Appendix B

Framework for Buildable Lands Analysis

This appendix describes a framework for buildable land analyses. The general methods it describes provide the theoretical background to the detailed work program outlined in Chapters 4, 5 and 6 that provides a methodology specific to Snohomish County and its communities. Consequently, there may be some instances where inconsistencies exist between the material contained in this appendix and the more specific methods recommended in previous chapters. In these instances, the approaches outlined in the previous chapters should be given greater consideration since they are the result of extensive Technical Advisory Committee review and discussion.

The appendix is organized as follows:

- Overview of a typical buildable lands analysis
- Approaches to analyzing demand for and supply of land

OVERVIEW OF BUILDABLE LANDS ANALYSIS

A buildable land analysis as defined by state law has not only a *supply* component, but also a *demand* component. The GMA requires local governments to address two questions: (1) Do local governments have enough suitable land to accommodate the growth anticipated during the remaining portion of the 20-year planning period? and (2) Are urban densities being achieved in urban growth areas?

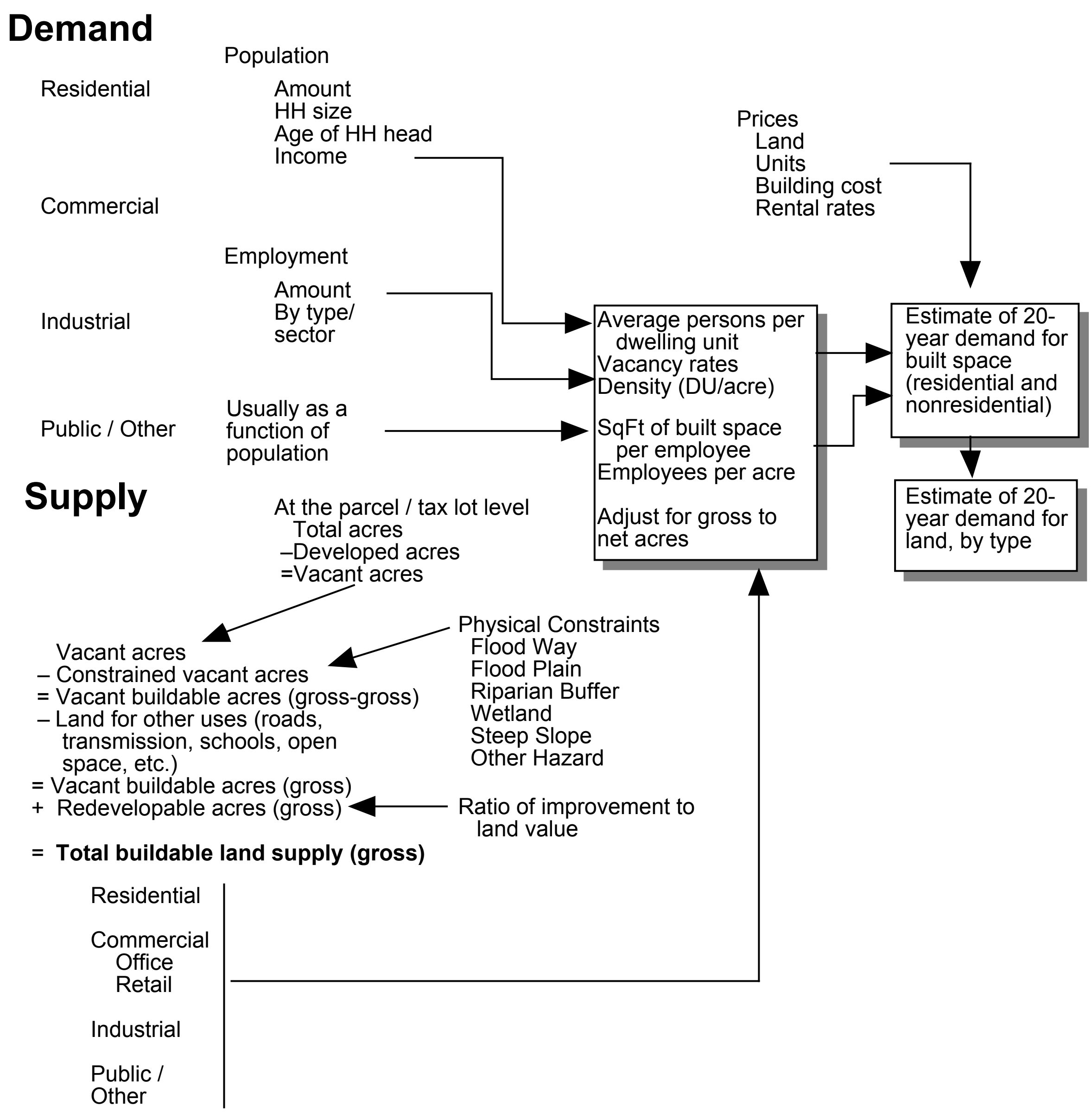
The first question embodies both supply and demand elements. The supply element is embedded in the phrase "do local governments have enough land." The demand element is addressed in the second part of the question: "to accommodate the growth anticipated during the remaining portion of the 20-year planning period."

