUD), residential (NEC), stores & residential.

Commercial: current jobs

To subtract current jobs, estimates were created regarding the number of jobs present now. These estimates were based on properties' current uses. Assumptions were made about a given use's FAR and employee density (employee / sq. ft). These assumptions were somewhat less dense than the future projected densities, based on the assumption that these properties are known to be underused. Then, based on the acreage of the property, the number of likely current employees was calculated. Any property with $0 improvement value was also considered to have no current jobs.

Removing Parcels with No Infill Potential

If the subtraction of current uses suggested that more jobs or housing would need to be relocated than could be created on-site, the growth potential for the site was "zeroed out" and the parcel was removed. A property was not zeroed out when it had negative net homes (or jobs) if it also produced at least one net job (or home); it was only removed if one category (jobs or homes) was negative and the other was less than 1.0. Altogether, the number of parcels outside of PDAs dropped from 32,555 to 25,078 when removing parcels without infill potential. The properties most often zeroed out have a current use of multifamily (2,469 parcels), Planned Unit Development (PUD) (2,215 parcels), duplex (1,092 parcels), and apartment (703 parcels).

Table 4: Number of parcels evaluated and likely to redevelop.

	Parcel Locator Sites*	Greenbelt Alliance Sites (after parcel exclusions)	Opportunity Sites Likely to Redevelop (after parcels zero out)
Inside PDAs**	22,465	18,428	16,539
Outside PDAs	47,839	32,555	25,078
Total	70,304	50,983	41,617

* Source: Institute for Urban & Regional Development. California Parcel Infill Locator Database method, 2006 parcel data.

** Infill estimates within PDAs are later replaced by estimates from ABAG and local jurisdictions. Parcels inside and within 50' of PDAs are generally not used in calculating infill projections or statistics about Opportunity Sites.

In general, particularly in the analysis section of this document, the research uses "opportunity sites" to refer to those sites outside of Priority Development Areas that did not zero out.

Evaluation of Assumptions

The following are important assumptions that this project made in subtracting the current uses from the net growth on a property:

- Even sites that assessors' data suggest may have some current use, either commercial or residential, could redevelop. Safeguards that prevent unfair evictions and drastic rent increases, and policies that promote affordable housing, are needed to ensure that redevelopment of

current uses does not happen via displacement or gentrification. These policies are described more fully in *Smart Infill*. For a copy, see see www.growsmartbayarea.org and click on "Here's How" and choose "Meeting the Challenge."
- The fact that almost one-fifth of the parcels "zeroed out" because they were projected to add fewer housing or jobs than they currently have suggests that densities used for estimating current and future potential err on the side of overestimating the current uses and underestimating future potential.

Estimating Distributed Growth Due To In-Law Units

Across the region in residential areas, landowners will create new places to live without redeveloping properties by making minor changes to existing properties. Homeowners may build "granny cottages" or "in-law units," or convert their garage, basement, shed, or guest rooms into separate apartments. Investors or homeowners may buy a single house, possibly make additions, and sell the building as several separate condominiums. Creating additional housing by making these minor changes to neighborhoods is an easy way for infill to happen.

Neighborhoods selected for development of in-law additions were those where the Smart Growth Strategy/Regional Livability Footprint Project had originally mapped the entire neighborhood as a dial-up place-type, including "+R," a 5% increase in the residential use, and "+B," a percentage increase in both the residential and employment uses.

Greenbelt Alliance assumed that these neighborhoods will increase by about 5%, or one new home per city block, as recommended by the Smart Growth Strategy/Regional Livability Footprint Project. This 5% was applied to census block data from Census 2000. Where only a portion of a census block intersected with these neighborhoods, it was assumed that the housing counted by the census was evenly distributed across the block. Where the centroid of the block fell outside of urbanized land or in an urban polygon 300 acres or smaller, the in-law unit potential for that block was dropped.

Evaluation of Assumptions

The following are important assumptions that this project made in adding growth due to in-law units:

- The Smart Growth Strategy/Regional Livability Footprint Project asked participants to look ahead to the year 2020. This research looks from 2005 to 2035. Presumably, if a growth of 5% occurs between 2002 to 2020, then that same amount of growth, or more, could occur by 2035.
- When calculating infill growth, the 5% increase was calculated from the 2000 census. The number of households in the region is estimated to have increased by 4.7% since 2000 (Projections 2009). Using the lower 2000 census number as the base for adding 5% will cause the prediction to err slightly on the lower side.

Incorporating Current Plans

The basic infill model relies on a parcel-based analysis of what will be built on individual parcels based on their current property values. Because the data comes from county assessors, it does not include any publicly owned land. It would also underestimate infill development in any

neighborhood where current property values would not suggest properties are economically available but where city improvements are likely to raise property values to a point that it would catalyze a cascade of new infill. To reflect these two important factors, areas where focused local government effort will take place were added to the model.

Cities and towns are actively promoting infill development, often downtown or near transit stations or corridors. They can and did apply to have those places designated as Priority Development Areas. The Association of Bay Area Governments estimated housing and job growth in those areas and modified them based on feedback of local jurisdictions.

