Smart Growth America
Improving lives by improving communities

September 2018

THE FISCAL IMPLICATIONS OF DEVELOPMENT PATTERNS
Rural Lands Stewardship Area, Collier County, Florida

Sprawl costs Collier County, Florida more than it brings in. This is the finding of a recent Smart Growth America study conducted together with the Conservancy of Southwest Florida.

By modeling three different possible development scenarios, each with its own level of density, the study team found that providing infrastructure and services at sprawl levels of density would cost Collier County more than it can generate from tax revenues. In contrast, a Smart Growth compact pattern of development would create a fiscally balanced growth pattern. These scenario analyses should not be construed as support for this level of development, but as an exercise to demonstrate the costs associated with such growth.

Three Scenarios

The study team evaluated three growth scenarios that would each accommodate about 310,000 new residents and 36,000 new jobs in Collier County.

- The first scenario, "Sprawl," had the lowest density. This was based on existing and proposed low-density development in the Rural Lands Stewardship Area (RLSA), on over 45,000 acres.
- The second scenario, "More Compact Density," involved a slightly denser and more contiguous area on over 40,000 acres.
- The third scenario, "Smart Growth Density," would concentrate development in compact, walkable development patterns on an area under 15,000 acres.

Each scenario would accommodate roughly the same number of homes, jobs, and bring in the same amount of revenue. However, the scenarios differed in costs.

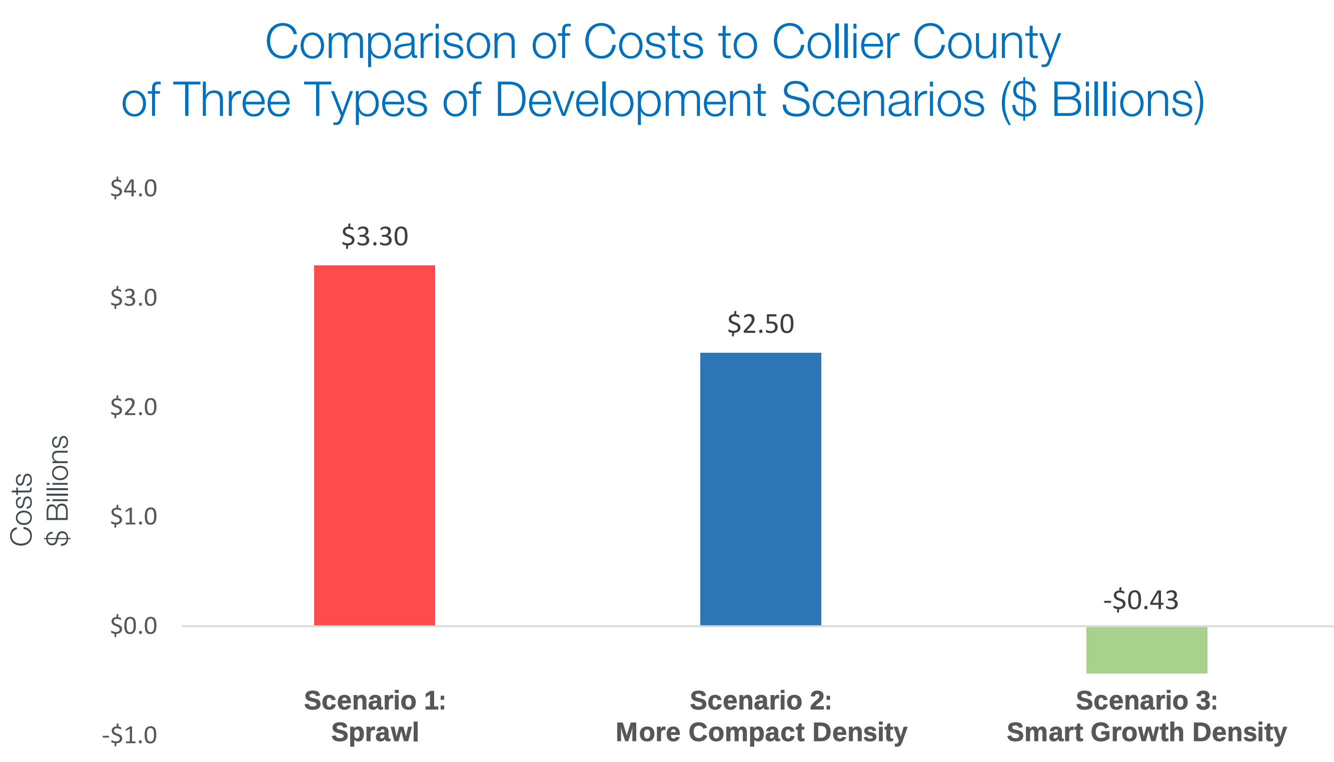
The SGA study team used statistical models to show that lower density leads to more infrastructure and service costs per person. The study found that sprawl levels of density require more road building and maintenance per person. Also, school transportation and emergency service costs increase as development sprawls.

Findings

The Sprawl scenario would ultimately cost Collier County more than the revenues that new households could generate. The net costs to Collier County over a 20-year period were highest in the Sprawl Footprint scenario.

- The Sprawl (Scenario 1) would have a net cost to Collier County of $3.3 billion over 20 years.
- The More Compact Density scenario (Scenario 2) would improve this, but still at a net cost of $2.5 billion over the same period.
- The Smart Growth Density scenario (Scenario 3) offers a positive net fiscal impact where the new growth in Collier County is fiscally balanced. At this level of density, Collier County would break even with $430 million in net revenue over 20 years.

In short, accommodating growth at higher density levels with a greater mix of uses would reduce costs for Collier County in the form of reduced roadway, school staff, school transportation, and EMS response costs. Accommodating development at the density levels we call Smart Growth Density would lead to a fiscally balanced growth pattern for the County.



Source: Smart Growth America, 2017

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Table of Contents

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 on this topic. Most of these conclude that "smart growth"[1]—defined generally as more compact patterns of development—is associated with reduced local government spending on a per capita basis relative to sprawling development. Smart Growth America's *Building Better Budgets*[2] report, published in May 2013, summarizes the results of 17 studies illustrating this pattern of reduced spending in compact patterns of development.

> *The Cost of Sprawl*, published by the Real Estate Research Corporation in 1974, was the first study to show that providing infrastructure and services to low-density sprawl 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.

Yet these findings are rarely included in the typical fiscal impact analysis done in connection with new land development proposals. There are many reasons for this, but the wide-ranging methodologies used in the above-referenced studies, as well as the time-consuming data collection required, have likely slowed the filtering of these advanced methods 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 employed person will add the same amount of public costs, regardless of whether they live and work in a sprawling, low-density development, or a higher-density, walkable, more compact one.

Smart Growth America (SGA) aims to apply our fiscal impact methodology to account for the increased cost efficiencies associated with more compact development patterns. The advantage of this methodology is that it helps evaluate the impact of different densities reflected in land use policies because the results show the differences in overall cost of infrastructure and operation of public services. Higher densities create efficiency by sharing the costs of infrastructure and operation of public services with a greater number of people, and thereby maximize the revenues received from those development patterns when compared to lower density development.

This report applies our fiscal impact methodology to the Rural Lands Stewardship Area (RLSA) of eastern Collier County, Florida.

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[1] For the purposes of this study "smart growth" is narrowly defined as more compact walkable development, and "sprawl" as lower density development.
[2] https://smartgrowthamerica.org/resources/building-better-budgets-a-national-examination-of-the-fiscal-benefits-of-smart-growth-development/

Scenarios

SGA worked together with the Conservancy of Southwest Florida to analyze the fiscal impacts on Collier County from potential development growth within the County's RLSA overlay. *We estimate that this area could accommodate upwards of approximately 309,686 residents when fully built out at the proposed density patterns of the current scenario.* We then consider costs over a period of 20 years (by 2037).[3] The findings of this analysis confirm that density matters when it comes to determining what new growth would cost the citizens of Collier County.[4]

The Conservancy of Southwest Florida asked SGA to develop three alternative scenarios for this analysis. The three scenarios were chosen to contrast the fiscal implications that density and housing patterns have on an area. Specifically, these scenarios address the possibilities and implications, both fiscal and environmental, on future development patterns in the RLSA as population increases and development pressures escalate in the County.

The first scenario and development density reflects the proposed landowner plan for development of the RLSA under Collier County's Comprehensive Land Use Plan and RLSA Overlay, *which has the capacity to add approximately 309,686 residents and an estimated 36,126 additional employed persons* to the County by 2037.[5]

Rural Lands Stewardship Area Key Stats

Approx. 309,686 Residents
TOTAL RESIDENTIAL POPULATION GROWTH AT FULL BUILD-OUT

36,126 Employed
ESTIMATED EMPLOYMENT GROWTH AT BUILD-OUT

345,812
24-hour population
TOTAL COMBINED GROWTH OF POPULATION (BOTH RESIDENTIAL AND EMPLOYMENT).