Figure B-1 shows the relationship between the supply and demand components of a buildable lands analysis.

DEMAND FOR LAND

Demand for land is typically characterized through analysis of national, regional, and local demographic and economic data. For residential uses, population and households drive demand. For the residential sector, for example, information about the characteristics of households is used to identify types of housing that will be affordable to area households. For non-residential uses, an employment forecast is the primary driver of demand for land, and is converted to estimates of the probable absorption rates for commercial and industrial lands.

Figure B-1: Components of a Land Needs Assessment



Source: ECONorthwest

Thus, a demand analysis typically includes the development of population and employment forecasts and a housing market analysis. The data generated from the demand analysis, combined with density assumptions, lead to an estimate of *land need (demand) by type.*

Population and employment forecasts are the cornerstone of any land demand analysis. To assess land demand at the city or urban growth area level, requires small area forecasts. The problems associated with small area forecasts are well known and documented. Following are several reasons why forecasts for small cities are highly uncertain:

- Projections for population in most cities and counties are not based on deterministic models of growth; they are simple projections of past growth rates into the future. They have no quantitative connection to the underlying factors that explain why and how much growth will occur.

- Even if planners for small cities had a sophisticated model that links all these important variables together (which they do not), they would still face the problem of having to forecast the future of the variables that they are using to forecast growth (in, say, population or employment). In the final analysis, all forecasting requires making *assumptions* about the future.

- Comparisons of past population projections to subsequent population counts have revealed that even much more sophisticated methods than the ones used in planning studies "are often inaccurate even for relatively large populations and for short periods of time."[1] The smaller the area and the longer the period of time covered, the worse the results for any statistical method.

- Small cities start from a small base. A new subdivision of 100 homes in a community of one million persons has an effect on total population that is too small to measure. That same subdivision in a community of 1,000 increases the City's population by about 25%. If phased in over three years, for example, the City's average annual growth rate during that period would be over 15%.

- Especially for small cities in areas that can have high growth potential (e.g., because they are near to concentrations of demand in neighboring metropolitan areas, or because they have high amenity value for recreation or retirement), there is ample evidence of very high growth rates in the short-term; there are also cases (fewer) of high growth rates sustained over 10 to 30 years.

There are at least two important reasons for discussing population and employment forecasting at this point:

- Forecasts of population and employment drive everything else in the land demand estimates: population growth means more households; more households need more houses; more houses need more buildable residential land; employment growth means more land needed for commercial, industrial, and office uses.

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[1]Murdock, Steve H., *et. al.* 1991. "Evaluating Small-Area Population Projections." *Journal of the American Planning Association*, Vol. 57, No. 4, page 432.

- Forecasts of population and employment are frequently developed to the county level by state economists or demographers. Those county-level forecasts are then "coordinated" at the local level through a process that considers a variety of local factors: land supply, services, location, etc. The jurisdictions then agree on local allocations that sum to the county control total.

The purpose of this discussion is not to describe a method to develop local population and employment forecasts. Rather, it is to point out the role that forecasts play in a buildable lands analysis.

In addition to the problems of developing accurate forecasts for small areas, another issue is important: the base year and the target year for the forecasts must be common for the county control totals, and the jurisdictions. Moreover, the base year for the forecasts must match the base year for the land inventory component of the analysis to prevent a mismatch between demand and supply. We address the implications for Snohomish County's situation in Chapter 5.