Greenbelt Alliance incorporated the Priority Development Areas and dropped both opportunity sites and in-law units in those areas. Where PDAs overlapped one another, the estimates were adjusted using ABAG information to avoid double-counting.

Greenbelt Alliance dropped census tract sections of a PDA whenever the entire tract in that PDA fell outside of urbanized land. This was found to apply to only one location (5021.00 in PDA "VTA1," the farmland in Coyote Valley south of San Jose).

Evaluation of Assumptions

The following are important assumptions that this project made in adding the Priority Development Areas:

- In integrating the PDA estimates created by the Association of Bay Area Governments in consultation with cities, Greenbelt Alliance integrated the assumptions from that project.
- In keeping census tract sections that partially overlapped non-urbanized land, Greenbelt Alliance assumed that the growth would be directed into urbanized areas within that tract.

RESULTS AND ANALYSIS

Overview of Results

According to the Associations of Bay Area Governments' Projections 2009, between 2005 and 2035, the region will need an additional 720,000 households and 1.66 million jobs.

This research shows that between 2006 and 2035, infill development in the region can add 1.69 million jobs (102% of the need) and 785,000 new homes (109% of the need).

Where Growth Will Happen

This infill development can be concentrated within seven sub-regions in the Bay Area where new development is most appropriate. Together, these smart spots could accommodate approximately four-fifths of the region's growth needs.

Table 5: Net infill homes and jobs, by smart spot.

	Net Homes	Homes (% of Need)	Net Jobs	Jobs (% of Need)
Northeast Santa Clara County	187,526	26%	339,661	20%
El Camino Real	98,849	14%	240,264	14%
Inner East Bay	105,691	15%	140,214	8%
San Francisco	54,189	8%	257,567	16%
Southern Alameda	56,543	8%	95,188	6%
Central Contra Costa	43,490	6%	131,722	8%
SMART Corridor	37,730	5%	100,226	6%
Total	584,018	81%	1,304,841	79%

The smart spot that can accommodate the most growth is Northeast Santa Clara County. For more details about these places, see www.growsmartbayarea.org and click on "It's possible."

Some of these areas are bigger or smaller than others. Comparing the amount of new development to the amount of urbanized land suggests that Northeast Santa Clara County will be developing more housing for its size than anywhere else in the region and also developing a high number of jobs for its size. The San Francisco smart spot will experience the highest job growth for its size.

Table 6: Intensity of infill development, by smart spot.

	Urban Acres	Net Homes / Acre	Net Jobs / Acre
Northeast Santa Clara County	27,220	6.9	12.5
El Camino Real	25,085	3.9	9.6
Inner East Bay	29,929	3.5	4.7
San Francisco	15,242	3.6	16.9
Southern Alameda	21,925	2.6	4.3
Central Contra Costa	16,923	2.6	7.8
SMART Corridor	14,277	2.6	7.0
Total	150,602	3.9	8.7

To create smart spots, researchers identified clusters of infill that fit Bay Area planning geographies. The opportunity site and in-law unit data were aggregated at the scale of census blocks. Census blocks were included if they had one net dwelling unit per acre or ten net jobs and if they were near other qualifying census blocks, using a semi-final version of the data.

Two smart spots were drawn to specifically concentrate along transit corridors: the Sonoma-Marin Area Rapid Transit (SMART) line and the El Camino corridor. Smart spot boundaries were drawn to include the full extent of nearby PDAs and downtowns where appropriate. When a PDA crosses the smart spot boundary, the appropriate portion of growth was allocated to each smart spot using ABAG's growth estimates by census tract for each PDA. After clustering the census blocks into smart spots, their edges were smoothed.

How Growth Will Happen

Growth will happen in three main ways: through real estate and development activity on opportunity sites; through homeowner improvements or minor intensification of existing buildings on in-law housing sites; and through intensive local government efforts inside Priority Development Areas.

Growth on underused properties can provide 42% of needed homes and 38% of needed jobs, and an additional 4% of needed homes can be provided by in-law (granny) units. Since Priority Development Areas can accommodate the bulk of the growth (63% of needed homes and 64% of needed jobs), local government activity to foster infill development is crucial.

Table 7: Distribution of new infill jobs.