Source: U.S. Census, U.S. Bureau of Economic Analysis

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[3] 20 years was used as the period of time (or timeframe) for the purposes of analysis to avoid factors such as uncertainty and to help calculate infrastructure financing. The period of completion for full build-out could be longer (e.g. 50 years), and the specific cost and fiscal impact totals could change, however the overall trend and magnitude in difference of cost would still be consistent even over a longer timeline. 20 years is simply a useful timeframe to choose for modeling and evaluation.

[4] Neither the Conservancy nor Smart Growth America are taking the position that this potential future build-out population number is appropriate for the RLSA. We are simply utilizing the RLSA's existing build-out population assumptions and calculating the costs associated with this amount of population growth under three very different development scenarios.

[5] The total number of people would be the estimated total based on the development area, and dwelling unit density of development. Also note that if the RLSA was to build out at the maximum allowed density of 4 dwelling units per acre, the build out population would be even higher. The employed persons total is an estimate calculated from the total commercial square feet. This number is nearly double the existing 2017 population of Collier County in its entirety, which was estimated by BEBR to be about 357,470. (https://www.bebr.ufl.edu/population)

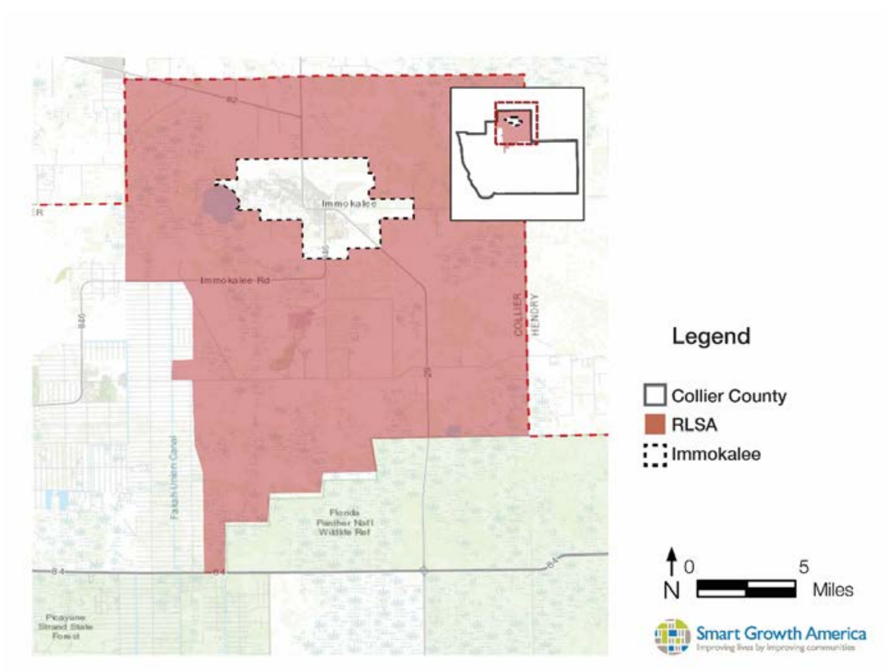
For this analysis, we use the term "**24-hour population**"[6] to refer to the combination of residents and employed persons living in the area. When referring to individuals, we use the term "24-hour person." For a full explanation of these terms, please see the Methodology section on page 17.

This combined total *24-hour population* growth of 345,812 is referred to throughout the report as the unit of reference when discussing the fiscal impact of costs and revenues that are shared between commercial and residential development. However, some of the costs considered in this analysis are unique to residential development, such as schools. When referring to the costs and revenues of components unique to residential development, residential per capita will be used as the unit of reference.

The RLSA, as shown in Figure 1, is approximately 195,846 acres in size and is separated from the Naples' urban area by expansive, low-density residential development, agriculture, and natural resource areas. In 2002 when the RLSA was adopted, most of the lands were in agricultural use. A large portion of this land continues to include sensitive wetland environments and significant wildlife habitat for listed species. One of the development areas included in all three scenarios, the town of Ave Maria, has been permitted for development. Another development project, known as Rural Lands West (RLW), has several permit applications in progress for the first phase of its development.

FIGURE 1

RURAL LANDS STEWARDSHIP AREA (RLSA)



6 For a full explanation of this term see the Methodology section, p. 25.

Scenario 1: Sprawl

Scenario 1 is derived from the RLSA Overlay and the Eastern Collier Multiple Species Habitat Conservation Plan of Eastern Collier County (HCP)[7]. Both the RLSA and the HCP reflect a fragmented pattern of new towns built at relatively low density and located well inland of the existing coastal urban area of the County. This scenario represents growth within a footprint of approximately 45,000 acres. This includes households built at an average density of 2.75 units per acre, the already permitted town of Ave Maria on 5,057 acres at a dwelling unit density of 2.18 units per acre, and the Rural Lands West proposed at a density of 2.43 dwelling units per acre as indicated in their application to Collier County.

This scenario anticipates development to eventually occur in more new towns and villages scattered throughout the RLSA. Based on the actual density of Ave Maria at 2.18 units per acre and the proposed density of 2.43 units per acre in Rural Lands West (RLW), it is reasonable to assume the density within other future communities in the RLSA will also be low. From the landowners' map within the 2015 version of the HCP, we know these towns and villages will sprawl across approximately 195,000 acres of landscape within the RLSA, in what appears to be a fragmented pattern. If fully built-out at these densities, the total growth in residential population would be approximately 309,686 persons.[8] In addition, the amount of commercial area that would follow this development would employ on average 36,126 persons.[9] A summary of the total acreage, density, and corresponding number of housing units are summarized in Table 1 on page 9.

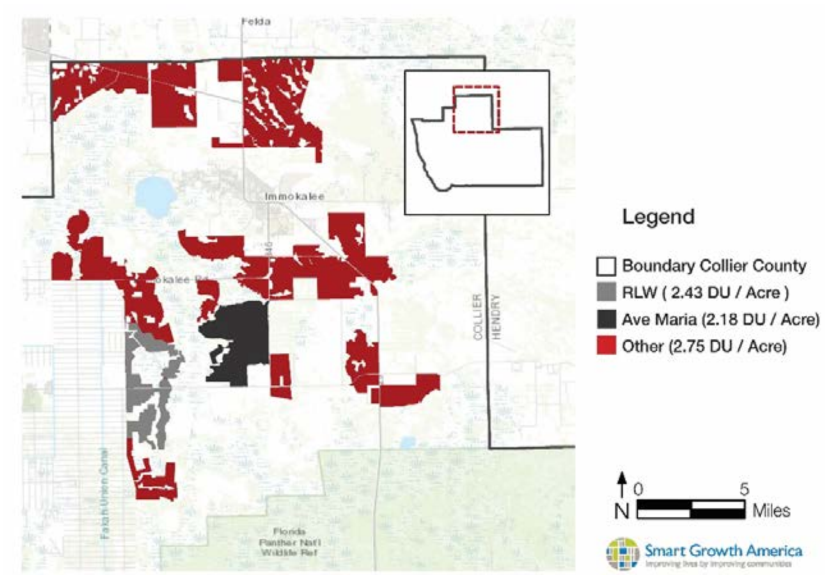
[7] This HCP proposes to authorize an Incidental Take Permit for all listed species within 45,000 acres of new towns and mining in the RLSA. This HCP is intended to address the many threatened and endangered species which live is Eastern Collier County. Updated HCP maps have been submitted to the permitting agency and while minor modifications have been made, these changes are not, from our perspective, substantive enough to impact this model. For more information, please go to https://www.conservancy.org/our-work/policy/eastern-collier-county

[8] As this is the population assumed under Scenario 1, we are referring to this number as the approximate growth assumption for all three scenarios.

