Smart Growth America
Improving lives by improving communities

THE FISCAL IMPLICATIONS OF DEVELOPMENT PATTERNS

Chattanooga, Tennessee

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City of Chattanooga

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Background and Objectives

The connection between land use development patterns and the costs of providing public infrastructure and services has long been a topic of study, particularly since *The Cost of Sprawl: A Detailed Analysis* was published in 1974. Since that time, dozens, if not hundreds of studies have been conducted related to this topic. Most of these have concluded that "smart growth" – more compact patterns of development – is associated with reduced local government spending on a per capita basis relative to sprawl (recognizing that the definition of each of those terms is not entirely consistent). Smart Growth America's *Building Better Budgets* report, published in May 2013, summarizes the results of 17 of these studies.

Yet these findings are not often included in the typical fiscal impact analysis done in connection with new development proposals. There are many reasons for this, but the inconsistent methodologies used in the above-referenced studies, as well as the time-consuming data collection efforts they involve, have likely slowed the filtering of these advanced academic findings into "practice." Instead, most, (though not all) fiscal impact analyses rely on a simple average cost approach, which implicitly assumes that each new resident or job will add the same amount of public costs, regardless of whether they live and work in a sprawling, low-density development, or a high-density, walkable urban one.

As part of a cooperative agreement with the U.S. Environmental Protection Agency, Smart Growth America ("SGA") aims to apply our fiscal impact methodology that accounts for the increased cost efficiencies associated with denser development patterns. This report applies our fiscal impact methodology to the City of Chattanooga, Tennessee.

The Cost of Sprawl, published by the Real Estate Research Corporation in 1974, was the first study to show that providing infrastructure to low-density, sprawling development costs more than for compact, dense developments. Low-density development's greater distances among homes, offices, shops, etc., require more road and pipe infrastructure than would be required to serve the same number of homes and businesses in a more compact development pattern. Looked at another way, one mile of infrastructure costs roughly the same to build no matter where it is, but that mile can serve many times more people in a high-density place than in a low-density place.

This analysis considers how Chattanooga might accommodate a forecasted 29,396 new residents over the next 20 years (by 2036). Density matters in terms of what new growth would cost the City.

We assessed three scenarios:

1) A Baseline scenario with growth at the existing average densities of 1.7 people per acre (0.8 households per acre) in greenfield development.
2) Alternative A, which uses a density of 13 people per acre (5.8 households per acre) and assumes 100 percent greenfield development. This density level equates to the 95th percentile density that exists in the City.
3) Alternative B, which also uses 5.8 households per acre, but does so at a mix of 50 percent infill and 50 percent greenfield development.

Under the Baseline Scenario, the City would face a 20-year cost of $1.45 billion in providing additional infrastructure to accommodate the new growth. The most aggressive alternative, Alternative B, costs substantially less: $293 million over 20 years. This represents a potential savings of $1.16 billion.

The cost savings are the result of reduced roadway, sidewalk, water, and sewer system costs at higher densities and infill development. When we consider the average tax revenues of the new residents, Alternative B results in a *positive net fiscal impact* of $6.9 million per year.

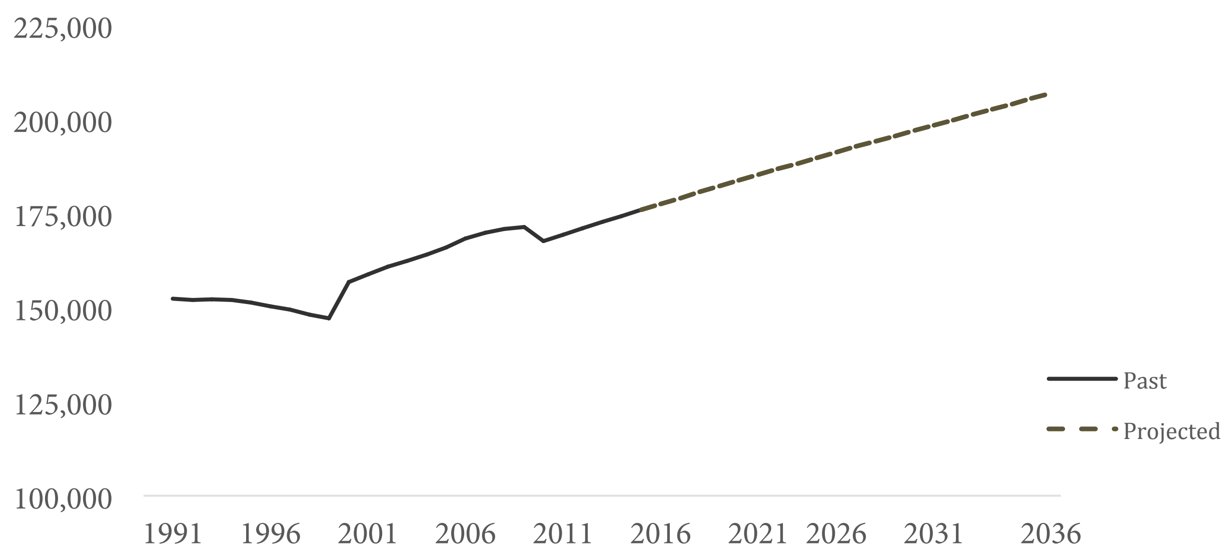
Chattanooga Population

While the population of Chattanooga decreased during the 1990s, the population has been increasing steadily since 2000. We applied county level population forecasts from the Boyd Center for Business and Economic Research[i] and forecasted a 17 percent increase in population by 2036 (0.8 percent annually). Figure 1 and Table 1 below illustrate the assumed growth rates we used for this analysis.

With reasonable growth on the horizon for Chattanooga, this fiscal impact analysis needs to address the question, "What will it cost to accommodate an additional 29,396 residents?" As our approach suggests, the answer depends on choices the community makes about density and infill development.

FIGURE 1

Chattanooga, TN Population and Forecast (2016 +)



Source: Smart Growth America, 2017

TABLE 1

	2016	2026	2036	Change 2016 to 2036
Population	177,488	191,235	206,884	29,396

Source: Smart Growth America, 2017

Development Scenarios

SGA worked together with the City of Chattanooga to develop alternative development scenarios. The development of these scenarios considered factors such as existing density levels, and plausible future densities. We then used geographic information systems (GIS) analysis to divide the City into equal 40-acre cells, and to identify the population and job density of each cell based on U.S. Census data.[ii]

Based on the GIS analysis, the existing average density in the City of Chattanooga is 1.7 people per acre. At Chattanooga's average household size of 2.26 people per household, this equates to 0.8 households per acre. In other words, the average density across the entire City of Chattanooga suggests that the average household is on a lot greater than 1 acre. This is despite the fact that highest densities we observed in Chattanooga were around 30 people per acre. The average density level is much lower primarily due to very low-density development within the City limits, especially in more rural areas.