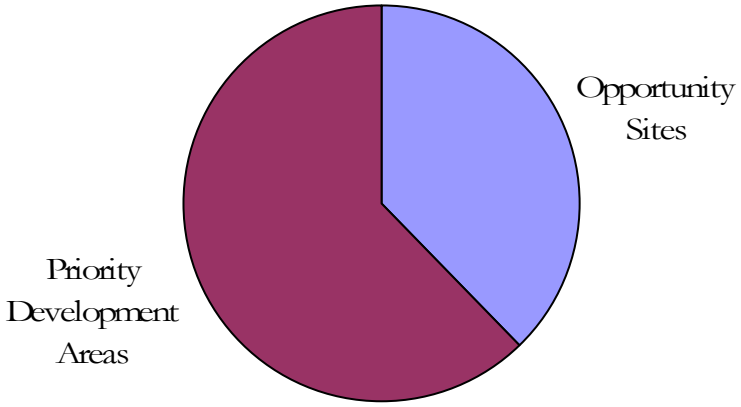
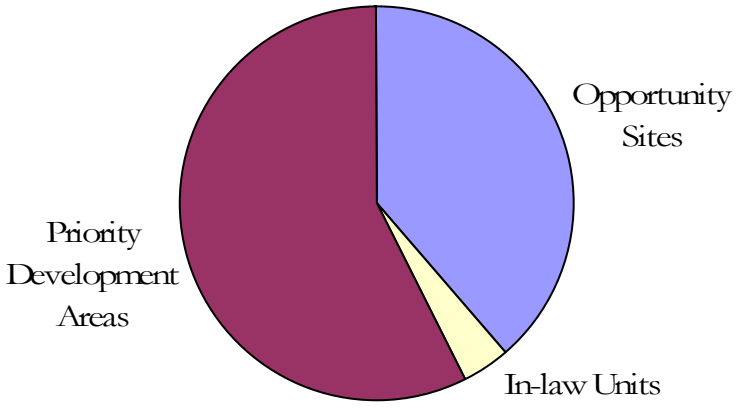


Table 8: Distribution of new infill homes.



Opportunity Sites

Throughout the Bay Area, on land outside of local jurisdictions' Priority Development Areas, more than 25,000 opportunity sites can make room for new infill development. Across their combined 17,000 acres, these properties can provide the region with an additional 303,732 homes and 636,836 jobs.

Below is more detail on these opportunity sites.

Current Uses of Opportunity Sites

Many of these opportunity sites are vacant, and others are in current use today. Of the approximately 17,000 acres outside of Priority Development Areas, around 31% are vacant now. Others are used for residential, industrial, commercial, and other uses.

Table 9: Current uses on opportunity sites likely to redevelop.[9]

	Acres	Homes (Current)	Jobs (Current)
Vacant	5,327	-	-
Residential	4,198	58,444	-
Manufacturing, Wholesale, Transportation, & Other Industrial	2,808	-	38,082
Retail & Other Commercial	2,225	26	45,501
Other & Mixed Use	1,299	1,592	7,202
Health, Education, Recreation, & Other Services	676	135	7,889
Financial and Professional Service, Office	636	-	38,745
Grand Total	17,168	60,197	137,420

The research assumes that some buildings currently used for housing or employment could be redeveloped at some point between 2005 and 2035. Public policies are important to ensure that the relocation of these jobs and homes does not displace current residents or occur due to rapid neighborhood gentrification.

The model shows some lands converting from residential to employment uses, and vice versa. The research allows the Smart Growth Strategy/Regional Livability Footprint Project's designation for an area's future use to differ from its current use, which is taken from the California Infill Parcel Locator assessors' parcel data. In some cases, this change in land use may happen. In others, it may not, and the discrepancy in uses may be due to differences in the scale of the data sources. The research assumes that these discrepancies would average out across the region.

Place-types of the Opportunity Sites

Each opportunity site falls into one of approximately twenty-five neighborhood types. A parcel's place-type describes the character of the building and neighborhood. Descriptions of the place-types are included in Appendix A. The results below show the distribution of opportunity sites outside of Priority Development Areas across place-types. The results will be discussed according to several key building and neighborhood characteristics in the sections and tables below.

[9] Opportunity sites are parcels outside of PDAs likely to redevelop. This table does not reflect the redevelopment occurring in Priority Development Areas or as in-law apartments.

Table 10: Place-types for new infill homes and jobs on opportunity sites.[10]

	Acres	Homes (Future)	Jobs (Future)
1B Residential High	9	1,332	219
1C Residential Medium-High	69	4,682	770
1D Residential Medium	636	18,650	2,911
1E Residential Low	4,278	56,041	12,406
1F Residential Very Low	2,716	18,737	5,268
1G Residential Rural Residential	103	20	4
2AB Mixed Use Almost Very High	23	3,111	4,861
2B Mixed Use High	190	22,786	23,734
2C Mixed Use Medium-High	191	18,646	19,423
2D Mixed Use Medium	895	54,891	49,011
2E Mixed Use Low	1,562	53,878	42,759
2F Mixed Use Very Low	3,204	79,557	71,771
3B Downtown High	70	3,694	35,920
3C Downtown Medium-High	220	6,431	62,524
3D Downtown Medium	1,030	16,348	141,299
3E Downtown Low	450	5,125	43,156
4A Employment Center High	48	-	31,474
4B Employment Center Medium	520	-	129,371
4C Employment Center Low	670	-	91,782
4D Employment Center Very Low	284	-	5,592
Grand Total	**17,168**	**363,929**	**774,257**

Future Uses of the Opportunity Sites

Redeveloping these opportunity sites will improve and strengthen neighborhoods. The Smart Growth Strategy/Regional Livability Footprint Project includes four categories of neighborhoods: residential, mixed-use, town center / downtown, and employment center. This research suggests that on opportunity sites outside of Priority Development Areas, the greatest number of acres will be residential neighborhood types, but that the vast majority of homes will be found in mixed-use neighborhoods that also have nearby shops and services. Employment will be distributed throughout the different neighborhood types, but the greatest density of new jobs will occur in downtown and employment center neighborhoods.

