Appendix B
Buildout Methodology for Monmouth County

Determining Lands Available for Development

In order to determine how much future growth could occur within each case study county, a GIS model was created that estimated how much vacant land was potentially available for development. The model consisted of an overlay of multiple layers of data for lands that could not realistically be developed due to various restrictions. One of the key layers restricted layers included lands that have already been put into permanent preservation. As such, a statewide open space coverage was produced by combining a myriad of "open space" GIS datasets for various types of open space data. The combined open space dataset consisted of over a dozen sources including the NJDEP, federal and state preserved open space layers and additional open space data gathered and compiled at Rutgers Center for Remote Sensing and Spatial Analysis in the summer of 2010. The coverage also includes farmland preservation parcels as of 2009 acquired from the NJ Department of Agriculture (NJSADC 2010).

In addition to preserved open space, other land categories which are restricted from development due to regulatory constraints were also added to the model. The constraints included steep slopes above fifteen percent, streams, water bodies and wetlands buffered to 50 feet, and category 1 streams buffered to 300 feet. The combined data mentioned above represented the restricted layer. In order to create the final "available lands" layer, the type URBAN land use category was selected from the 2007 DEP Land Use/Land Cover dataset and added to the restricted lands layer. All source layers were converted to raster layers with a 50 foot grid cell size in order to facilitate the overlay and buffering process.

The combination of restricted lands and urban lands created a mask of lands that were not available for future development. The areas not covered by the mask represented the remaining available vacant lands layer. While this model provides a reasonable estimate of remaining available lands, it has limitations and should only be taken as approximate. It is likely that there is actually somewhat less land available due to incomplete open space inventories, privately held land trusts and other constraints on a property's ability to be developed such as zoning, lot configuration and road access in addition to larger buffers around wetlands and habitat of significant value. Nonetheless, this available lands data produced through this analysis represents the most comprehensive snapshot of New Jersey's development pattern, given the available data.

Monmouth Buildout Methodology

Monmouth County is fortunate to have a composite zoning GIS data layer which makes buildout projections in a home rule state considerably less complicated. The composite zoning layer provides a generalized description of the zoning areas so that *use*, *minimum lot size* and *lot area coverage* are consistent across all zones within the county. This makes buildout projections relatively straight forward.

The available lands model identified 45,801 acres of vacant land available for future development within the county, which is approximately 15% of the county land base. A zonal cross-tabulation was conducted between the zoning layer and the available lands layer to identify acreages of available and restricted land located within each given zone. Since the output calculation of area tabulation is produced in the base units of the dataset (square feet - NJ State Plane) it was necessary to normalize by 43,560 (square feet within an acre) to produce results in acres. The output table was joined back to the zoning attributes table. This new table lists the relevant data such as, the municipality, composite zone,

and municipal zone, amounts of available and restricted land along with other attributes of the zoning data. This table was then exported in Excel file format so that further calculations could be made to determine the number of potential units, new residents, floor space, and number of potential new jobs in the county.

Table B-1 depicts the data and buildout formula that was used to generate the final results. The total land in each residential zone was assigned the variable (A). The total developable land (B) was derived from the available lands overlay model described above. The yield adjusted available land (C) was generated by multiplying available lands (B) by a yield factor of 80% (C=B*0.8). The yield factor takes into account that yield will generally be reduced below the base zoning by 20% due to infrastructure and right-of-ways, etc. The base zoning density provided by the county composite zoning layer was stated in column D.

The projected potential number of units (E) per zone was calculated by multiplying the total yield- adjusted developable residential land by the zone base density (E=C*D). The average household size (F) was used to calculate the number of new residents (G) by multiplying it by the number of potential units (G=E*F). This basic buildout formula was applied to all zones, and then the resulting data was formatted into a pivot table to show the number of units and residents by municipality and zone.

The total buildout projection for each zone was broken into four residential density ranges: *high medium*, *low*, and *rural* in a manner that reflected the NJDEP land use/land cover dataset residential classes. The lowest density category, *rural*, is less than 1 unit per acre. The *low density* category is between 1 and 2 units per acre. *Medium density* is between 2 and 5 units per acre and the *high density* category is greater than 5 units per acre.

Table B-1
Monmouth County Residential Analysis

Columns	Equation
Municipality	
Residential Zone	
Total Land in Residential Zone (acres)	A
Total Developable Land (acres)	B
Total Developable Residential Land (acres)	C=B*0.8
Maximum Residential Density Permitted (units per acre)	D
Potential Number of Units	E = C * D
Average Household Size (persons per unit)	F
Number of New Residents	G = E * F

The results of the Monmouth residential buildout model are provided in Table 2.3 of the report. Looking closer at the zones within the high density category reveals certain outliers in the distribution of new units throughout the county. The largest single value exists in the MF-15 (multi-family) zone in Manalapan Township. A potential total of 2,454 units could be built at the median zone density of 19.55 units per acre on 157 acres of available land. Another zone in Manalapan Township, SF-0, is projected to have a total of 771 units at buildout on 55 acres of land at the median density for the zone, 17.42 units per acre. A total of 925 units are projected in Howell Township on 100 acres at a density of 11.55 units per acre. One notable outlier that was removed from the data was in Tinton Falls Borough. It was a high density Mixed Use zone (MU-24) located with the boundaries of Naval Weapons Station Earle and held a projected value of roughly 6,000 new units. Although it was included in the county composite zoning layer as high density mixed residential, it became apparent that available land model in this area overestimated the amount of land that could reasonably be developed and was thus subtracted from the results.