LAND NEEDED FOR HOUSING

Residential land demand estimates begin with population forecasts. Those forecasts are then translated into needed dwelling units by making assumptions regarding the number of persons in group quarters, average household size (some times disaggregated by type of dwelling unit), and vacancy rates. Total residential dwelling units are typically disaggregated by housing types, which are then related back to plan designations or zoning districts. Finally, residential units are turned into needed acres (by dwelling unit or lot type) by applying density assumptions.

The following steps provide the general structure for a housing demand analysis:

1. Project the number of new persons during the planning period. Issues with population forecasts were discussed in the previous section.
2. Identify relevant national, state, and local demographic and economic trends and factors that will affect the 20-year projection of structure type mix. This analysis considers trends in factors such as age, household size, migration patterns, employment, and other factors that affect not only overall demand for housing, but also the type of housing. Key factors include assumptions about average household size and persons in group quarters. Average household sizes in most metropolitan areas have decreased in the past 20-30 years. If the housing need assessment assumes a change in household size over the forecast period, that change must be applied not only to new housing units, but also to population in existing housing units. The sidebar shows one approach to addressing changing household sizes. It is more difficult to find good data to support assumptions on persons in group quarters. Assumptions about persons in nursing homes and assisted living situations can be based off of age distributions and historic

ratios; other group quarters such as dormitories may be more difficult. One approach is to conduct interviews with organizations such as universities that manage group quarters facilities.

3. Describe demographic characteristics of the population and, if possible, household trends that relate to demand for different types of housing (e.g., household income, household size, age of household head, percent of income paid for housing and tenure). This step would ideally allow a cross-correlation of the variables listed above which could be built into a model that predicts demand for housing by type based on income, household size, and age of household head. Even if these were the only three significant variables influencing housing preferences (they are not), and if they each only had four subcategories (e.g., age of head 18-30, 31-40, 41-55, 55+) they would lead to 64 different household types (4*4*4).

   More rigorous specifications of demand and supply equations are possible, but are typically beyond what are feasible or necessary for a local land assessment aimed at meting GMA requirements.

4. Determine the types of housing that are likely to be affordable to the projected households, based on household income, household size, age of household head, tenure data and trends, and knowledge about national, state, and location housing trends, and local housing policies. This step attempts to correlate housing types with housing affordability. Developing a plausible model that predicts demand for housing at different price ranges over a 20-year period is, for all practical purposes, unrealistic. For example, economists generally do not develop forecasts of household income out more than a few years. Moreover, the forecast of each variable carries uncertainty, that uncertainty is compounded if one attempts to correlate those forecasts.

5. Estimate the number of additional needed units by structure type. At a minimum, communities should estimate the number of single-family and multiple family dwelling units needed over the planning period. More robust models make distinctions between single family lot sizes, and types of multiple family units (i.e., duplexes, row houses, garden apartments, etc). The U.S. Census data provides a baseline for this analysis, however, local policy can have a strong influence on the mix of housing types.

6. Determine the needed density ranges for each plan designation and the average needed net density for all structure types. The density assumptions are generally based on a combination of analysis of past development, and policy. The analysis of past development allows estimates of how close to allowable densities development has achieved. Local policy should provide for density targets both at the

Typical Method for Calculating Needed Dwelling Units

  Future (forecasted) population
- Current (estimated) population

= population increase (future - current)

- persons in group quarters

= persons in new dwelling units

÷ persons per dwelling unit

= occupied dwelling units
- demolitions

+ vacant dwelling units

+ additional units needed to accommodate decreased household size of existing households

= Total needed dwelling units

community level, and the individual comprehensive plan designation or zoning district level.

The analysis also needs to be specific about whether gross or net densities are being applied.[2] Step 6 is a crucial step in the context of the GMA requirements. The monitoring provisions of the GMA require local governments to compare actual to planned density of development for the period from the last plan review to the effective date of the new analysis. The density assumptions are generally applied by housing type (e.g., single-family/multiple family), and sometimes by lot size for single-family. Each housing type gets a density assumption. Most methodologies use net densities, which are converted to gross acres using a net-to-gross factor.

LAND NEEDED FOR EMPLOYMENT

This section describes methods for estimating land needed for employment. These estimates typically begin with employment forecasts.[3] Those forecasts are sometimes disaggregated by sector and then related to specific plan designations or zoning districts. Employment is then converted to land need by applying assumptions about employees per acre, or square feet of built space per employee and floor-area ratios (FAR).