Chattanooga Key Stats

1.7 people / acre
AVERAGE POPULATION DENSITY

0.8 households / acre
AVERAGE HOUSEHOLD DENSITY

13 people / acre
SCENARIO POPULATION DENSITY

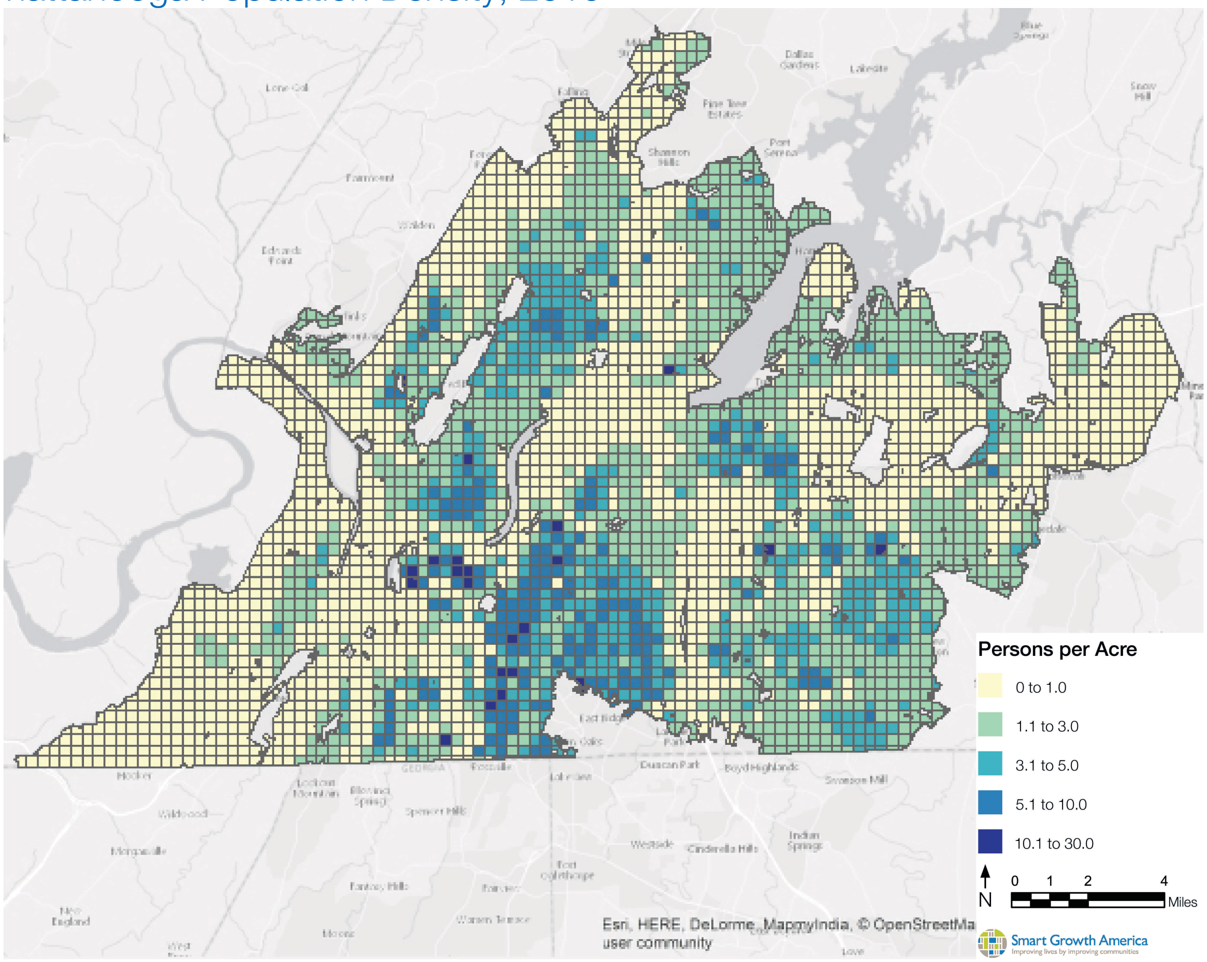
5.8 households / acre
SCENARIO DEVELOPMENT DENSITY

30 people / acre
HIGHEST OBSERVED DENSITY IN CHATTANOOGA

Figure 2 illustrates the densities across the various analysis cells in Chattanooga. As seen, the highest population densities exist near the University of Tennessee at Chattanooga and near the housing authority development in the East Lake neighborhood. Many of the traditional residential communities in Chattanooga, represented in shades of blue in Figure 2, have density levels ranging from 5 to 13 people per acre.

FIGURE 2

Chattanooga Population Density, 2010



Source: Smart Growth America, 2017; U.S. Decennial Census, 2010

This analysis assesses three potential development scenarios to accommodate the additional 29,396 combined residents.

1. The Baseline Scenario assumes that new development would continue at the existing average density of 1.7 people per acre. This equates to a residential density of 0.8 households per acre.

2. Alternative A represents accommodating new growth at 13 people per acre comprised completely of greenfield development. This represents about 5.8 households per acre.

3. Alternative B represents the same density levels as Alternative A, 5.8 households per acre, but incorporates a mixture of 50 percent greenfield development and 50 percent infill.

TABLE 2

Chattanooga, Tennessee Density Alternatives

	Baseline	Alternative A Dense 100% Greenfield	Alternative B Dense 50/50 Greenfield, Infill
Population per Acre	1.7	13	13
Total Gross Acres	16,992	2,261	2,261
Households per Acre	0.8	5.8	5.8

Source: Smart Growth America, 2017

Accommodating the new residents and jobs at these density levels would lead to vastly different physical footprints. The Baseline Scenario would require 16,992 acres of development; and Alternative A and Alternative B would require 2,261 acres as illustrated in Figure 3. Alternative B would be built at the same density as Alternative A, but it would provide additional cost savings by using a mix of infill and greenfield development.

FIGURE 3

Area Requirements of Analysis Scenarios, Chattanooga, Tennessee

Source: Smart Growth America, 2017

Methodology

This analysis focuses on five expenditure types for the City of Chattanooga: Roads, sidewalks, sewer lines, manholes, and catch basins. We selected these items based on the available data from the City of Chattanooga, and we consider these items for sketch planning purposes. There are many other infrastructure costs, such as police and fire services, schools, and civic infrastructure that are also part of planning for population growth. Focusing on only these five items narrows in on costs that have the strongest relationship to population densities, which can be estimated given the sketch level planning scenarios. Because this analysis does not use all possible infrastructure items, the costs we present are likely a conservative estimate of what future development would actually cost the City.