[10] These opportunity sites are parcels outside of Priority Development Areas likely to redevelop. This table does not reflect the redevelopment occurring in PDAs or as in-law apartments. It includes gross homes and jobs, before current dwelling units and jobs are subtracted, to best envision these areas in the future. The totals for future homes and jobs are therefore higher than the net increase in homes and jobs, since current jobs and homes will be relocated to this space and subtracted from the gross future homes and jobs to find the net increase. Because this table focuses on areas outside of PDAs, often cities' downtowns or transit station areas, it may somewhat overemphasize lower density areas.

Table 11: Land use categories for future homes and jobs on opportunity sites.[11]

	Acres	Homes (Future)	Jobs (Future)
Residential	7,811	99,462	21,579
Mixed-Use	6,065	232,869	211,560
Town Center / Downtown	1,770	31,598	282,899
Employment Center	1,522	-	258,219
Total	17,168	363,929	774,257

Future Heights of the Opportunity Sites

One concern about infill is whether it will include inappropriately tall buildings. The research does not suggest that most properties on opportunity sites outside of Priority Development Areas (PDAs) will be tall. Approximately two out of every three infill acres outside of PDAs will develop at heights of one to two stories. Nearly half of homes, and 30 % of jobs, will be found in these one- to two-story buildings. Of what remains, almost all will develop as three- to four-story buildings.

Table 12: Heights for future homes and jobs built on opportunity sites.[12]

	Acres		Homes (Future)		Jobs (Future)	
1 to 2 stories	11,705	68%	159,480	44%	229,980	30%
3 to 4 stories	4,711	27%	148,449	41%	366,121	47%
5 to 6 stories	459	3%	25,076	7%	113,422	15%
9 stories	269	2%	27,812	8%	59,873	8%
12 stories	23	0%	3,111	1%	4,861	1%
Grand Total	17,168		363,929		774,257	

[11] See Footnote 10.

[12] See Footnote 10.

Table 13: Heights for infill land (acres) on opportunity sites.[13]

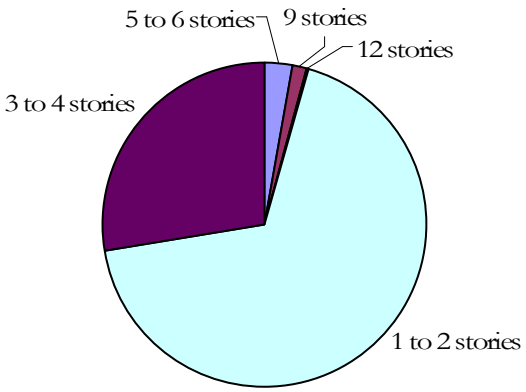


Table 14: Heights for future homes built on opportunity sites.[14]

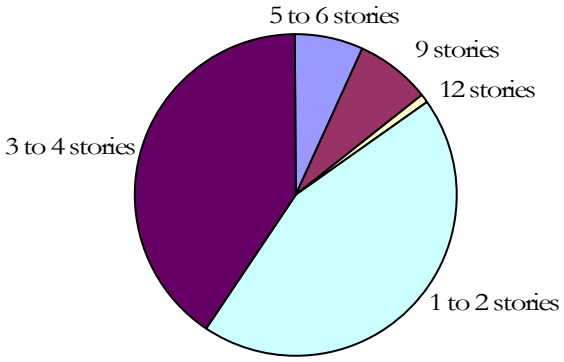
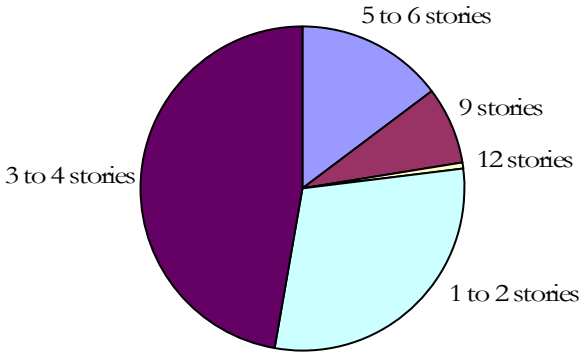


Table 15: Heights for future jobs built on opportunity sites.[15]



[13] See Footnote 10.

[14] See Footnote 10.

[15] See Footnote 10.

Parcel Sizes of the Opportunity Sites

Another common concern about infill development is the size of the parcels and the feasibility of building on parcels of that size. However, in the model, over 66% of the model's projected housing units and 70% of the model's projected jobs on opportunity sites outside of Priority Development Areas are on plots larger than an acre.