Several methods exist to determine industrial land need. The most appropriate method depends on the data available. Basic methods such as extrapolation of past development trends or ratios of industrial acres per employee or per total land area are appropriate for small communities where data are limited. These methods, however, only forecast land demand in the aggregate: they cannot provide reliable estimates by sector or type.

For larger communities that have better data sources, forecasting employment-supporting land need is usually based on ratios of employee per land area (acre). The sidebar illustrates a typical method for estimating demand for commercial and industrial lands. The basic steps in this analysis are:

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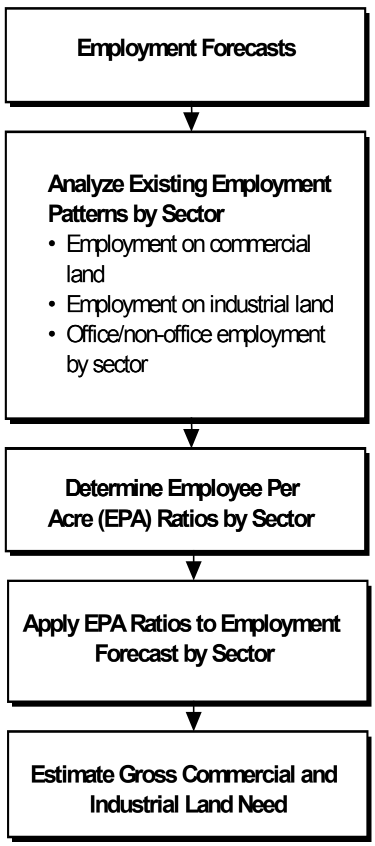
[2] A Gross Vacant Acre is an acre of vacant land before land has been dedicated for public right-of-way, private streets, or public utility easements: in general, that means the land is in larger acreages and has not yet been subdivided. For example, a standard assumption is that about 20% of land in a subdivision is used for streets and utilities: if so, then a gross vacant acre will yield only about 35,000 sq. ft. (80% of a full acre) for lots.

A Net Vacant Acre is an acre of vacant land after land has been dedicated for public right-of-way, private streets, or utility easements. A net vacant acre has 43,560 square feet available for construction, because no further street or utility dedications are required: all the land is in lots.

[3] A forecast of employment, thus, is a demand side forecast that drives demand for land. This report does not describe how employment forecasts are made: it assumes, however, that they have been made and are available at the local geography for which the land need estimates are being made.

1. *Develop employment projections*. Based on historic data and regional and statewide projections, or other available data, develop a sector-level employment projection. There are several ways to work from state or county-level forecasts to local forecasts. For the purpose of this project, we simply assume that such forecasts are available and provide no further explanation about how to make such forecasts.

Steps in estimating land needed for employment



2. *Analyze existing employment patterns by sector*. This step is intended to determine the amount of employment to allocate to broad employment sectors: commercial, industrial, and office at a minimum. While county-level forecasts are commonly more detailed that the three sectors described above, information on employee-per-acre factors to estimate land need is generally not as detailed.

   A further complication arises in that some employment locates on land designated for other uses (i.e., a commercial use in an industrial zone), and that employment types can mix on a single site (i.e., office employees on a mill site). While this may be a useful analytical step, most communities do not have the employment data that allows analysis of employment at the individual firm and tax lot level. It is more common to work with employment at the industry sector level.

3. *Determine employee per acre ratios*. Employee per acre (EPA) ratios allow conversion of jobs into land. Developing the EPA assumptions can be difficult since few empirical analyses of employee per acre ratios exist. Most jurisdictions apply ratios of between 10 and 35 depending on the area and the employment type. Common data sources for EPA ratios include studies in other jurisdictions, or using the Bureau of Economic Analysis ES-202 employment tapes to locate employment on individual sites. Some communities also have business inspection systems maintained by the local fire marshall that tie employment to specific sites.

4. *Apply the ratios to employment forecasts by sector*. This step applies employment per acre ratios to changes in employment by sector for the forecasting period. The output of this analysis is an estimate of land demand by employment sector. For large employers, conducting interviews and allocating employment by hand may yield more accurate results. It is particularly important to determine whether a few large employers that may constitute a majority of employment in a particular jurisdiction are expecting to grow, and if so, the extent to which they expect to do so on land that the buildable land analysis would define as vacant. Many large employers have sufficient land to accommodate future expansion.