Infrastructure items considered:

- ROADS
- SIDEWALKS
- SEWER LINES
- CATCH BASINS
- MANHOLES

For each expenditure item, the City of Chattanooga provided appropriate GIS shapefiles. Using this data, we applied those infrastructure items to the 40-acre cell grid, and this process allowed us to calculate unit density (e.g. “roads per acre”).

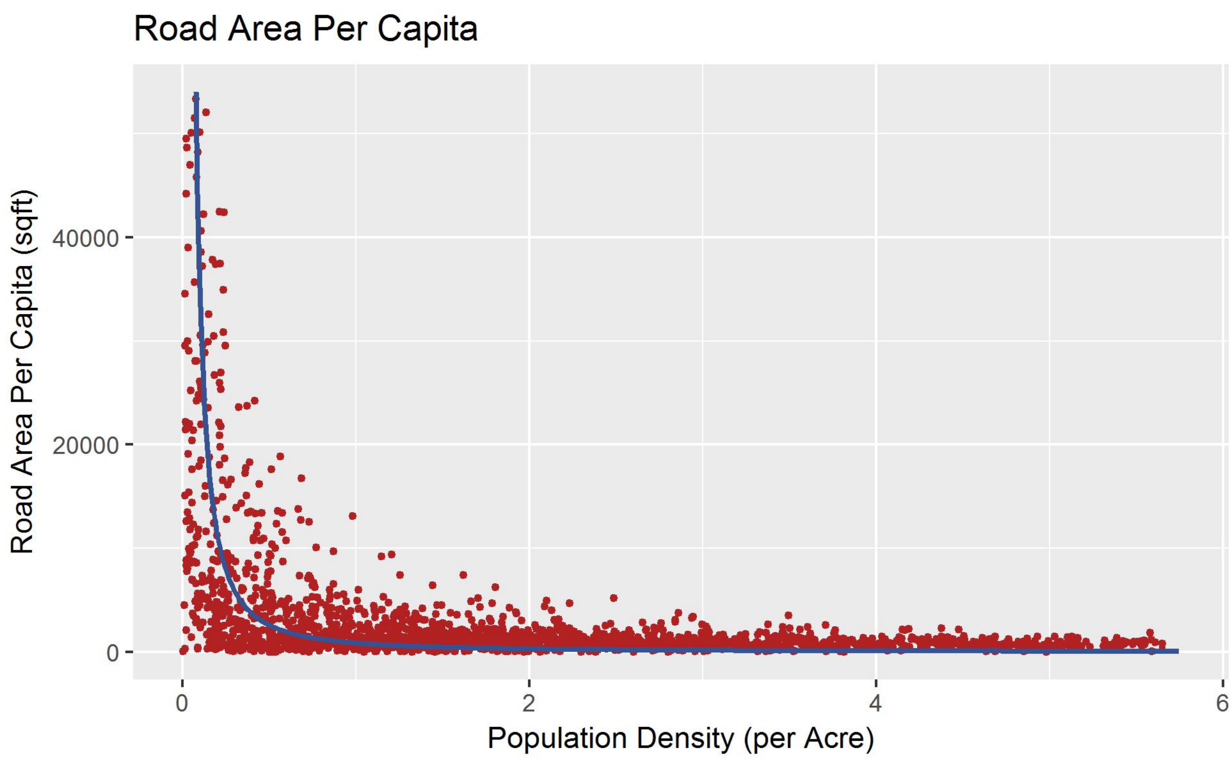
We then applied estimates of units per acre, for each infrastructure item, as the basis of an ordinary least squares (“OLS”) regression analysis. In creating the data set, the unit of analysis was the 40-acre cell. The result is a set of models that estimates unit density (e.g. “roads per acre”) as a function of population density (e.g. “people per acre”). These models allow one to estimate the amount of infrastructure units needed per capita as a function of density. This operation is critical because it distinguishes this analysis from prior “average cost analyses.”

Take Table 3 as an example, which illustrates how “road area per capita needed” quickly and drastically decreases as a function of population density. At very low levels of population there are thousands of square feet of road needed per person. At higher density this decreases to levels of less than 1,000 and even less than 500 square feet per person because roads can be shared and distributed among more people.

This scatter plot is the basis of the regression analysis. We created unique models for each infrastructure item, with each item exhibiting a similar relationship. The scatter plots, resulting regression outputs, and cost itemization are reported in Appendix A.

TABLE 3

Road Area per Capita, by Density (Chattanooga, TN)



Source: Smart Growth America, 2017

Each model estimates the quantity needed per capita, and then the total quantity of infrastructure needed. Using those total quantities, we used item-specific cost factors, each of which was developed based on SGA research and coordination with the City of Chattanooga.

The final step in this analysis was to add two additional costs: the costs of financing, and operations and maintenance costs. Infrastructure items are long-term capital investments, and governments typically issue bonds to pay for these investments. This analysis assumes that the financing cost to the City would be 2.2 percent interest over 20-years (a typical cost of long-term municipal bonds in 2016). Finally, the analysis adds operations and maintenance cost of 5 percent.

Results

There are two key results from this analysis. The first are the total 20-year costs, which are the total costs that our fiscal impact model estimated. For a sense of scale we report the results on a per-year basis (Table 4).

The second result is what we call *net fiscal impact* (Table 5). The net fiscal impact takes the total 20-year cost, and compares it against potential revenues of new residents. Here, we use an average revenue based on the City's 2017 budget of $1,297 per resident ($2,932 per household). The three scenarios all plan for the same level of growth, therefore they each would generate the same revenues. The only change among the scenarios is on the cost side. When we compare the revenues against the costs, the difference is the net fiscal impact. A negative net fiscal impact indicates that the City would lose money in accommodating the new growth; a positive net fiscal impact indicates that the City would actually make net revenues.

The results of this analysis (Table 4) show that the Baseline scenario would cost the City $1.45 billion over 20 years. This equates to $72.7 million per year, equivalent to 32 percent in of the City's 2017 proposed total budget.[iii] Applying the estimated potential tax revenues from new residents yields a 20-year net fiscal impact of -$1.02 billion, or -$51.2 million per year (Table 5).

Alternative A, which assumes a traditional neighborhood density of 5.8 households per acre, would reduce the 20-year costs to $433 million ($21.7 million per year). The net fiscal impact is almost cost-neutral: a 20-year net fiscal impact of -$3.1 million ($157,000 per year).