Table 16: Infill development on opportunity sites by parcel size.[16]

	Parcels		Acres		Homes (Future)		Jobs (Future)	
> 5.0 acres	578	2%	6,401	37%	124,834	34%	277,079	36%
> 2.0 acres	1,679	7%	9,870	57%	196,231	54%	447,173	58%
> 1.0 acres	3,221	13%	12,013	70%	240,806	66%	541,426	70%
> .75 acres	4,208	17%	12,891	75%	258,165	71%	585,813	76%
> .50 acres	5,739	23%	13,827	81%	277,599	76%	631,058	82%
> .25 acres	9,365	37%	15,128	88%	305,166	84%	687,661	89%
All parcels	25,078		17,168		363,929		774,257	

Many of the parcels identified by Greenbelt Alliance's model are quite small. In fact, approximately 87% of sites are less than one acre. However, because of their small size and their projected neighborhood types, those small sites are not expected to accommodate much growth.

The majority of parcels identified by Greenbelt Alliance's model that are one acre or smaller would develop as low-density uses that are feasible to build on smaller lots. Within Greenbelt Alliance's model almost two-thirds (64%) of land split into parcels under an acre would be built at just one- or two-story heights, and almost all (93%) would be four stories or less, a height which can still be built with less costly construction methods.

Table 17: Heights of small parcels (parcels 1 acre or smaller).[17]

	Acres	
1 to 2 stories	3,303	64%
3 to 4 stories	1,488	29%
5 to 6 stories	228	4%
9 stories	135	3%
12 stories	1	0%
Grand Total	5,155	

[16] See Footnote 10.

[17] See Footnote 10.

Unit Sizes of the Opportunity Sites

Across the region, on opportunity sites outside of Priority Development Areas, the average unit size will be 1,256 square feet per unit. Larger units are available for those larger families who need them, with over 20 percent 1,800 square feet or larger.

Table 18: Future homes by unit size (square feet).[18]

	Homes (Future)
1,000	182,688
1,200	103,332
1,500	3,111
1,800	56,041
2,400	18,737
2,500	20
Average	1,256

Single family homes

How many of the homes in the model are single-family, and how many would that mean would be available across the region? According to the California Department of Finance, in 2005, the base year for the model, almost 1.7 million homes (62%) in the Bay Area are single family (attached and detached). The model adds almost 85,000 single-family homes, causing the percentage region-wide to drop from 62% down to 53% of all homes being single family.

The place-types 1E, 1F, and 1G are conservatively assumed to be the only single-family homes (attached and detached) added in the model. While the townhomes in 1D and the horizontal mixed use in 2F might also be single family, those are not included here. This calculation includes homes outside of PDAs, and it also includes homes inside PDAs, after assuming that land inside PDAs develops according to its place-type but and then increases by 80%.

Table 19: Current and future single-family homes (attached and detached).[19]

	2005	2035
Single family homes	1,663,892	1,748,738
Total homes present / needed	2,663,491*	3,302,780**
Percent of homes that are single family	62%	53%

* Source: California Department of Finance

** Source: ABAG's Projections 2009

[18] See Footnote 10.

[19] Unlike the preceding tables, this analysis focuses on net homes, and it includes parcels within Priority Development Areas. It makes the assumption that infill growth within PDAs occurs on opportunity sites and within in-law neighborhoods. An increase of 80% was then applied. This table differs from others because researchers were particularly concerned that excluding the higher-density downtown areas found in PDAs could bias the results.

In-Law Units

Incremental infill within existing neighborhoods provides a small number of homes: 4% (29,096) of homes created. These were included in the model because they are an important way that infill can happen that creates minimal changes to the surrounding neighborhoods, boosts home affordability for homeowners, and makes room for more socioeconomic diversity within a community.

Priority Development Areas

This research incorporates local governments' plans for infill growth. The Association of Bay Area Governments' Priority Development Areas (PDAs) encompass the most intense areas of focused infill growth and therefore provide a significant portion of both the housing and jobs. According to estimates created by ABAG and local jurisdictions, approximately 63% of needed homes and 64% of needed jobs can be accommodated as infill in Priority Development Areas. Within the PDAs, according to the most current data available as of the time of this research, and after subtracting non-urban PDA census tracts, over 450,000 homes and nearly 1,050,000 jobs can be accommodated as infill.

Priority Development Areas estimates are higher than the model's projection of the infill capacity within those neighborhoods. PDAs appear to increase the infill potential of those neighborhoods over the estimates achieved by opportunity sites and in-law housing units by approximately 50% in employment and 80% in housing.

The efforts of local governments are crucial, and it makes sense that these would boost local infill potential, for several reasons. First, the infill model does not include any publicly owned land, such as BART parking lots or military bases. The efforts of local governments can make this additional land available. Second, targeted city activity can raise property values. This brings more redevelopment activity. The model would show this as future updates of the assessors' parcel data would show more parcels falling below the 1:1 improvement-to-land value ratio and become economically viable for redevelopment.

Without the city efforts and addition of public lands reflected in the PDAs, the region is unlikely to succeed at providing the needed homes and jobs. The Bay Area could not achieve the targets through profit-driven real estate activity alone. The research shows the importance of supporting local government activities that will encourage infill development.

CONCLUSION

This document is intended to provide the technical details that support Greenbelt Alliance's infill research. The data here raises interesting questions about the growth coming to the Bay Area, the benefits and challenges of growing in this way, and key policy changes necessary to make this possible. Commentary on these questions are available in *Smart Infill*, a practical how-to guide that also includes key questions and answers about infill, as well as the *Grow Smart Bay Area* brochure and website (www.growsmartbayarea.org).