[9] "Building Area Per Employee by Business Type" http://cityofdavis.org/home/showdocument?id=4579

FIGURE 2

SCENARIO 1: SPRAWL FOOTPRINT (45,000 ACRES)



Scenario 2: More Compact Density

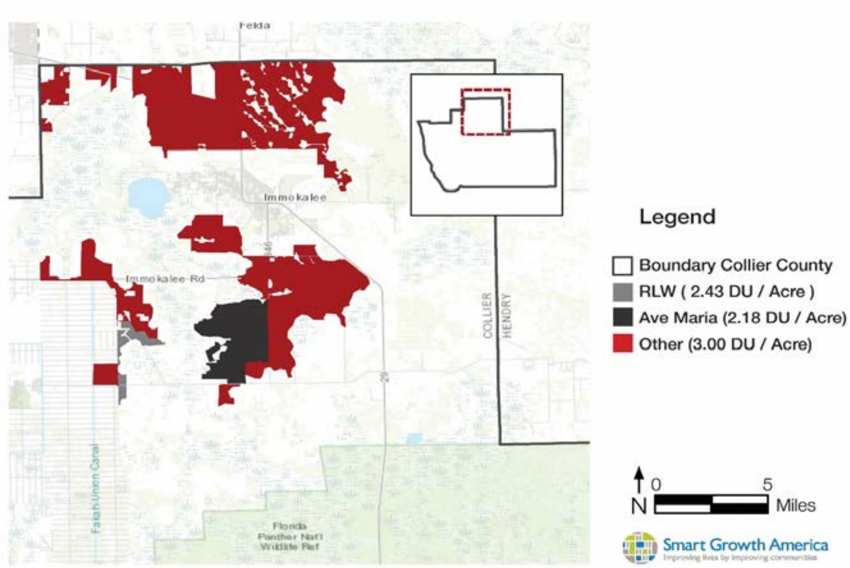
Scenario 2, as shown in Figure 3 below, applies slightly higher densities (up to 3 dwelling units per acre) for new growth within a total footprint area of approximately 40,700 acres. This scenario is similar to Scenario 1, in that it accounts for growth similar to the approximately 309,686 residents plus 36,126 employed persons as projected in the first scenario for a 24-hour population of 354,463 on slightly less acreage.[10]

The density levels of Scenario 2, which are slightly higher than the Scenario 1, would still accommodate a similar level of development within the footprint shown in Figure 3. While the costs and revenues of this scenario remain comparable to Scenario 1, the main difference in this scenario is that by planning for growth within a more compact and contiguous area, the County could accommodate the same 24-hour population, while reducing environmental impacts. This is achieved by moving development away from primary zone panther habitat and into the secondary zone. (See Page 15 for further information on primary and secondary zone panther habitat).

The reduction in fragmentation and slight increase in density would also result in some savings in the cost of infrastructure and operation of public services. At the same time, changes in the actual housing patterns would be minimal. A summary of the total acreage, density, and corresponding number of housing units that would follow are summarized in Table 1 on page 9.

FIGURE 3

SCENARIO 2: MORE COMPACT DENSITY FOOTPRINT (40,696 ACRES)



[10] It should be noted that differences in density and footprint would result in slightly fewer dwelling units and residential population (2% less).

Scenario 3: Smart Growth Density

Scenario 3, as shown in Figure 4 below, is the application of significantly higher densities and a more walkable development pattern. This Scenario places future new towns outside primary and adult breeding panther habitat and in close proximity to existing roads and the Immokalee urbanized area. This scenario also shows a reduced footprint that would accommodate nearly the same growth as projected in scenarios 1 and 2. However, unlike the other scenarios this one *yields significant savings in costs and generates a cost-neutral fiscal impact.* Costs and revenues for each level of development density were calculated separately and totaled to arrive at the final estimate of fiscal impact. The higher density levels in this scenario were selected by SGA to illustrate the benefits that land use policy decisions can have on the fiscal impact of development and on the environment.

The savings in costs generated by this scenario could be used by the County to address needed infrastructure and improvements in existing urban areas, since they would not be required for supporting infrastructure and services in sprawling developments in the RLSA. Densities within this scenario range from 2.18 housing units per acre in Ave Maria, up to 14 housing units per acre in future compact town development. Scenario 3 demonstrates how high density needs to be to have a positive fiscal impact in the RLSA.

Table 1 on page 9 summarizes the estimated populations for the development areas, densities, and corresponding number of dwelling units that would follow from those patterns.

FIGURE 4
SCENARIO 3: SMART GROWTH DENSITY FOOTPRINT (14,915 ACRES)

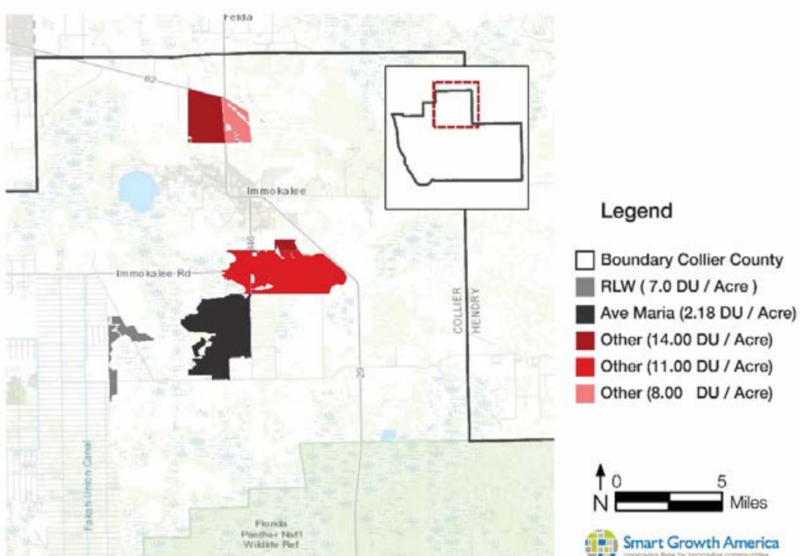


TABLE 1

Summary of Objectives for All Three Development Scenarios

	Scenario 1: Sprawl	Scenario 2: More Compact Development	Scenario 3: Smart Growth
Residential Population	309,686	304,048**	309,900
Total Dwelling Units	119,570	117,393	119,652
Total Gross Acres*	45,007	40,704	14,924
Residential Density (DU/ Acre)	2.75, 2.43, 2.18	3.0, 2.43, 2.18	14.0, 11.0, 8.0, 7.0, 2.18

**Total acreage might vary slightly between this table and Figure 7 by 5 to 15 acres between the fiscal impact analysis, and panther habitat loss due to the use of different projections within GIS to match source data.*
***Population under this scenario is less than the other scenarios due to scenario parameters retaining density at a similar level to Scenario 1, while directing development to a more appropriate footprint, which precluded 45,000 acres of new towns. This resulted in less acreage developed and thus, less population.*

Key Findings

Net Fiscal Impact

There are two key fiscal metrics derived in this analysis. The first is the total 20-year cost, which our fiscal impact model estimated. For a sense of scale, we also report the results on a per-year basis.

The second metric is what we call *net fiscal impact* (Table 2 & Figure 5). The net fiscal impact takes the total 20-year cost, and compares it against potential revenues from new residents. Here, we use average revenues based on Collier County's 2017 budget of $931 in annual revenue per capita (residential population) for non-school expenditures,[11] and $1,361 annual revenue per capita destined for schools.[12] With this allocation of revenue as denoted in the budget, we also estimate each employed person to generate an additional $307 of tax revenue annually for the County.[13]

Table 2 and Figure 5 show that as density of development increases, the net fiscal impact per acre also improves. It is important to note that Scenarios 1, 2, and 3 all have approximately the same number of housing units on varying amounts of land, while the three scenarios are all based on different development objectives (see Table 1 on page 9).

Comparing the most and least expensive outcomes, under Scenario 1, the County would face a 20-year cost of $10.9 billion to provide additional infrastructure and services to accommodate the new growth. Scenario 3, would cost the County substantially less, (i.e., $7.1 billion over 20 years). Therefore, Scenario 3 represents a potential savings in costs of $3.7 billion relative to Scenario 1, which is not surprising, given Scenario 3 incorporates a more compact development footprint, and the principles and practices of smart growth.[14]

The savings in costs are the result of reductions in roadway, school building, staffing and transportation, as well as EMS response costs, at higher densities. When we consider the average tax revenues of the new residents and employed people, Scenario 3 results in a *neutral net fiscal impact* where the costs would break even with revenues to the County within a growth scenario of a 24-hour population of 345,812 within 20 years.

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[11] Collier County Florida Board of County Commissioners. Fiscal Year 2016-2017 Budget http://www.colliergov.net/home/showdocument?id=67346. P.48 indicates $342,768,700 forecast revenues for FY2017. This figure is subtracted by property taxes (p.46, $38,850,000) and carryforward from the previous year (p. 48, $48,727,500). The final revenue estimate is $299,379,600.

[12] Collier County Public Schools Final Budget 2017-2018. https://www.collierschools.com/cms/lib/FL01903251/Centricity/domain/86/budget%20book/BudgetBookPart1-FINAL1718.pdf P.4 indicated a total proposed millage proceeds of $437,606,708 at production of this analysis. CCPS has subsequently updated this figure to $435,904,620. The original $437 million figure is used in this analysis.