The commercial analysis was conducted using a similar approach as the residential analysis. The commercial spreadsheet, depicted in table B-2, lists the total land in commercial zone (A), the Total Developable Land (B) and the percentage of land allowed to be covered by a building (C). The maximum amount of land to be covered by a building (D) was calculated by multiplying the total developable land by the percentage building coverage (D=B*(C/100)). The maximum number of stories (E) was used to calculate the maximum amount of floor space in square feet (F) using the equation (F=E*D*43,560). The amount of floor space per job (G) was used to calculate the number of jobs (H) by using a job to floor space ratio developed by the Council On Affordable Housing (COAH) and adopted for use in the Plan Endorsement process by the Office of Smart Growth. This ratio varies depending on the type of commercial use; 1000 square feet of floor space for one retail job, 500 square feet of floor space for one industrial job, and 333 square feet of floor space for one office job. Using these ratios, the number of jobs was calculated by multiplying the maximum floor space by the floor space per job (H=F*G). These equations were applied to each zone in every municipality and the data was then formatted into a pivot table to show the number of new jobs by municipality.

The commercial analysis results in an additional 121,517,596 square feet of commercial and industrial floor space with an additional 223,450 jobs. From this total number of jobs, 30,971 are within strictly commercial zones. This number was calculated using a retail rate of 1000 square feet per job. Mixed Use zones were also calculated using the retail floor space per job rate and resulted in a total of 24,942 new jobs. Industrial zones would see a total increase of 58,482 and office zones would see an increase of 109,055 new jobs under the model.

Table B-2
Somerset Commercial/Industrial Buildout

Columns	Equation
Commercial Zone	
Total Land In Commercial Zone (acres)	A
Total Developable Land (acres)	B
Percentage of Land Allowed to be Covered by Building (%)	C
Maximum Amount of Land to be Covered by Building (acres)	D = B * (C/100)
Maximum Number of Stories Allowed	E
Maximum Amount of Floor Space (sq. ft.)	F = E * D * 43560
Floor Space per Job	G
Number of Jobs	H

Appendix C
Buildout Methodology for Somerset County

The same buildout model used for Monmouth County could not be applied to Somerset due to the absence of a countywide composite zoning map. Since zoning data was unique for each municipality within the county, this resulted in a lack of consistent and cogent density data for roughly one third of the county's unique zones, forcing us to use a modified modeling approach. The lack of data was attributable to municipal land use ordinances written with site specific regulations of minimum lot sizes and setbacks and ordinances that were unidentifiable or missing from the county's collection as well as other complicating factors such as overlay zones, conditional uses or zones without single clearly identifiable density data.

To compensate for lack of cogent base density data for these municipalities, a model was developed using the 2007 New Jersey Land Use/ Land Cover data from NJDEP and county-wide parcel layer. Since each residential property parcel generally represents one housing unit, the parcel layer was converted to parcel centroid points as a proxy for housing units. Since all property parcels are not necessarily developed nor necessarily residential, a subset of parcel centroids was selected for only centroids that were within polygons identified as residential within the land use/land cover dataset. The model generated an estimated residential density for the zone by dividing the total number of parcel centroids within residential polygons by the total land area of residential polygons within the zone. This manner of projecting future residential density based on the existing built residential density of the zone makes the assumption that the zoning that produced the existing residential patterns is still in place to guide future residential development.

The Somerset County zoning data has 1,023 separate zoning polygons representing roughly 350 unique zoning delineations. We gathered zoning data for each of the unique zoning descriptions by viewing municipal zoning ordinances on file at the Somerset County Planning Department. Of the total individual zoning polygons, 265 did not have a clearly definable base zoning density and needed to have the proxy density generated as described above. A final combined density field was generated that used the associated base density where available and the modeled density when not available. A similar buildout calculation was then conducted for Somerset County as described for Monmouth County using the combined zoning density field.

Commercial and industrial buildout modeling was also more challenging in Somerset than Monmouth again due to the lack of consistency in the way the ordinances were written. Since this research analysis had a limited scope and budget, a simplified projection of commercial and industrial buildout was taken using previous land use development as an indicator future development. Each zone had the amount of commercial and industrial land use identified as a proportion of the total urban footprint. This ratio was used as a projection of the pattern of future commercial and industrial land use that would be developed within the zone to buildout for the remaining available land.

For example, a hypothetical zone had 1,000 acres of urban land as identified in the 2007 dataset. If the 1,000 acres of urban in that zone had a mix of 16% commercial and 9% industrial then the future buildout of that zone would be calculated by multiplying the total available lands by 0.16 to estimate future commercial and 0.09 to estimate future industrial within that zone. This assumes that future buildout will follow a pattern of development that has already occurred within each zone. Other assumptions with the Somerset Commercial/Industrial buildout projections was that all development will be single story so that the land use footprint represents the building floor area and since there was

the lack of distinction between the specific categories of employment type associated with each land use, a general 500 square feet per job was used for job projection.

This model for projecting jobs is admittedly simplified and could result in the jobs projection substantially under or over estimated. However, the projection is intended to show order of magnitude and is reasonable considering the scope and funding limitations of the research project. A more precise buildout model of jobs could be conducted with further resources provided to support a more robust modeling approach. Such an approach would need to comprehensively inventory the parameter of each of the county's 350 unique zoning descriptions.