Alternative B is similar to Alternative A but adds 50 percent infill development. By exploiting existing infrastructure through infill development, this scenario substantially reduces costs. We estimate 20-year costs at $292.6 million ($14.6 million per year). This is the only scenario shown where the City would be "in the black" and make more estimated revenues than it would pay in infrastructure costs. The 20-year net fiscal impact is +$137.7 million (+$6.9 million per year).

The density level of 5.8 households per acre is important because it is the density at which the additional costs of infrastructure are offset by potential revenues. At lower density levels (such as the Baseline density of 0.8 households per acre), the City would likely have a *negative* net fiscal impact. It is at 5.8 households per acre where we see an almost cost-neutral net fiscal impact (Alternative A); and by adding infill development (Alternative B), the City reduces costs even further, creating a *positive* net fiscal impact.

TABLE 4

Results – Chattanooga Development Costs in Summary

(Millions $)	Baseline	Alternative A	Alternative B
Capital Costs – 20 years	$1,122	$334.2	$225.6
Amortized Costs (20 years at 2.2% rate)	$1,398	$416.7	$281.3
Maintenance Costs – 20 years	$56.1	$16.7	$11.3
Total Costs – 20 years	$1,455	$433.4	$292.6
Total Costs per Year	$72.7 (+32% to budget)	$21.7 (+9.4% to budget)	$14.6 (+6.4% to budget)

Source: Smart Growth America, 2017

TABLE 5

Results – Chattanooga Development Net Fiscal Impact

(Millions $)	Baseline	Alternative A	Alternative B
Total Costs – 20 Years	$1,455	$433.4	$292.6
Est. Tax Revenue - 20 Years	$430.3	$430.3	$430.3
Net Fiscal Impact – 20 Years	-$1,024	-$3.1	+$137.7
Total Costs – Annual	$72.7	$21.7	$14.7
Est. Tax Revenue – Annual	$21.5	$21.5	$21.5
Net Fiscal Impact – Annual	-$51.2	-$0.16	+$6.89

Source: Smart Growth America, 2017

Another way of looking at costs is to consider the marginal costs per new resident or household. This measure tells us, on the average, how much each new resident costs the City in terms of infrastructure. Under the Baseline Scenario, each new resident would cost the City $2,474 per year. This compares to $737 annually per resident under Alternative A and $498 annually per resident under Alternative B (Table 6).

TABLE 6

Results – Chattanooga Development Costs per Capita (Marginal Costs)

	Baseline	Alternative A	Alternative B
Total 20-year Costs per Additional Resident	$49,486	$14,744	$9,952
Annual Costs per Additional Resident	$2,474	$737	$498
Annual Costs per Additional Household	$5,592	$1,666	$1,125

Source: Smart Growth America, 2017

The bottom row of Table 6 simply scales these per person costs to the household level. One way of interpreting these numbers is to think of them in terms of how much each household would have to pay the City to "break even" in terms of infrastructure. The Baseline Scenario would cost the City $5,592 annually for each new household; $1,666 annually for each new household under Alternative B; and $1,125 annually for each new household under Alternative B (Figure 8).

Alternative A and Alternative B represent noteworthy points for a revenue analysis, and it brings us back to what we observe for net fiscal impacts. Recall that the net fiscal impact calculations used the 2017 budget average revenues of $2,932 per household. This tells us that Alternative A and Alternative B have a marginal cost per resident *less* than the expected marginal revenues – a "profit."

These marginal costs result differ from the net fiscal impact because they do not consider the fact that new residents do not arrive all at once, and the net fiscal impact calculations do. When the revenues trickle in year-over-year, Alternative A is nearly neutral for net fiscal impact (-$157,000 annually), and Alternative B has a positive net fiscal impact (+$6.9 million annually).

This analysis tells us that *development at existing average density levels would cost the City more money – only for these infrastructure items – than the City would likely receive in revenues.* The costs are amplified when we consider the comprehensive set of infrastructure items. However, this is a simplified analysis for sketch planning purposes.

Revenues per household in these scenarios are likely to be lower than those shown here because most of the additional revenue to the City would be in the form of property taxes. This means that even higher levels of density would be necessary to have "cost neutral growth."

The net fiscal impact results underscore the notion that the new growth would create a cost to the City if future development continues to build at existing densities. Those additional costs would have to be made up somewhere. For example, under the Baseline Scenario, the City would have to generate $5,592 annually from each new household for the household to pay its own marginal costs. Hypothetically, the City could tax these new households $5,592 per year, but we know that is unlikely. What is more likely is that the costs would be distributed among the existing residents and businesses. The City could also depend on external funds or state funds to pay for the costs, but the point remains that these revenues would have to be generated from somewhere.

Finally, we convert the costs into "cost savings" relative to the Baseline Scenario (Table 7). Using this point of view, Alternative A and Alternative B offer significant potential savings to the City compared to the Baseline. Alternative A would save the City $1.02 billion over 20 years ($51.0 million per year), while Alternative B would save the City $1.16 billion over 20 years ($58.1 million per year).

TABLE 7

Results – Chattanooga Development Cost Savings

(Millions $)	Baseline	Alternative A	Alternative B
Total 20-year savings	-	$1,021	$1,162
Savings per year	-	$51.0	$58.1

Source: Smart Growth America, 2017

Conclusion

This analysis considers how Chattanooga might accommodate 29,396 additional residents over the next 20 years (by 2036). The type of density matters in terms of what it would cost the City.

The City could accommodate new growth at existing average densities of 1.7 people per acre and do so at a cost of infrastructure provision of $1.45 billion over twenty years, or a net fiscal impact of -$1.02 billion after considering potential tax revenues of new residents.

An alternative scenario (Alternative A), which uses among the highest densities already observed in the City and assumes 100 percent greenfield development, would cost $433.4 million over the same period, or a 20-year savings of $1.02 billion over the baseline scenario. The 20-year net fiscal impact is -$3.15 million.

A third scenario (Alternative B) uses the same higher densities and does so using 50 percent infill development. This scenario would cost $292.5 million over the same 20-year period, or a 20-year savings of $1.16 billion over the baseline scenario. At this point the City is “in the black,” with a 20-year net fiscal impact of +$137.7 million.

In short, accommodating growth at density levels typical of dense traditional neighborhood development patterns (about 5.8 households per acre) would save the City in the form of reduced roadway, sidewalk, manhole, catch basins, and sewer system infrastructure costs. Accommodating development at this density with a mix of infill development will result in a *positive* net fiscal impact to the city.

This is a set of hypothetical scenarios for the City of Chattanooga, with assumed population forecasts. However, it highlights the financial consequences of land-use decisions over the long term. The costs of low-density, sprawling development add up to significant amounts over time. Planners and policymakers in the region should take note before the next 50 years of development makes the problem even worse. Smarter growth, with more compact development patterns, would reduce long-term costs.