[13] Collier County Florida Board of County Commissioners. Fiscal Year 2016-2017 Budget http://www.colliergov.net/home/showdocument?id=67346 P. 46.

[14] Scenario modeling did not incorporate impact fees or Developer Contribution Agreements.

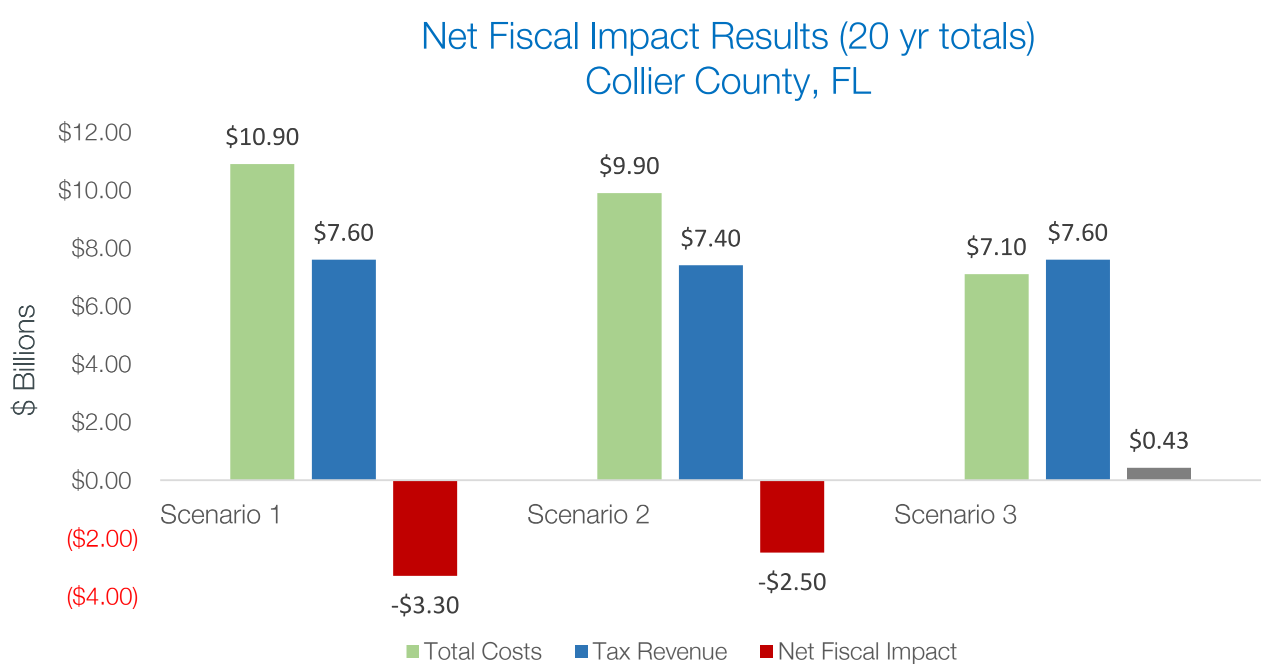
TABLE 2

Results – Collier County Development Net Fiscal Impact

Dollars (in Billions unless otherwise indicated)	Scenario 1: Sprawl	Scenario 2: More Compact Development	Scenario 3: Smart Growth
Total Costs – 20 Years	$10.9	$9.9	$7.1
Est. Tax Revenue - 20 Years	$7.6	$7.4	$7.6
Net Fiscal Impact – 20 Years	-$3.3	-$2.5	+$0.4
Net Fiscal Impact – Per Year*	-$540 Million	-$125 Million	+$21 Million

Source: Smart Growth America, 2017
**Annual costs are average costs per year. The estimated costs on an annual basis would vary from year to year.*

FIGURE 5



Source: Smart Growth America, 2017

All three scenarios plan for the same level of growth (24-hour population) therefore, each would generate about 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 County would lose money in accommodating the new growth ("in the red"); a positive net fiscal impact indicates that the County would actually make net revenues ("in the black").

The results of this analysis show that Scenario 1 would cost Collier County $10.9 billion over 20 years (Table 3). This equates to $540 million per year. Applying the estimated potential tax revenues from new population and employment growth yields a 20-year *net fiscal impact* of -$3.3 billion, or an average of -$165 million per year. (Table 2)

Scenario 2 assumes slightly higher densities per acre on slightly less acreage. This development pattern would reduce the 20-year costs to $9.9 billion ($500 million per year). The *net fiscal impact improves* compared to Scenario 1 (per this conservative analysis), but it is still a negative 20-year net fiscal impact of -$2.5 billion (a loss of nearly $125 million per year on average).

Scenario 3 has the highest density patterns of the three scenarios being compared. We estimate 20-year costs for this development pattern at $7.1 billion ($370 million per year). The 20-year *net fiscal impact* is neutral, with costs and revenues breaking roughly even. This scenario would put the County "in the black" and the County would make more estimated revenues than it would pay in infrastructure costs (a gain of $430 million over 20 years).

The alternatives set forth in Scenario 3 are important because they illustrate what it would take for all of the additional costs of infrastructure to be offset by potential revenues. At lower density levels (such as in the Scenario 1) the County would likely have a *negative* fiscal impact. Incorporating a different development pattern that includes higher densities in specific areas and mixed-use developments would enable the County to generate a *neutral* net fiscal impact from future growth. The $3.7 billion saved would be available for other uses in infrastructure and improvements in existing urban areas of the County, since they would not be diverted to infrastructure and services in sprawling developments in the RLSA.

TABLE 3

Summary: Cost and Maintenance of Infrastructure, and The Operation of Public Services

(Billions $)	Scenario 1: Sprawl	Scenario 2: More Compact Development	Scenario 3: Smart Growth
Capital Costs* – 20 years	$6.8	$6.3	$3.7
Amortized Costs (20 years at 2.2% rate)	$8.4	$7.8	$4.7
Maintenance Costs* – 20 years	$0.3	$0.3	$0.2
Operation of Public Service Costs*	$2.1	$1.8	$2.3
Total Costs – 20 years	$10.9	$9.9	$7.1
Total Costs - Annual	$0.54	$0.50	$0.36

Source: Smart Growth America, 2017
**Capital costs include roads and the construction of school buildings. Maintenance costs represent 5% of the total capital costs per year. Operation of public services include school staffing and transportation, and EMS costs.*

It should be noted that in Table 3 the capital costs differ from the total 20-year costs because the net fiscal impact accounts for the additional financial costs of a project that occur over time for infrastructure costs. For example, for the new towns the County might first issue bonds to finance the construction of much of the infrastructure that will be needed, such as roads, schools, etc. Then, over a period of years, homes and commercial places of employment would be built incrementally and then occupied, and corresponding revenues would follow later over time. This is reflected in the amortized costs, which when added with the maintenance costs and the cost of the operation of public services give the full 20-year cost as shown in Table 3, above.

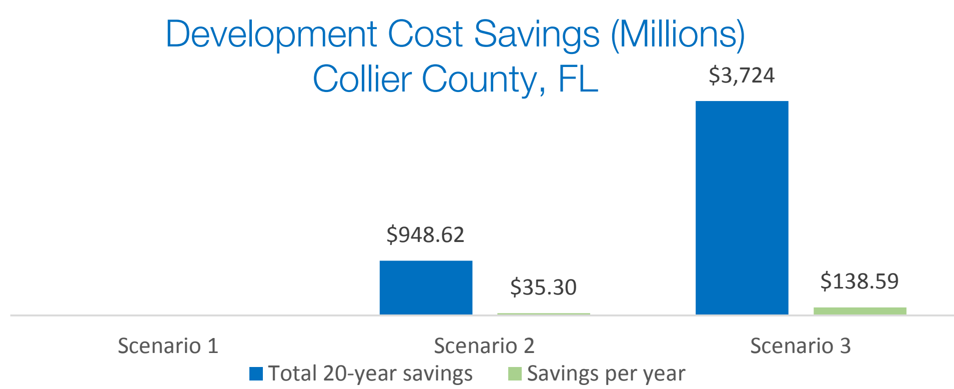
When the revenues trickle in year-over-year, Scenario 3 shows a neutral net fiscal impact. However, this same effect of delayed revenues over time to pay for capital costs would result in a negative fiscal impact for Scenario 1 (-$165 million annually) and Scenario 2 (-$124 million annually).

This analysis shows that development in line with Scenario 1 would cost Collier County more money for these infrastructure items than the County would likely receive in additional revenues. The costs are amplified when we consider a comprehensive set of infrastructure items. However, it should be noted that this is simplified for scenario planning purposes.