5. *Determine aggregate demand for employment-supporting land.* This step divides the employment estimated in the previous step to that which is likely to locate on industrial and commercial (divided, to the extent possible, into office and retail) land, and that which is likely

locate on non-industrial lands. The final result is an estimate of the demand for industrial, retail, and office land.

LAND NEEDED FOR OTHER USES

Residential and employment uses together typically account for on the order of 80% to 95% of land needed to accommodate growth. Land is also needed for other public or quasi-public purposes such as parks, open space, churches, fraternal organizations, and so on.

All things being equal, land used for public facilities such as schools, hospitals, governments, churches, parks, and other non-profit organizations will expand as population increases. Many communities have specific standards for parks. School districts typically develop population projections to forecast attendance and need for additional facilities.

With some exceptions, the assumptions applied to the supply analysis consider public and institutional lands unavailable to meet land needs for residential, commercial, and industrial uses. The issue to consider is whether *additional* public and institutional land will be required over the analysis period.

There are several approaches for estimating land needed for these other uses. One approach is to assume that all or part of such land needs are already covered in the residential or employment land need estimates. One might argue, for example, the land needed for new elementary schools is already accounted for as part of either the net-to-gross reduction in buildable residential land, or the allocation of government and education employment (to offices, schools, sewer treatment plants, parks, and so on).

Most approaches, however, allocate extra land to these uses. One approach is to estimate need as a function of population (usually expressed as acres needed per 1000 persons). A study done by ECO for Metro, in Portland Oregon, estimated land needed for other uses at about 25 acres per 1000 persons or 60 acres per 1000 dwelling units.

The other approach is to estimate need as a function of residential acres. ECO recently analyzed developed land coverage for all 67 UGBs within the Willamette Valley of Oregon. While considerable variation existed among communities, the average ratio for all of the communities was about 55% residential land and 45% land for all other uses (including land for employment). On average about half of the land classified as developed for employment and all other uses (23%) was in public, semi-public, and other uses that do not support private employment.

SUPPLY OF BUILDABLE LAND

The general steps for estimating the supply of buildable land are:

1. Calculate gross vacant acres, by zoning district or plan designation, including fully vacant and partially vacant tax lots.

2. Calculate gross buildable vacant acres by zoning district or plan designation by subtracting unbuildable acres from total acres.
3. Calculate net buildable acres by zoning district or plan designation by subtracting land for future public facilities from gross buildable vacant acres. This step should differentiate between platted land (no deductions for public facilities) and tract land (deductions for public facilities).
4. Calculate total net buildable acres by zoning district or plan designation by adding redevelopable acres to net buildable acres.