A few caveats to this analysis are warranted. First, because the population forecast assumes projections of an increase of 17 percent over 20 years, the magnitude of the numbers can vary. This is also the case with the development scenarios, which are hypothetical scenarios for density levels for the new growth. An analysis of a specific scenario or development pattern, especially with a defined geography would allow for assessment of other factors such as the costs of fixed services like schools, fire, police, waste management, and transit.

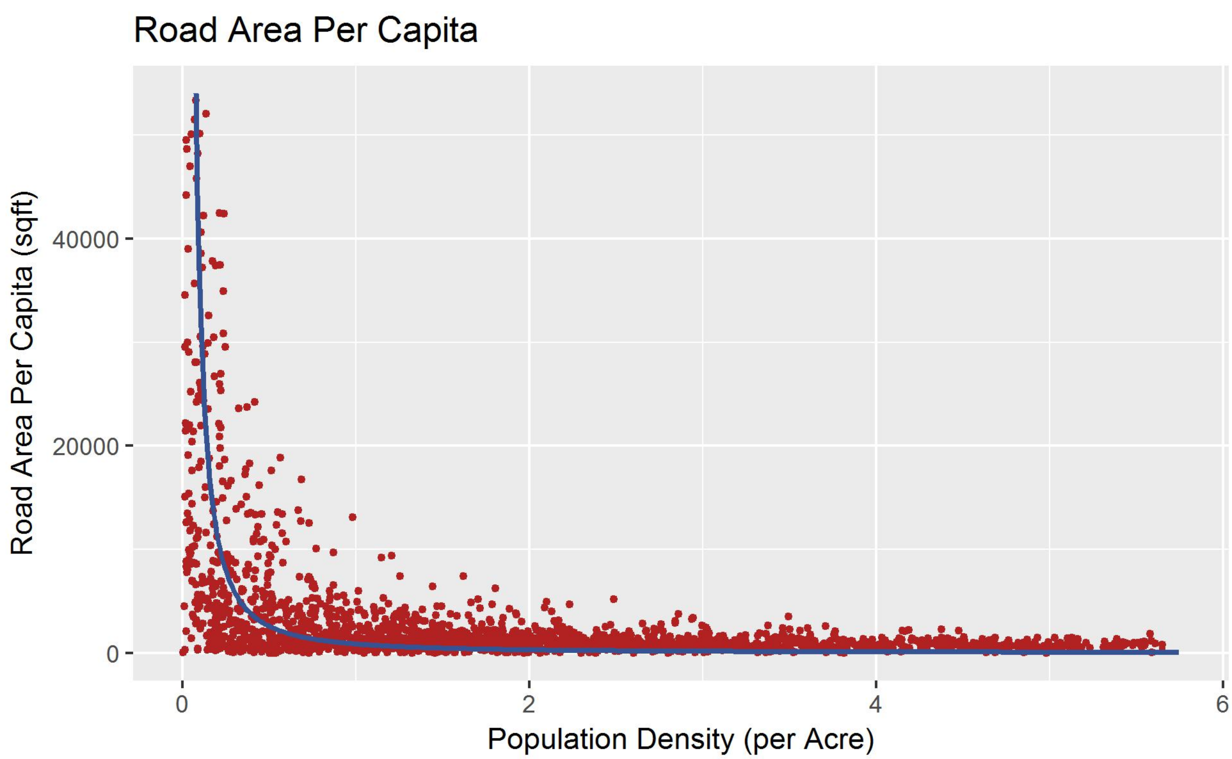
Secondly, Alternative A and the Baseline Scenarios assume new development in a “greenfield” pattern. The more likely case, reflected in Alternative B, is that at least part of the new growth to the City will be absorbed in existing housing and commercial stock, or as infill development in the existing footprint. Costs of absorbing residents or jobs in existing stock are generally negligible to the City aside from some costs of additional government services. Also, costs for infill development vary greatly, with complex developments costing significant sums in infrastructure, while other types of infill development cost a fraction of what greenfield development costs. Generally, based on discussions and work with several municipalities, SGA finds that the costs of infill development to the government can be around 35 percent of what the same development would cost in a greenfield.

Finally, SGA conducted this analysis for the City of Chattanooga using data particular to that community. These factors and magnitudes differ from community to community, representing the various policy and spending decisions that differ across the country. Infrastructure provision, especially on a per-capita basis, can vary widely from one place to another, even at similar density levels. Thus, it is best to understand these cost estimating models as best suitable for Chattanooga. The parameter estimates themselves are not suitable for application to other communities, although the trends of higher density requiring fewer people per capita do hold.

This analysis should be used as a guideline for the City of Chattanooga to consider the fact that context-sensitive higher density levels are not only beneficial from an economic, social equity, and environmental standpoint, they also make financial sense. As portrayed, the City stands to save an additional $1.16 billion by building at dense levels already present in the City; and these levels of density that are easily congruent with the character of the community. Continuing to build at low-density levels would yield heavy capital costs for major infrastructure items, and these costs can be mitigated with a “smart growth” approach to new development.