The findings of this study on net fiscal impact underscore the risks to the County inherent in encouraging low-density new towns and villages. In the case of a negative fiscal impact, the County would have to raise revenues to cover the additional costs incurred. These revenues would have to be generated from somewhere—whereas Scenario 3, with its higher density, could generate a positive fiscal impact.

Finally, we convert the costs into "savings in costs" relative to the Scenario 1 (Table 4). From this stand point, Scenario 3, and to a lesser degree Scenario 2, offer significant potential savings to Collier County compared to the Scenario 1. Scenario 2 would save the County $948 million over 20 years ($35.3 million per year), while Scenario 3 would save the County $3.7 billion over 20 years ($138.6 million per year) when each are compared to Scenario 1. These are savings in costs (or reduced costs), not net fiscal impacts that would also consider revenues.

FIGURE 6



Source: Smart Growth America, 2017

TABLE 4

Results – Collier County Development Savings in Costs (Compared to Scenario 1)

(Millions $)	Scenario 2: More Compact Development	Scenario 3: Smart Growth
Total 20-year savings	$948.6	$3,724
Savings per year	$35.3	$138.6

Source: Smart Growth America, 2017

Cost of Panther Habitat Loss

In addition to fiscal costs, the total acreage consumed by development also creates significant environmental costs. Planning decisions can result in fragmentation, degradation and isolation of endangered wildlife habitat, including that of many listed species, most notably the endangered Florida panther. The impact may be irreversible.

The recovery of the endangered Florida panther depends upon maintaining the ability of the Primary, Secondary, and Dispersal Zones to contribute to a viable population. Habitat loss and fragmentation often stem from rapid human population growth and conversion from natural habitats and agriculture to urban land use. Primary zones are defined as lands essential to the long-term viability and survival of the Florida Panther. Secondary zones are identified as additional natural and disturbed lands in south Florida that may be important to support an expanding panther population, especially if habitat restoration were possible.[15] [16]

Although Scenarios 1 and 2 have fairly similar development acreages, the compact contiguous *pattern of development in Scenario 2 reduces the loss of primary habitat by 15,695 acres.* Scenario 3 also reduces the loss of primary habitat by the same amount, 15,695 acres compared to Scenario 1 while also significantly reducing the total habitat loss (both primary and secondary combined) by 30,098 acres.

The analysis shows that Scenario 1 would lead to a total loss of 45,012 acres of combined primary and secondary zone habitat, with a loss of 17,820 acres in primary habitat. In addition, Scenario 1 would lead to an increased fragmentation of remaining habitat. The impact of planning and creating a more contiguous pattern of development as observed in Scenario 2 shows that although 40,710 acres of habitat would be lost due to development, the remaining area would be less fragmented and the total potential loss of primary panther habitat could be reduced to the already permitted primary panther habitat impact of Ave Maria of 2,125 acres.

Scenario 3, not only provides the greatest savings in fiscal costs through the application of higher density, but also reduces the total panther habitat loss (in both primary and secondary habitat areas) to just 14,914 acres (compared to the total loss of habitat of about 45,012 and 40,710 acres in Scenarios 1 and 2 respectively.)

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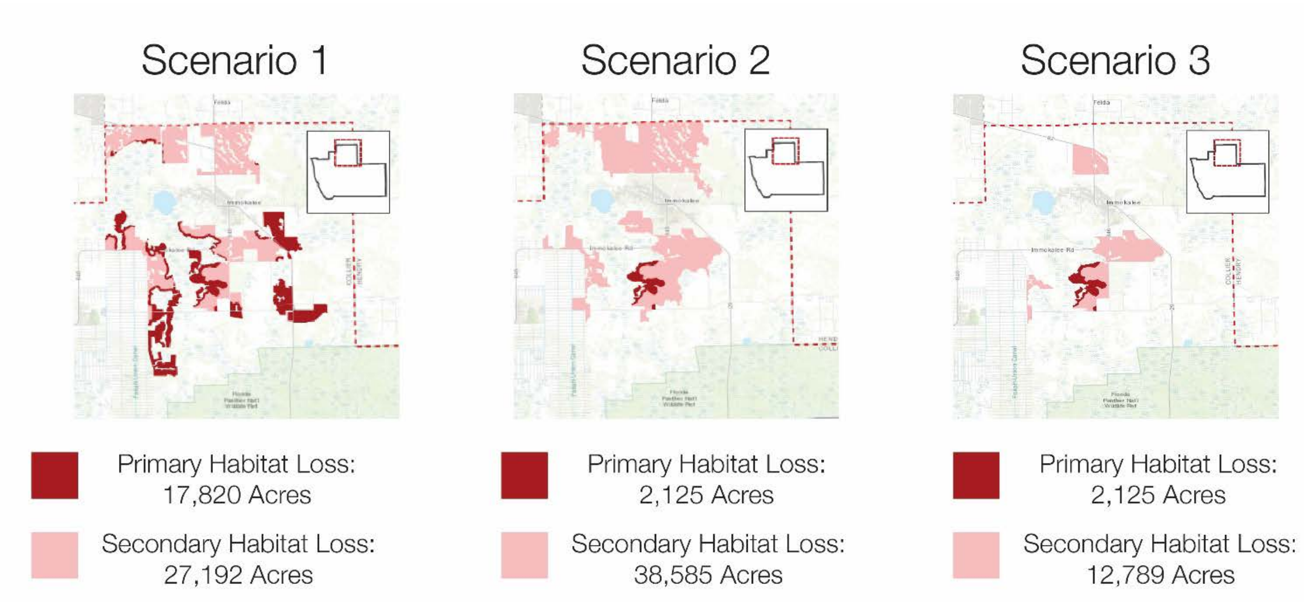
[15] Kautz, Randy, et al. "How Much Is Enough? Landscape-Scale Conservation for the Florida Panther." Science Direct, El Sevier, 3 Feb. 2006, doi.org/10.1016/j.biocon.2005.12.007.

[16] In addition to removing additional impacts from primary panther habitat, Scenario 2 also removes impacts from Adult Panther Breeding areas. Adult Panther Breeding areas are defined in Frakes, Robert A., et al. "Landscape Analysis of Adult Florida Panther Habitat." Plos One, vol. 10, no. 7, 2015, doi:10.1371/journal.pone.0133044.

FIGURE 7

Impact on Panther Habitat, by Scenario



Methodology

Development cost items considered:

- Roads
- Schools and Staff
- School Transportation
- EMS Response

This analysis focuses on four expenditure types for Collier County: roads, new schools and staffing, school transportation, and EMS response. We selected these items based on the available data from Collier County and the State of Florida (discussed later in this section for each item). We consider these items for scenario planning purposes. There are many other infrastructure costs, such as police and fire services, civic infrastructure, water and storm water facilities that are also part of planning for population growth. Focusing on only these four items helps to narrow in on costs that have some of the strongest relationships to population densities, which can be estimated in our planning scenarios. Because this analysis does not use all possible infrastructure items, the costs we present are likely to be low relative to what future development would actually cost the County.

To assist SGA in estimating the distribution and subsequent of area of roads, Collier County provides publicly available GIS shapefiles.[17] 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 estimate unit density (e.g. "roads per acre") as a function of population and employment density (e.g. "24-hour population per acre"). These models allow us to estimate the amount of infrastructure units needed per 24-hour population as a function of density. (This operation distinguishes the form of analysis from "average cost analyses" more commonly used in fiscal impact modeling, as referred to on page 2.)