The methodology and results suggest four main conclusions:

- ➔ The research underestimates the Bay Area's infill potential. Although no dataset and therefore no analysis can be perfect, the exclusions of single-family homes, condominiums, and some publicly owned land from the data; the use of only properties that are economically viable in 2006; and the use of a vision intended to be achieved by 2020 when dealing with a scenario further in the future all suggest that the Bay Area has even more infill potential than calculated.

- ➔ The infill model is based on input from community members, elected officials, and other experts. The Smart Growth Strategy/Regional Livability Footprint Project involved over 2,000 people around the region, and now, the planning for Priority Development Areas will involve the active participation of local communities.

- ➔ The homes and employment areas that this research envisions are not a radical change from what the Bay Area looks like today. Two-thirds of the land and over 40% of homes built outside Priority Development Areas will be built at heights of one to two stories.

- ➔ Developing in this way will make the Bay Area an even better place to live. Redeveloping underused land, one-third of which is vacant now, into mixed-use urban areas, could increase housing options and provide affordable, walkable, active communities for current and future residents.

- ➔ The critical challenges are ensuring that development hits the density targets and that cities succeed in their efforts to bring more housing to their downtown and transit areas. Public policies should encourage cities to enact minimum densities and raise or eliminate maximum densities, enact maximum parking requirements and parking pricing policies and reduce or eliminate minimum parking requirements. Regional, state, and federal support is necessary to create incentives for these actions and to ensure that cities have the resources they need to successfully focus growth into the Priority Development Areas.

This research confirms that it is possible for the Bay Area to accommodate projected growth within its already-urbanized footprint.

Appendix A: Place-type Descriptions and Densities

				Building Information				Job Densities		Residential Densities		
Place-type	**Original Description** (Source: Smart Growth Strategy / Regional Livability Footprint Project)	**Original Examples** (Source: Smart Growth Strategy / Regional Livability Footprint Project)	**Revised Description**	**Avg. Stories**	**Floor-Area Ratio**	**Non-Residential %**	**Residential %**	**Sq.Ft / Job**	**Job / Acre**	**Unit Size**	**Common Area**	**Du / Ac**
1A Residential Very High	Twenty or more stories of Residential with supporting Commercial.	Portions of downtown San Francisco; Portions of Chicago, IL; Manhattan, NY	Residential skinny towers with ground-floor retail	25	10.8	5%	95%	400	59	1,500	20%	238
1B Residential High	Eight or more stories of Residential with supporting Commercial.	San Francisco (Golden gateway, South Beach high-rise, Pacific Heights/Alta Plaza); Emeryville (Pacific Park Plaza)	Residential mid-rise with ground-floor retail	9	4.3	5%	95%	400	23	1,000	20%	142
1C Residential Medium-High	Four or more stories of Residential with supporting Commercial.	San Francisco (South Beach mid-rise); San Jose (River Oaks Village/Montague Expressway area)	Residential apartment/condo buildings with ground-floor retail	4	2.0	5%	95%	400	11	1,000	20%	68
1D Residential Medium	Three-story average Residential (apartments, townhouses and small-lot single family) with supporting Commercial zones.	Mountain View (The Crossings); San Mateo (Mariner's Island); North Berkeley	Residential mix of apartments, town homes and small-lot single family with supportive retail	3	0.9	5%	95%	450	5	1,200	10%	29
1E Residential Low	Single-family developments, some two-story garden apartment developments, with supporting Commercial centers.	Residential areas of Pleasanton, Livermore, San Ramon, San Jose (Almaden Valley), Menlo Park, Rohnert Park, Novato, Fairfield	Residential garden apartments and small-lot single family with nearby commercial centers	2	0.6	5%	95%	450	3	1,800	5%	13
1F Residential Very Low	Large-lot single family, minimal Commercial.	Los Altos Hills, Alamo, Ross, Hillsborough	Large-lot single family homes with minimal supportive commercial	2	0.4	5%	95%	450	2	2,400	0%	7
1G Residential Rural Residential	Large acreage ag-oriented single family (5+ acre typical), minimal Commercial.	Pope Valley, Alexander Valley	Large-acreage agriculture-oriented single family (5 acres or more), minimal commercial	2	0.0	5%	95%	600	0	2,500	0%	0
2AA mixed Use increase			High-rise mixed-use downtown district tending residential (i.e. downtown Chicago/Manhattan)	40	21.5	20%	80%	350	536	1,500	20%	400
2A Mixed Use Very High	Twenty- or more story Commercial, Office and Residential buildings with many high-rise buildings, highly intermixed. Numerous buildings with Office or Residential over Commercial.	Portions of downtown San Francisco; Portions of Chicago, IL; Manhattan, NY	High-rise mixed-use downtown district tending residential (i.e. parts of SOMA in San Francisco)	25	12.0	20%	80%	350	299	1,500	20%	223
2AB Mixed Use Almost Very High			Mid-rise/high rise mixed-use district tending residential (i.e. Van Ness Avenue corridor)	12	7.2	20%	80%	300	209	1,500	20%	134
2B Mixed Use High	Eight- or more story Commercial, Office and Residential buildings with many high-rise buildings, highly intermixed. Numerous buildings with Office or Residential over Commercial.	San Francisco (Van Ness Avenue corridor)	Mid-rise mixed-use district tending residential (i.e. San Francisco Mid-Market district)	9	4.3	20%	80%	300	125	1,000	20%	120
2C Mixed Use Medium-High	Six-story average Commercial, Office and Residential buildings with some high-rise buildings, highly intermixed. Numerous buildings with Office or Residential over Commercial.	San Francisco (Northern Waterfront/North Beach, Upper Market Street)	Six-story average mixed-use tending residential (i.e. San Francisco's Upper Market, Northern Waterfront districts)	6	3.5	20%	80%	300	102	1,000	20%	98
2D Mixed Use Medium	Four-story average Commercial, Office and Residential buildings intermixed or in relative proximity to each other, including some buildings with Office or Residential over Commercial.	Oakland (Piedmont Avenue area, Rockridge); San Mateo (North El Camino Real)	Four-story average mixed-use tending residential (i.e. Adeline & San Pablo Avenues in Oakland/Emeryville)	4	2.2	20%	80%	350	55	1,000	20%	61
2E Mixed Use Low	Three-story average Commercial, Office and Residential buildings intermixed or in relative proximity to each other, including some buildings with Office or Residential over Commercial.	San Mateo (25th Avenue area), Palo Alto (California Ave area), San Jose (Alameda area), Berkeley (4th St.), Redwood City (El Camino Real), Sunnyvale (El Camino Real), San Francisco (Geary Blvd.)	Three-story average mixed-use tending residential (i.e. Berkeley's Fourth Street area or outer Geary Blvd in S.F.)	3	1.1	20%	80%	350	27	1,000	10%	34
2F Mixed Use Very Low	Two-story average Commercial, Office and Residential buildings intermixed or in relative proximity to each other, including some buildings with Office or Residential over Commercial.	Santa Rosa (Railroad Square), Larkspur-San Anselmo (Sir Francis Drake corridor)	Two-story average mixed-use tending residential (i.e. Santa Rosa's Railroad Square)	2	0.9	20%	80%	350	22	1,200	5%	25