Appendix A – Technical Output

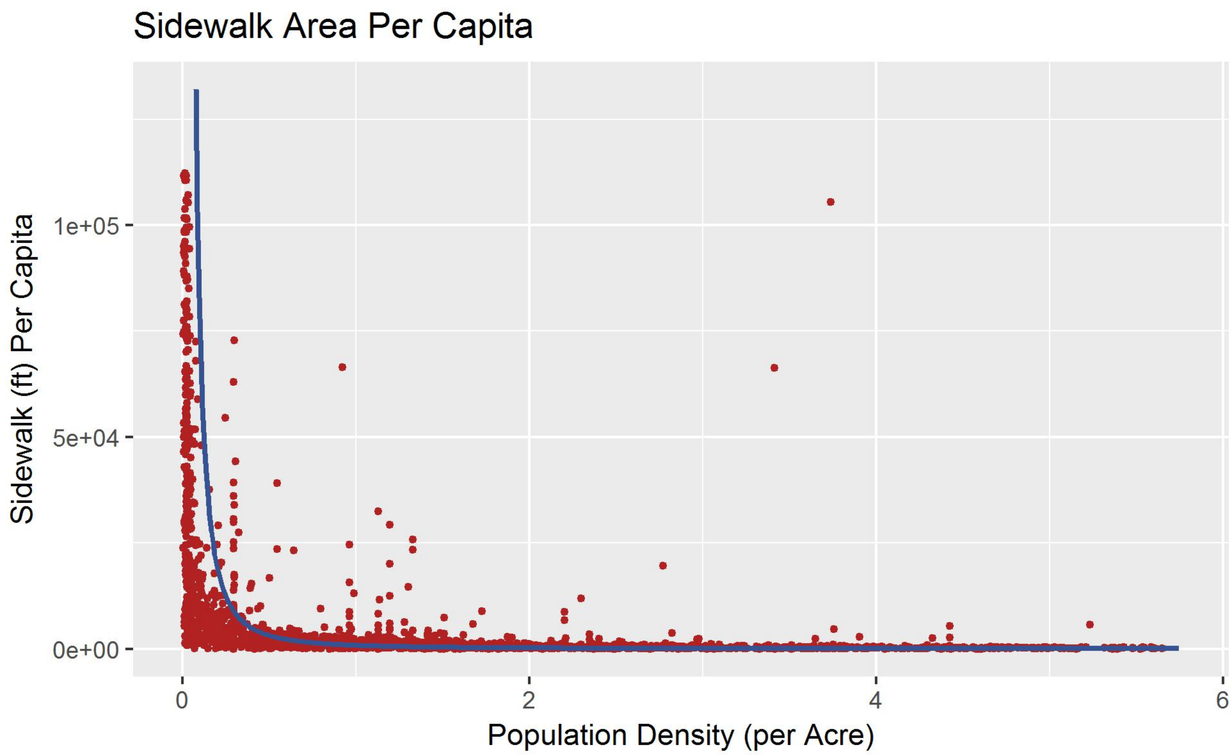
Roads



OLS	Using observations 1-3562 (n = 1958)	ln(Road Area per Capita)= 7.24+ -0.606*ln(population per acre)		
Missing or incomplete observations dropped: 1,604		Dependent variable: Road Per Capita		
	coefficient	std. error	t-ratio	p-value
Constant	7.24	-0.028	262.446	p < 0.001
Population per acre	-0.606	-0.023	-25.832	p < 0.001
Mean Dependent Variable	3077	S.D. Dependent Variable	6335	
Sum Squared Residuals	2813.36	S.E. of Regression	1.199	
R-squared	0.254	Adjusted R-squared	0.254	
F	667.29	P-value(F)	0.0000	
Log-likelihood	-3133.125	Akaike criterion	713.6858	

	Baseline	Alternative A	Alternative B
Unit Cost ($/sf)	$30	$30	$30
Est. Road Area (sf) per Capita	1,000	657	488
Est. Road Area Needed (sf)	29,398,206	19,315,086	14,349,455
Est. Cost of Road Area Needed ($)	881,946,185	579,452,590	430,483,654

Sidewalks

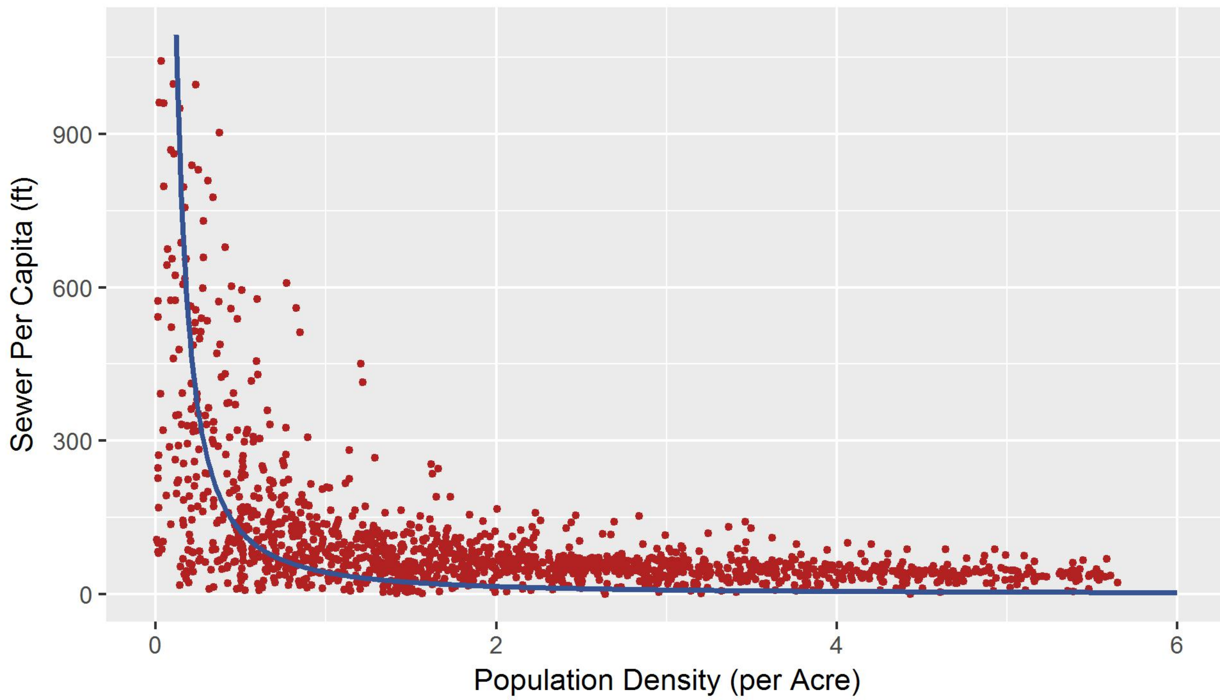


OLS	using observations 1-3562 (n = 2084)	In(Sidewalk Length per Capita)=6.719 +- 0.97 * In(population per acre)		
Missing or incomplete observations dropped: 1,478		Dependent variable: Sidewalk Per Capita		
	coefficient	std. error	t-ratio	p-value
constant	6.719	-0.025	265.876	<0.001
Population per acre	-0.97	-0.016	-60.711	<0.001
Mean dependent var	4,743	S.D. dependent var	17,619	
Sum squared resid	2679	S.E. of regression	1.11	
R-squared	0.639	Adjusted R-squared	0.639	
F	3685	P-value(F)	0	
Log-likelihood	-3,218.00	Akaike criterion	527.5337	

	Baseline	Alternative A	Alternative B
Unit Cost ($/sq. ft.)	$4	$4	$4
Est. Sidewalk Area per Capita	487	248.4	154.4
Est. Sidewalk Area Needed (sq. ft.)	14,302,259	7,301,390	4,537,560
Cost of Sidewalk Needed ($)	57,209,034	29,205,559	18,150,239