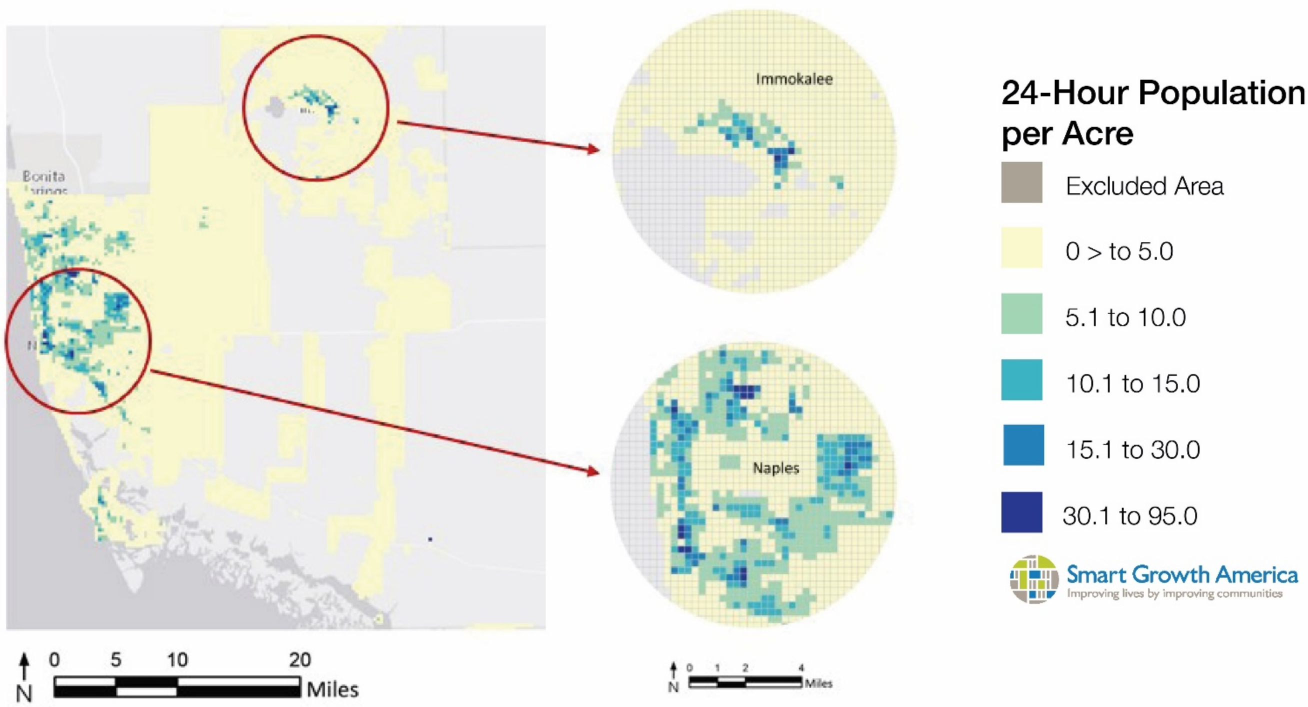
Take Figure 9 for example, which illustrates "road area per 24-hour population needed." This sharply decreases as population density increases. At very low levels of population, Collier County requires thousands of square feet of road per 24-hour person. At higher density this decreases to low levels of square feet of road per 24-hour person because roads can be shared and distributed among more residents and employees. A fuller explanation of the usage and definition of 24-hour population can be found on Figure 12 on page 21.

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

[17] Collier County GIS Services. https://www.colliercountyfl.gov/your-government/divisions-f-r/information-technology/gis-services-opendata

FIGURE 8

Collier County 24-Hour Population Density, 2010



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

The existing average density across the entire County is 2.3 24-hour persons per acre. This analysis focuses on developed areas only, and excludes undeveloped areas and areas such as parks, protected wetlands, and water bodies. Density calculations are made per 40-acre grid cell using Census data as shown on Figure 8.

Significantly higher densities were observed within areas of the County, for example within the City of Naples and in the unincorporated area of Immokalee. Density in these areas reach levels of approximately 30 to 95 24-hour persons per acre. (While this range of 30 to 95 for 24-hour persons per acre is broad, there are only a few selected observed areas that fit within this level of density). The County's average density level of 2.3 24-hour persons per acre is much lower than Naples or Immokalee.

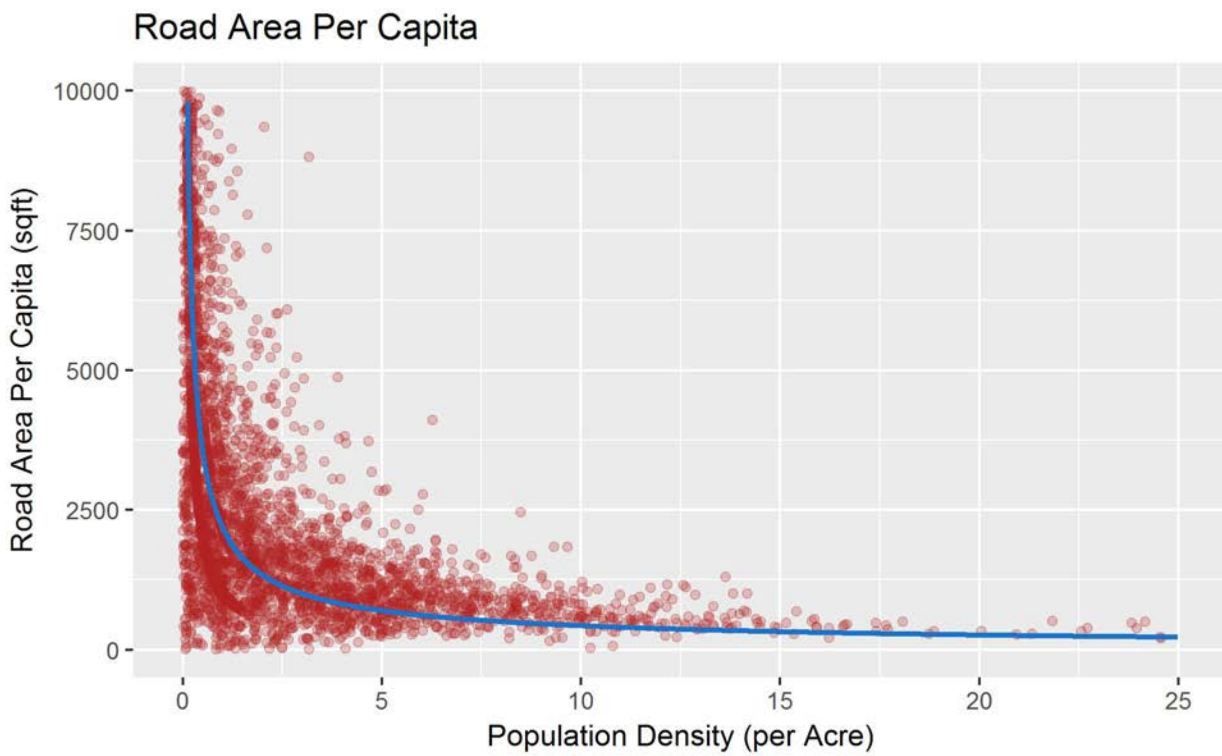
These Countywide observations of existing population were used to develop statistical models[18] that estimate future infrastructure development patterns and costs. Note that these observations

[18] Statistical models conducted as OLS models in R-Studio. The unit of analysis was the 40-acre grid cell. Models were log-log form, such that Log(Infrastructure Item Density) = C + Log(24-Hour Population Density). A logarithmic form was determined appropriate given the downward sloping shape as seen in the figures in the following page.

are 24-hour population of residents and jobs within an area as observed through the Census and GIS analysis.[19]

FIGURE 9

Road Area per 24-Hour Population, by Density, Collier County



Source: Smart Growth America, 2017

The model for roads estimates the quantity of infrastructure needed per 24-hour person. The graph above shows the observed quantities of infrastructure (in this case measured in term of square foot of road) per capita. [20] The blue trend line obtained from the observations is used to estimate patterns of future development for various levels of density. Here we see as population density per acre increases, the road area required per capita diminishes rapidly. Using these total quantities, we derive item-specific cost factors, each of which were developed based on SGA research and coordination with The Conservancy of Southwest Florida.

The final step in this analysis was to add two additional costs: the costs of financing, and the cost of operations and maintenance. Infrastructure items are long-term capital investments which governments typically issue bonds to pay for. The analysis assumes that the financing cost to the

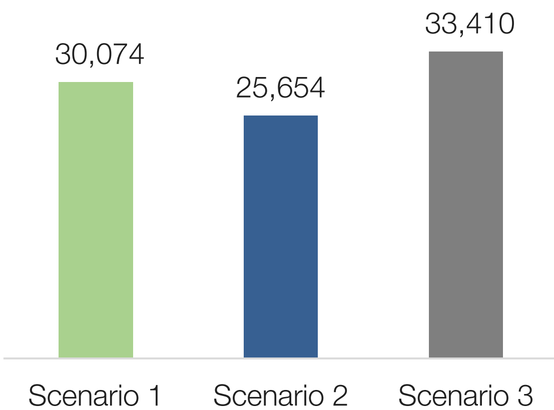
[19] These density observations often vary from proposed densities of specific developments because they only take into account the specific area being developed and not the surrounding context. In other words, the analysis uses gross density in a 40-acre cell, not the specific spot density of a proposed site.

[20] We utilize the term “per capita” to mean per resident or employee. In other words, the denominator is 24-hour population.

County would be 2.2 percent interest over 20-years (a typical cost of long-term municipal bonds in 2017). Finally, the analysis assigns an operations and maintenance cost of 5 percent to the cost of road building.[21] [22]

FIGURE 10

School-Age Children Projection, by Scenario



Source: Smart Growth America; U.S. Census PUMS 2011-2015

We estimated school costs using detailed data provided by the state and County departments of education. This analysis used specific costs and planning estimates obtained through Florida's Department of Education budget and planning documents for new building construction, staffing levels[23], and transportation costs[24] [25] and capacity each year.[26]

We then calculated school-age children estimates using public use microdata sample (PUMS) data provided by the U.S. Census, which contains anonymous records of individual responses that can be used to profile dwelling unit patterns.