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				Building Information				Job Densities		Residential Densities		
Place-type	**Original Description**	**Original Examples**	**Revised Description**	**Avg. Stories**	**Floor-Area Ratio**	**Non-Residential %**	**Residential %**	**Sq.Ft / Job**	**Job / Acre**	**Unit Size**	**Common Area**	**Du / Ac**
3AA SF Downtown increase			High-rise mixed-use downtown district (i.e. downtown Chicago/Manhattan)	40	24.00	70%	30%	350	2,091	1,500	20%	167
3A Downtown Very High	Twenty or more stories of mixed uses with many high-rise buildings.	San Francisco (Financial District); Chicago (Loop), IL; Midtown Manhattan, NY	High-rise mixed-use downtown district (i.e. San Francisco Financial District)	25	14.8	70%	30%	350	1,291	1,500	20%	103
3AB Downtown almost very high			Mid-rise/high rise mixed-use district (i.e. downtown Oakland)	12	7.4	70%	30%	300	752	1,000	20%	77
3B Downtown High	Eight or more stories of mixed uses with many high-rise buildings.	Oakland (Downtown); San Jose (Downtown)	Mid-rise mixed-use district (i.e. downtown San Jose)	9	5.0	70%	30%	300	513	1,000	20%	53
3C Downtown Medium-High	Five-story average of mixed uses with some high-rise buildings, surrounded by one- to four-story Residential buildings.	Downtown Santa Rosa, Downtown Walnut Creek, Downtown Palo Alto, Downtown San Mateo	Five-story average of mixed uses with some taller buildings (i.e. downtown Santa Rosa or Walnut Creek)	5	2.8	70%	30%	300	285	1,000	20%	29
3D Downtown Medium	Three-story average of mixed uses surrounded by one- to four-story Residential buildings.	Downtown Petaluma, Downtown Hayward, Downtown Fairfield, Downtown San Rafael, Downtown Los Gatos, Downtown Burlingame	Three-story average of mixed uses (i.e. downtown San Rafael)	3	1.4	70%	30%	300	137	1,000	10%	16
3E Downtown Low	Two-story average of mixed uses surrounded by one- to three-story Residential buildings.	Downtown Pleasanton, Downtown Orinda, Downtown Mill Valley, Downtown Vacaville, Downtown Healdsburg, Downtown Half Moon Bay, Downtown Saratoga, Berkeley (Elmwood)	Two-story average of mixed uses (i.e. downtown Healdsburg)	2	1.1	70%	30%	350	96	1,200	5%	11
3F Downtown Very Low			Two-story low-density average of mixed uses (i.e. downtown Pacifica)	2	0.5	70%	30%	350	42	1,200	5%	5
4A Employment Center High	Single-use Office/Light Industrial (many four stories or more), regional Retail Commercial and/or Institutional. Possibly some medium and/or high density multifamily Residential adjacent.	Business: Foster City/Redwood Shores, Great America area, Bishop Ranch. Retail: Stoneridge Mall, Sun Valley Mall, Hillsdale Mall, Eastridge Mall, Great Mall areas. Institution: UC Berkeley, UCSF. Airport: SFO, Oakland Int'l, San Jose Int'l	Single-use high-intensity suburban-style employment center (i.e. Redwood Shores, Great America employment areas)	6	4.5	100%	0%	300	653	1,500	0%	-
4B Employment Center Medium	Single-use Office/Light Industrial (three-story average), sub regional Retail Commercial and/or Institutional. Possibly some medium density multifamily Residential adjacent.	Business: South San Francisco (East of 101), Emeryville. Retail: San Mateo (Bridgepointe/Mariner's Island), Novato (Vintage Oaks area), Oakland/Emeryville (E.Baybridge), Milpitas (McCarthy Ranch). Institution: SF State, Stanford. Airport: Sonoma County.	Single-use subregional employment center, three-story average (i.e. SSF's Oyster Point, Emeryville Biotech Area)	3	2.0	100%	0%	350	249	1,500	0%	-
4C Employment Center Low	Single-use Office/Light Industrial (two-story average), regional Retail Commercial and/or Institutional. Possibly some low or medium density multifamily Residential adjacent.	Business: Newark, Palo Alto (bayshore), Santa Rosa (Airport Business Park) Retail: Pleasant Hill (Crescent Drive area), Daly City (Westlake Center Area) Institution: community colleges	Single-use Office/Light Industrial center, two-story average (i.e. airport business parks, community colleges)	2	1.1	100%	0%	350	137	1,500	0%	-
4D Employment Center Very Low	Single use buildings (typically Industrial use), one-story average.	Hayward (Industrial Blvd), San Carlos (Industrial Blvd), North Richmond, Oakland (Port of Oakland)	Single-use buildings, typically industrial, one-story average (i.e. Hayward industrial area)	0.4	100%	0%	950	20	1,500	0%	-	-