Sewer Lines

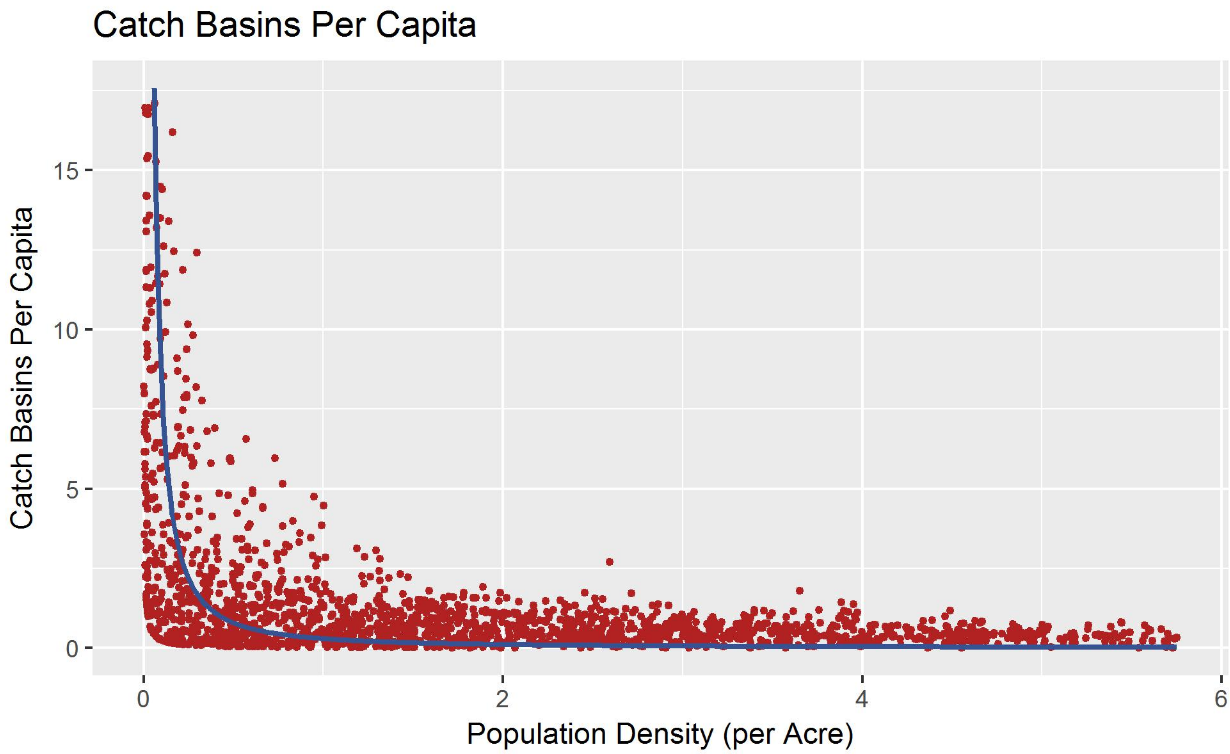
Sewer Length Per Capita



OLS	using observations 1-3,562 (n = 1,475)	ln(Sewerline Length per Capita)=4.383+ -0.531*ln(population per acre)		
Missing or incomplete observations dropped: 2,087		Dependent variable: Sewer Per Capita		
	coefficient	std. error	t-ratio	p-value
Constant	4.383	-0.021	209.173	p < 0.001
Population per acre	-0.531	-0.019	-27.705	p < 0.001
Mean Dependent Variable	102.6	**S.D. Dependent Variable**	135.3125	
Sum Squared Residuals	826.72	**S.E. of Regression**	0.749	
R-squared	0.342	**Adjusted R-squared**	0.342	
F	767.55	**P-value(F)**	0.0000	
Log-likelihood	-1665.959	**Akaike criterion**	-849.9506	

	Baseline	Alternative A	Alternative B
Unit Cost ($/linear-ft)	$63	$63	$63
Est. Storm Pipe (linear-ft) per Capita	60	41.4	31.9
Est. Storm Pipe Needed (linear-ft)	1,755,214	1,215,582	937,365
Est. Cost of Storm Pipe Needed ($)	109,700,885	75,973,867	58,585,331

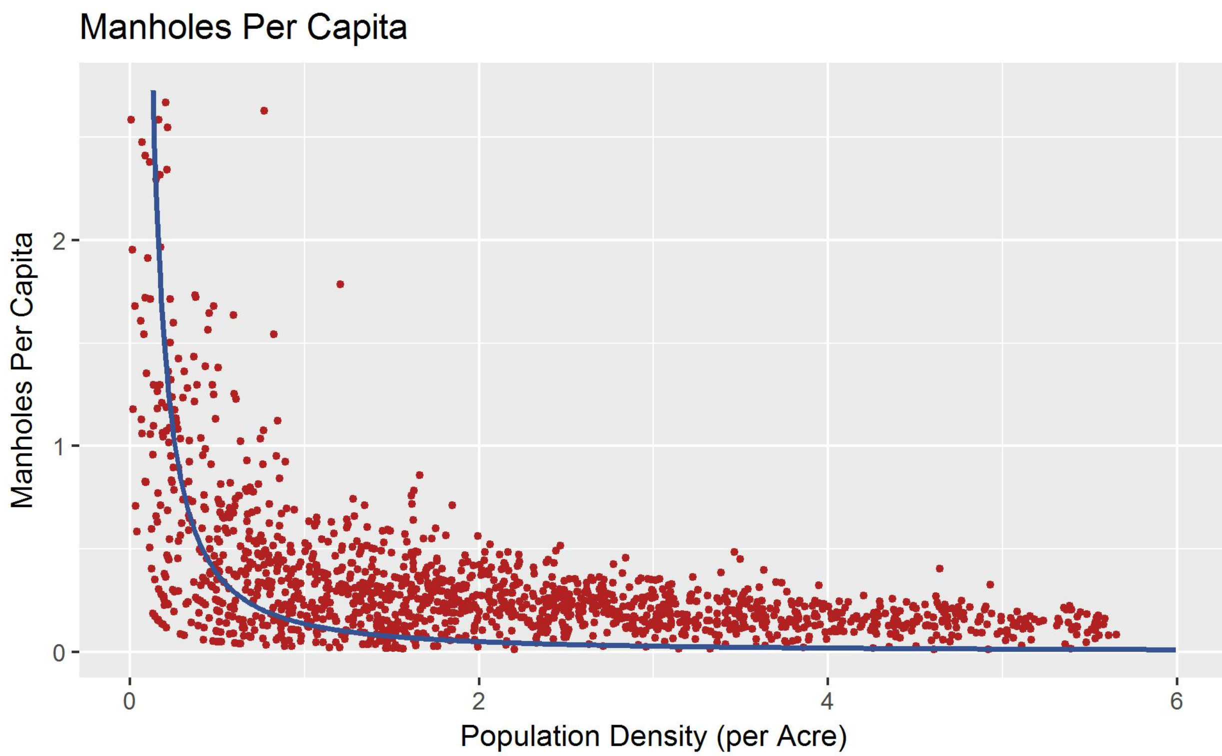
Catch Basins



OLS	using observations 1-2,998 (n = 1946)	ln(Catch Basins per Capita)= -0.4712+ -0.46132*ln(pop per acre)		
Missing or incomplete observations dropped: 1,052		Dependent variable: Basin_Per_Capit		
	coefficient	std. error	t-ratio	p-value
Constant	-0.4712	0.02582	-18.25	$p < 0.001$
Population per acre	-0.4613	0.01846	-24.99	$p < 0.001$
Mean Dependent Variable	1.387	**S.D. Dependent Variable**	2.34791	
Sum Squared Residuals	2274.89	**S.E. of Regression**	1.11	
R-squared	0.2528	**Adjusted R-squared**	0.2524	
F	624.5	**P-value(F)**	0.0000	
Log-likelihood	-2814	**Akaike criterion**	388.068	