Different housing types and density can lead to different outcomes for school-age children projections.

Projections for the total number of school-age children expected for each development scenario can be viewed in Figure 10. Additional data for school-age children projections per housing type can be viewed in Appendix A.

School and EMS distance costs were determined by calculating the change in distances for groups of people by density levels. Since transportation costs only account for distance, and do not account for routing or the number of stops, we calculated school transportation costs by converting the number of school-age children per acre into a linear distance to determine the miles per student required to travel for each density level.

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[21] Five percent operations and maintenance costs is consistent with engineering cost estimates in other communities that Smart Growth America has interviewed. It is also consistent with contingency allowances for capital cost estimation. This is in the range of assumptions commonly used in transportation cost estimating. See: http://www.samtrans.com/Assets/_Planning/BRT/Operating+and+Maintenance+Costs.pdf. However, it should be noted that this is on the conservative end of estimates and actual costs could be higher.

[22] As of April 2018, Collier County Operations and Maintenance Costs are even higher than SGA estimates at 15 – 20%.

[23] Florida Department of Education, Staff Data. http://www.fldoe.org/accountability/data-sys/edu-info-accountability-services/pk-12-public-school-data-pubs-reports/staff.stml

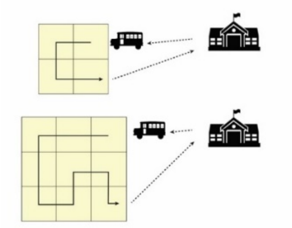
[24] Florida Association of IMS. http://famisonline.org/wp-content/uploads/2015/06/FAMIS-2015-TransportationFunding.pdf

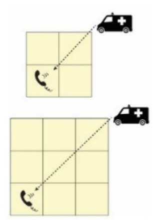
[25] "Florida School District 2015-16 Transportation Profiles." www.fldoe.org/core/fileparse.php/7585/urlt/SDTPSY1516Profiles.pdf

[26] Florida Department of Education. http://www.fldoe.org/core/fileparse.php/7507/urlt/collier1516.pdf

FIGURE 11

School Transportation & EMS Response Costs, by Density





Higher Density =
Fewer Avg. Miles Traveled per 911 Call or Student

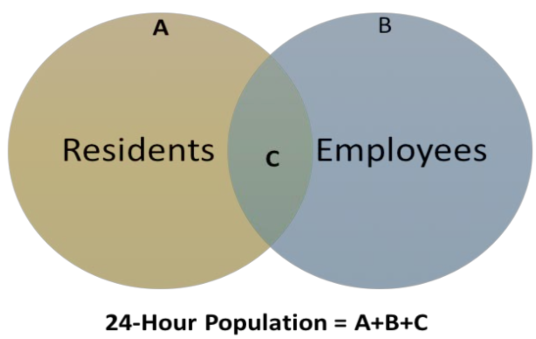
Lower Density =
Greater Avg. Miles Traveled per 911 Call or Student

SGA calculated EMS costs through a similar method to school transportation costs. We converted the average number of 911 calls per dwelling unit to a per acre basis for each density level. We then determined the average distance per call by computing the average distance required to reach each caller.[27] Illustrations of the modeling concept used to calculate school and EMS transportation expenses can be seen in Figure 11.

For this analysis we use the term "24-hour population. This is equal to the residential population (at place of residence) in the study area, plus the employment (at place of employment) in the study area. Some people live and work in the same area, and in this case the 24-hour population figure deliberately double-counts them. This stems from the theory that there are unique infrastructure needs for residents, and other unique infrastructure needs for employed persons. Figure 12 to the right illustrates this as a conceptual diagram. Throughout this analysis, when we refer to additional population, we mean the 24-hour population unless otherwise specified.

FIGURE 12

DIAGRAM OF 24-HOUR POPULATION DEFINITION



[27] "9-1-1 Statistics." Collier County, FL Sheriff. https://www.colliersheriff.org/my-ccso/communications/9-1-1-statistics

Alternative Methodologies and Considerations

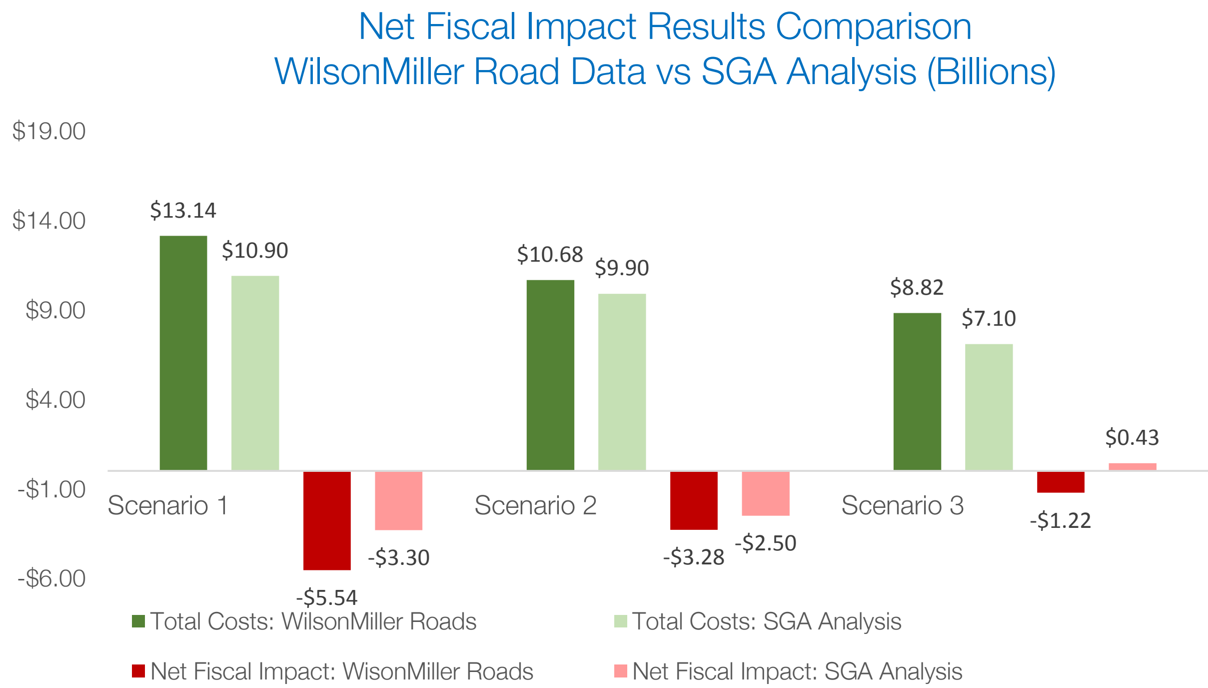
In addition to our regression-based analysis, we also considered the costs of external roads in the development of each scenario per a map created by WilsonMiller Consulting[28] and provided to SGA by the Conservancy. Additionally, we considered the Conservancy's estimates for the cost of building this road network (See Figure 15). This secondary analysis allows us to make a key comparison. While the SGA analysis is a forecast based on regression modeling, the Conservancy's analysis is based on a proposed future road network. It considers roads external to, or outside of the actual and proposed developments. In other words, because the Conservancy's estimates do not consider internal roads (which we assume would be "paid for" by the developer), the external roads are costs to be directly incurred by Collier County.

Generally, our SGA road cost estimates and bottom-line numbers were more conservative than the analysis generated using the WilsonMiller road cost estimates provided to us by the Conservancy. As seen below, using the WilsonMiller road cost estimates, we are still left with the same general trend and ultimate conclusion. Broadly, Scenario 1 is the most expensive and has a 20-year net fiscal impact of -$5.54 billion; Scenario 2 results in a net fiscal impact of -$3.28 billion; and Scenario 3 yields a net fiscal impact at -$1.22 billion. The differences in costs and net fiscal impacts between the two methodologies are compared in Figure 13.

The trends hold in that Scenario 1 yields the worst net fiscal impact, and Scenario 3 the best. The WilsonMiller road network cost estimates, however, create one difference with the SGA regression analysis: in Scenario 3, the SGA estimates yield a slightly positive net fiscal impact, while the alternative costs yield a negative net fiscal impact by a small amount. However, it is effectively a neutral net fiscal impact, with a loss of -$1.22 billion over 20 years, or only $6.2 million per year. Furthermore, this trend suggests that density levels in the range of—and especially higher than—Scenario 3 will be fiscally neutral and eventually potentially positive.