Appendix B: Employment Density Background Research

Job Cluster	NAICS Code	Industry Title	Planner's Estimating Guide [1] (gross)	Puget Sound [2] (gross)	SCAG [3] (gross)	Portland [4] (net)	San Jose [5] (gross)	Denver [6] (gross)	EPS [7] (gross)
			(square feet / employee)						
Agriculture & Natural Resource									
	11	Agriculture, Forestry, Fishing and Hunting		3,000		590			
	21	Mining				590			
Manufacturing, Wholesale & Transportation									
	22	Utilities		503		460		350-600	550
	31-33	Manufacturing	609	696	439		500		
	42	Wholesale Trade	698			1390	500		
	48-49	Transportation and Warehousing		1086	814	700	500		
Retail									
	44-45	Retail Trade	631	494	344	470	500	380	550
Financial & Professional Services									
	52	Finance and Insurance	350	292	288-311	370	250	330	300
	53	Real Estate and Rental and Leasing	350	292	288-311	370	250	330	300
	54	Professional, Scientific, and Technical Services	350	292	344		300	330	450
	55	Management of Companies and Enterprises	350	292	288-311		250	330	300
	56	Administrative and Support and Waste Management and Remediation Services							
Health, Education, & Recreational Services									
	61	Educational Services		766		770	350		
	62	Health Care and Social Assistance		323		350	350	430	
	71	Arts, Entertainment, and Recreation		697		740	350	140	
	72	Accommodation and Food Services			1152			140	
	81	Other Services (except Public Administration)							
Other									
	51	Information							
	23	Construction	288			590			
	92	Public Administration		429	261	530	250	270	

[1] Nelson, Arthur. Planner's Estimating Guide: Projecting Land-Use and Facility Needs. Chicago, Illinois: Planner's Press. 2004

[2] Pflum, Kapena. Employment Density in the Puget Sound Region. University of Washington, Daniel J. Evans School of Public Affairs. 2004.

[3] The Natelson Company, Inc., and Terry A. Hayes Associates. Employment Density Study: Summary Report for the Southern California Association of Governments. 2001. http://www.scag.ca.gov/forecast/downloads/employ_den.pdf

[4] Yee, Dennis and Jennifer Bradford. Technical Report: 1999 Employment Density Study. April 1999. http://www.metro-region.org/library_docs/maps_data/1999employmentdensitystudy.pdf

[5] Strategic Economics. Towards the Future: Jobs, Land Use and Fiscal Issues in San Jose's Key Employment Areas 2000-2020. Prepared for the City of San Jose. February 2004.

[6] City of Boulder Planning Department. Projecting Future Employment - How Much Space Per Person? June 11, 2002.

[7] Converstation with Rebecca Benassini of Economic & Planning Systems; February 21, 2007

This overview is part of work done for Greenbelt Alliance by Sheila Curtis Nickolopoulos while a graduate student fellow at UC Berkeley's Graduate School of Public Policy.