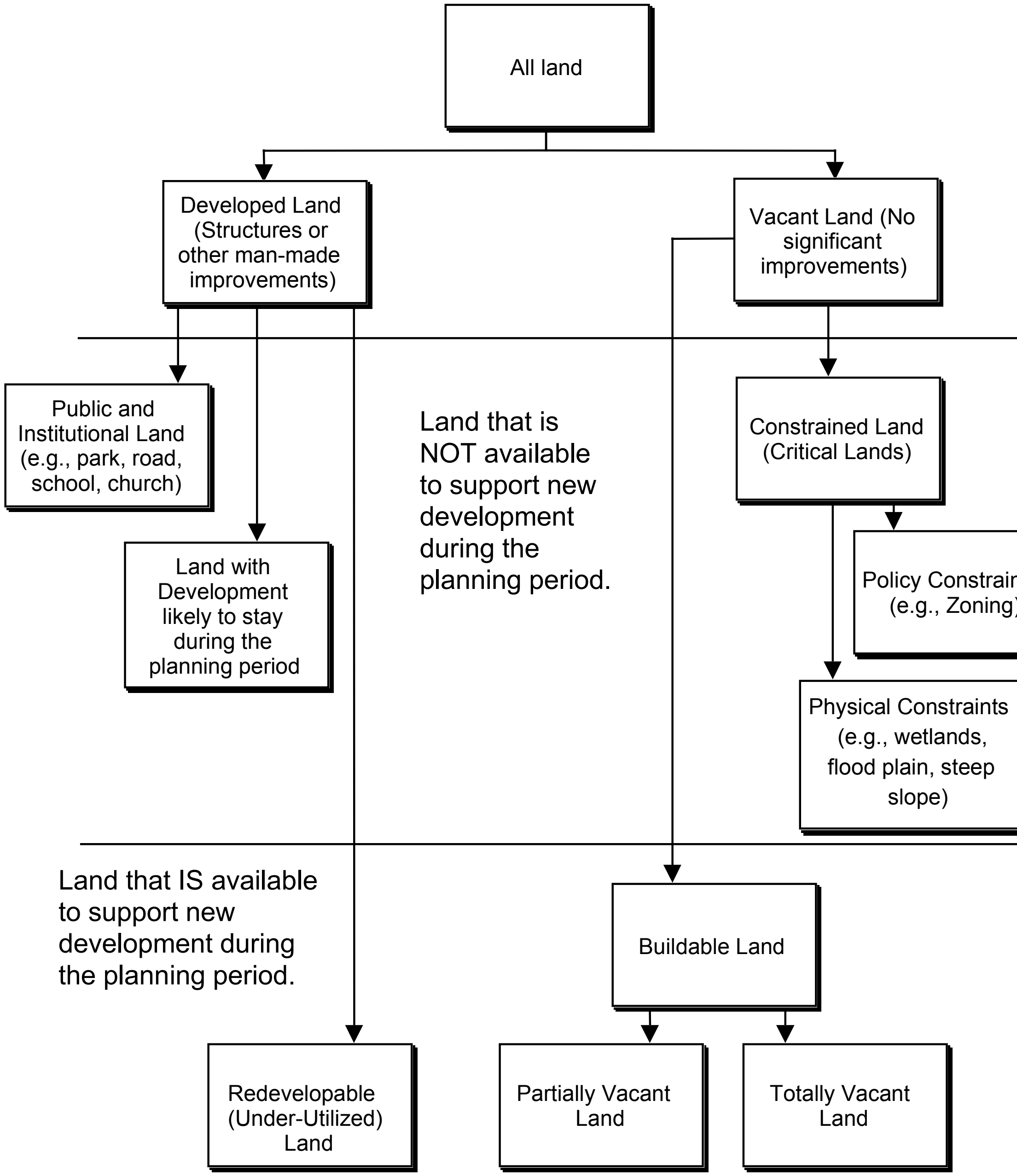
There are many ways that “vacant land” and “buildable land” can be defined. Figure B-2 shows one way that is internally consistent and compatible with statutory guidelines.

Figure B-2 illustrates that:

- Vacant land means land without structures or other significant man-made improvements. (A typical threshold for defining "significant manmade improvements" is tax lots that have no structures or have buildings with improvement values of under $10,000.) In general, “vacancy” is not a difficult determination to make: most people walking the land or looking at an aerial photograph could agree on what land was covered by significant structures that constituted existing development (and thus precluded new development unless the existing development were demolished). The trick is to define "vacancy" and "buildability" without individual examination of every plot of land; i.e., to define it in ways that existing data bases and GIS sources can be to show the amount and location of such land.
- Vacant land that is constrained (either physically or legally) is not buildable. Constrained land is conceptually identical to what state law refers to as *critical areas*. Such land may be constrained by natural features such as slopes, wetlands, and designated floodways. Some of those features may be absolute constraints on development (water courses, cliffs); in most cases, however, physical constraints lead to unbuildable land because of policies that apply to them (e.g., though there are no physical impediments to building in a floodplain, policy prohibits it for several reasons related to the public good). Other policy constraints might include zoning (which often limits use or density) and public facilities (e.g., limits on service extensions).

  A key issue regarding environmental constraints is overlap. For example, areas that are within drainageways may also be in the 100-year floodplain and be protected wetlands. In previous studies we have addressed this overlap using GIS overlays that provide aggregate constraint figures. This is crucial to prevent double-counting of constrained acres.

Figure B-2: Classification scheme for urban land



Source: ECONorthwest

Figure B-3 summarizes the relationship between development status and constraint status. It starts at the top with all land, which is then categorized as developed or vacant. Land in the middle third of the figure is not available for development; land in the bottom third is.