	Baseline	Alternative A	Alternative B
Unit Cost ($/each)	$5,000	$5,000	$5,000
Est. Catch Basin per Capita	0.48	0.35	0.28
Est. Catch Basins Needed (each)	14,256	10,357	8,261
Est. Cost of Catch Basins Needed ($)	71,279,192	51,783,087	41,305,481

Manholes



OLS	using observations 1-3,562 (n = 1,444)	ln(Manholes per Capita)=-1.259+ -0.48 *ln(population per acre)		
Missing or incomplete observations dropped: 2,118		Dependent variable: Manholes_Per_Capita		
	coefficient	**std. error**	**t-ratio**	**p-value**
Constant	-1.259	-0.021	-60.816	p < 0.001
Population per acre	-0.48	0.01999	-23.997	p < 0.001
Mean Dependent Variable	0.3277	**S.D. Dependent Variable**	0.34383	
Sum Squared Residuals	728.38	**S.E. of Regression**	0.711	
R-squared	0.285	**Adjusted R-squared**	0.285	
F	575.845	**P-value(F)**	0.0000	
Log-likelihood	-1554.852	**Akaike criterion**	-984.1914	

	Baseline	Alternative A	Alternative B
Unit Cost ($/each)	$200	$200	$200
Est. Manholes per Capita	0.22	0.16	0.12
Est. Manholes Needed (each)	6,416	4,600	3,635
Est. Cost of Manholes Needed ($)	1,283,145	919,986	727,034

Appendix B – Commercial Corridor Development Example

Background

The following is an application of the analysis results toward a specific development example. In 2016, a Knoxville developer proposed a large mixed-use rental housing development downtown near Erlander Hospital expected to be completed in late 2017.[iv] The development would occupy a 2.62-acre tract with 80% of the street facing ground level devoted to commercial use.

This analysis assumed that the mix of studio, and 1 & 2 bedroom units would have a slightly lower average household size than the 2.0 persons assumed for the rest of the city. A vacancy rate of about 5% was also used. The resulting calculation projects a population increase from this development of 209 people. The density of the development using these assumptions would be 160 persons per acre.

This analysis also incorporates development that is 100% infill, which should minimize infrastructure costs by utilizing existing infrastructure in the area, and the high density of development should also lead to a positive fiscal impact.

It should be noted that the commercial impact of this development is not considered because this fiscal analysis has been conducted around residential development activity and revenues. Also, this analysis differs from the previous fiscal impact in the assumption that the population and resulting revenues will all be added within the first year, as opposed to gradually over time.

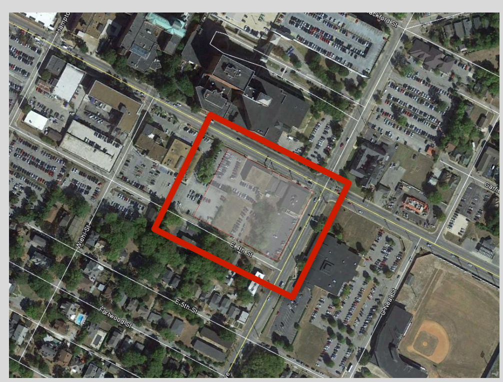
Development Key Stats

2.62 Acres of Mixed-Use

80% Ground Level Street Facing for Commercial Use

3-4 Story Parking Structure

Additional Pop. - 209 People*
Density – 160 people / acre



**Population estimate assumes a household size of 2.0 and a vacancy rate of 5%.*

Results

The fiscal model estimates a 20-year total cost of $246,526 (Table 8). However, this project would be estimated to have a positive net fiscal impact of $24,633 over that same time period. The net fiscal impact is calculated by comparing the total costs, with an estimated projected revenue of $1,232 for each of the 209 expected residents.

The scenario accounts for development at a very high density of 160 persons per acre with 100% infill development that leverages the existing infrastructure.

The density level shows a large development cost savings of $10,096,067 over the average development density of 1.7 people per acre within Chattanooga. It also saves $91,674 more than alternative B, which assumes a density of 13.0 persons per acre and 50% infill/greenfield development. (Table 10)

TABLE 8

Development Costs & Fiscal Impact

Total Costs	
Capital Costs – 20 years	$190,093
Amortized Costs (20 years at 2.2% rate)	$237,021
Maintenance Costs – 20 years	$9,505
Total Costs – 20 year	$246,526
Fiscal Impact	
Total Costs – 20 years	$246,526
Est. Tax Revenue – 20 Years	$271,159
Net Fiscal Impact– 20 years	$24,633
Annual Fiscal Impact	
Total Costs – Annual	$12,326
Est. Tax Revenue – Annual	$13,557
Net Fiscal Impact – Annual	$1,232

TABLE 9

Development Cost Savings

	Baseline	Alternative A	Alternative B	Development Example
Total Costs – 20 year	$10,342,593	$3,081,481	$2,080,000	$246,526
Total 20-year Savings	-	$7,261,112	$8,262,593	$10,096,067
Cost per Year	$517,130	$154,074	$104,000	$12,326
Savings per year	-	$363,056	$413,130	$504,803

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[i] Boyd Center for Business and Economic Research at the University of Tennessee, 2015 Single Year Population Projections for 2011 to 2064

[ii] The GIS analysis was conducted using ESRI ArcGIS. For population density calculations, areas not within the City's municipal borders were omitted. Population was divided into 40-acre cells from Census Block data using an aerial-weighted average calculation. Major water features were omitted from the aerial weight calculation.

[iii] City of Chattanooga Proposed Budget, 2017.

[iv]Green, Alex. "Planners Endorse 220-unit Apartment Building near Erlanger." Timesfreepress.com. Times Free Press, 15 Mar. 2016. Web. 30 May 2017.