Figure B-3. Relationship between development status and constraint status

<table>
<tr><th rowspan="3">Constraint Status</th><th colspan="4">Land Status</th></tr>
<tr><th colspan="2">Vacant</th><th colspan="2">Developed</th></tr>
<tr><th>Complete</th><th>Partial</th><th>Redevelopable Threshold</th><th>Not Assumed Redevelopable</th></tr>
<tr><td>No Constraints</td><td colspan="3" rowspan="2">Land that is available for development</td><td>No development potential</td></tr>
<tr><td>Constraints that reduce development potential</td><td>No development potential</td></tr>
<tr><td>Complete Constraints</td><td>No development potential</td><td>No development potential</td><td>No development potential</td><td>No development potential</td></tr>
</table>

Source: ECONorthwest

- Complications occur when the physical assessment of vacancy gets overlaid on tax lot boundaries. If tax lot boundaries did not have to be considered, then every square foot of land can be characterized as vacant or developed. Tax lot boundaries, however, often lump developed and vacant land together on the same tax lot (e.g., one house on a three-acre lot). Thus, on a tax-lot level vacant land that is not constrained (i.e., buildable land) comes in two varieties: *totally vacant* (no significant improvements on the tax lot) and *partially vacant* (or, symmetrically in GMA terms, *partially used*). Partially vacant land consists of tax lots occupied by a use but which contain enough land to be further subdivided without need of rezoning. For low-density residential lands, tax lots over one acre are generally considered partially vacant. For all other uses, tax lots with building coverages that leave vacant portions larger than the minimum allowable lot size for the underlying zoning district are generally considered partially vacant.

- *Redevelopable* land is not vacant, but it is available to support some of the new development demanded by increasing population and employment. Redevelopment occurs on redevelopable land. *Infill* is sometimes lumped with redevelopment. Logic of Figure B-2, however, suggests that it be treated separate. Redevelopable land is developed; infill land is either vacant or partially vacant. Infill is not a type of vacant land, but a condition of a tax lot relative to surrounding tax lots. If surrounding tax lots are primarily developed, then an isolated buildable tax lot (i.e., a tax lot totally or partially vacant) is also an infill tax lot.

  In the language of the GMA, redevelopable land is either synonymous with, or a large subset of, *under-utilized* land. Under-utilized land is land in tax lots zoned for more intensive uses than that which currently occupies the property. For instance, a single-family home on multifamily-zoned land will is considered under-utilized. Several approaches could be applied to determine redevelopable or under-developed tax lots. Improvement-to-land-value ratios are frequently applied to determine redevelopment potential. However, subjective judgment is required to identify at what level redevelopment may occur.

In summary, the big steps for estimating the amount of buildable land are: *Classification of land into several mutually exclusive categories*. Thus, in the logic of Figure B-2 there are three types of land that can support new development: buildable vacant land, buildable partially-vacant land, and redevelopable land. Common data sources are use codes maintained by county assessors, or field inventories.

Table B-1 illustrates a tabular summary of land supply data. The supply analysis should use GIS data to develop a summary of land supply that can be cross-referenced geographically, by attribute. This is possible for all communities in Snohomish County, where the County GIS Department has planning information and coverages at the tax-lot level or is intending to build those coverages based on procedures outlined in this report.

Table B-1. Sample Buildable Residential Lands Worksheet

		Minus	*Equals*	*Minus*	*Equals*	*Minus*	*Equals*	*Plus*	*Equals*
Tax Lot#	Total Acreage	Developed acreage	Gross vacant acreage	Constrained acres	Gross buildable vacant acres	Acres for public facilities (25%)	Net buildable vacant acres	Redevelop-able acres	Total net buildable acres
Single-Family (Low Density Residential)									
1202	10.0	0.0	10.0	1.1	8.9	2.2	6.7	-	6.7
1400	5.0	1.0	4.0	0.0	4.0	1.0	3.0	-	3.0
1506	8.0	8.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0
Subtotals							9.7	4.0	13.7
Multi-Family Residential (High Density Residential)									
2000	20.0	0.0	20.0	2.0	18.0	4.5	13.5	-	13.5
4500	3.0	3.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0
Subtotals							13.5	3.0	16.5
Total Net Buildable Acres							23.2	7.0	30.2

Source: ECONorthwest, 2000.

Many different approaches exist to modeling land supply in a GIS format. The County already has tax lot boundary information linked to basic assessment records. Most jurisdictions create separate data layers for vacant lands, constraints, land uses and other attributes. Some, however, map land use (including vacant lands) at the sub tax-lot level. Our experience is that maintaining a separate vacant lands coverage is better both from and administrative and analytical standpoint.