[28] WilsonMiller Consulting, Naples Florida. Acquired by Stantec, Inc.

FIGURE 13



Source: Smart Growth America, 2017, WilsonMiller 2008, The Conservancy of Southwest Florida

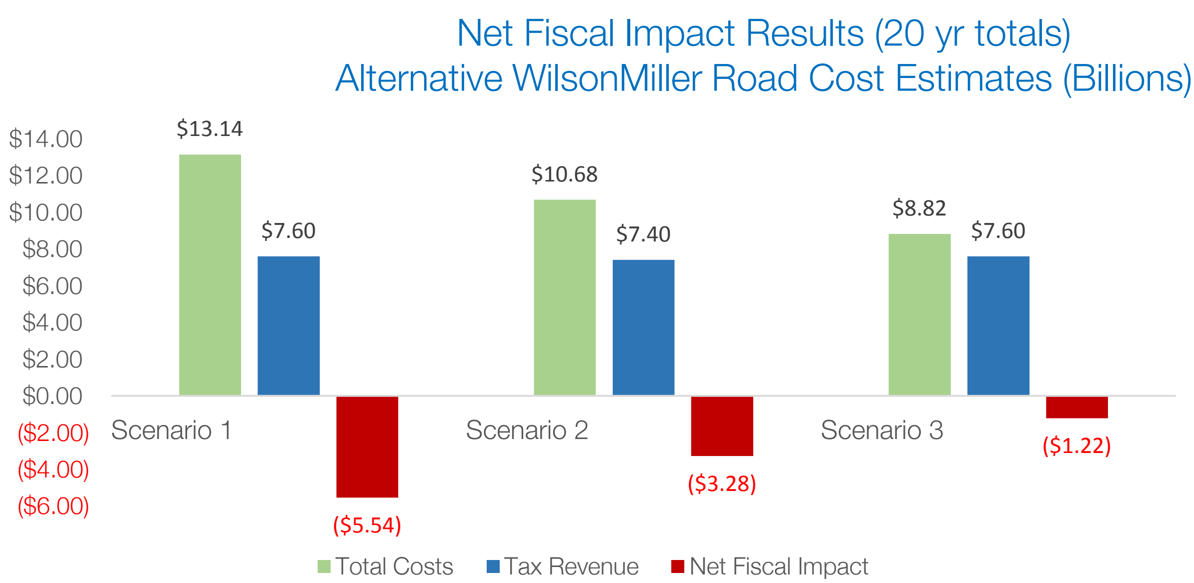
Table 5

Net Fiscal Impact Results Using Alternative WilsonMiller (2008), Road Estimates

(Billions $)	Scenario 1	Scenario 2	Scenario 3
Total Costs	$13.14	$10.68	$8.82
Tax Revenue	$7.60	$7.40	$7.60
Net Fiscal Impact	-$5.54	-$3.28	-$1.22
Total Costs – Annual	$0.65	$0.53	$0.44
Est. Tax Revenue – Annual	$0.38	$0.37	$0.38
Net Fiscal Impact – Annual	-$0.27	-$0.15	-$0.06

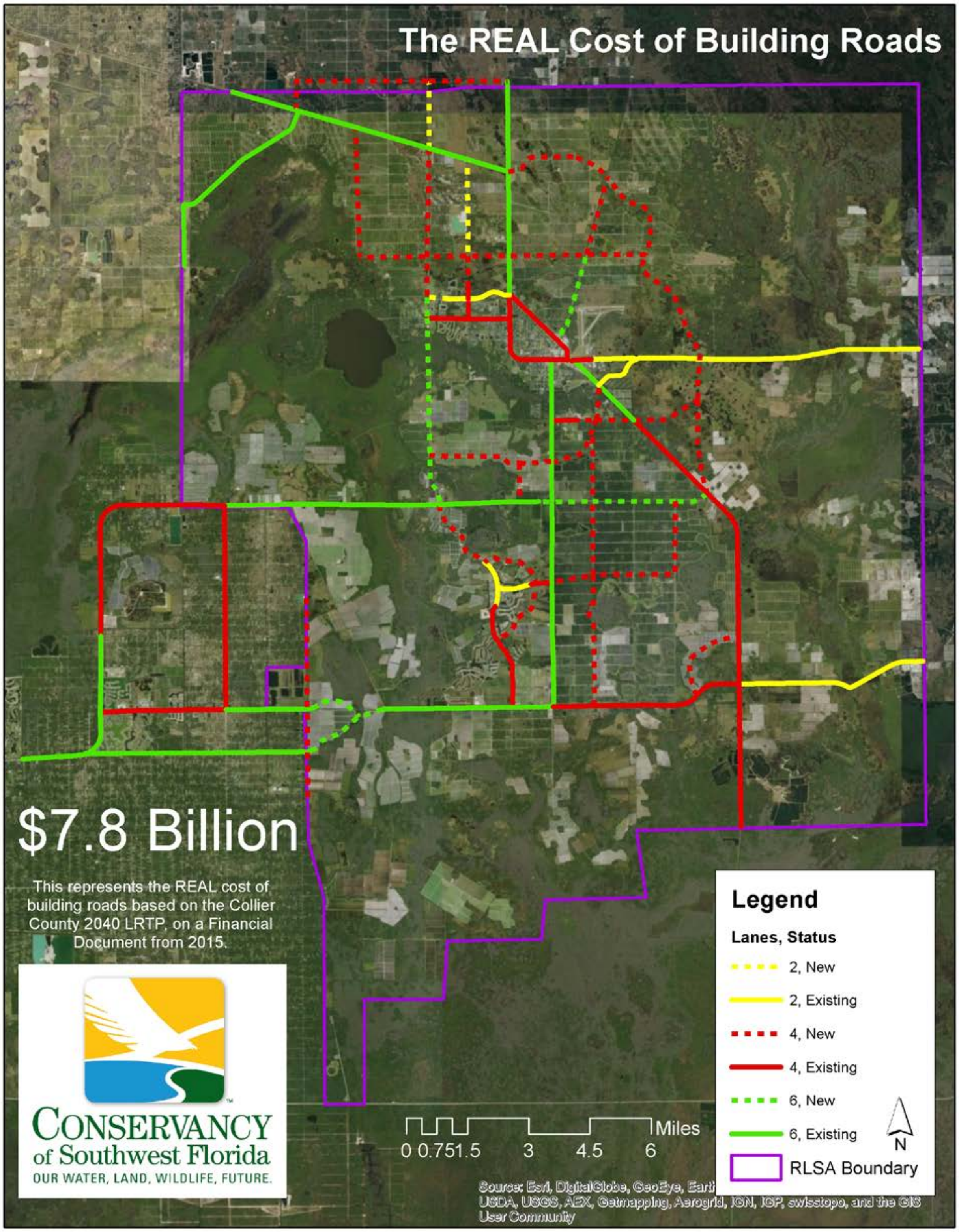
Source: Smart Growth America 2017, WilsonMiller 2008, The Conservancy of Southwest Florida

FIGURE 14



Source: Smart Growth America 2017, WilsonMiller 2008, provided by The Conservancy of Southwest Florida

FIGURE 15



March 2018 Environmental Policy

Conclusion

This analysis considers how the Rural Lands Stewardship Area of Collier County could accommodate 345,812 additional residents and newly employed persons, referred to as “24-hour population,” and the financial and environmental costs of these new towns over the next 20 years (by 2037). Density matters when it comes to determining what it would cost the County to provide services to these newly developed areas.

Collier County could accommodate this new growth at average densities and development patterns that are in line with current trends, and do so at a cost of $10.9 billion over 20 years, with a net fiscal impact of -$3.3 billion (loss of $3.3 billion), after considering the potential tax revenues of its 24-hour population. Needless to say, this scenario is far from being fiscally neutral or positive.

An alternative scenario (Scenario 2), which uses slightly higher densities similar to that observed in the first scenario, would cost the County $9.9 billion over the same period, or $948 million less than Scenario 1 over 20 years, while retaining a similar mix of suburban housing product. The 20-year net fiscal impact of -$2.5 billion (a loss of $2.5 billion), would still be a net loss for Collier County.

The third scenario (Scenario 3) uses much higher densities, reaching 14 units per acre in some areas to create walkable, livable, mixed-use new towns. This scenario would cost the County $7.1 billion over the same 20-year period, reducing costs over 20-years by $3.7 billion, relative to the other scenarios. At this point the County would break even between the costs of development and the revenues generated.

In short, accommodating growth at higher density levels with a greater mix of uses would reduce Collier County’s costs for roadways, school staff, school transportation, and EMS response. Accommodating new towns at the density levels proposed by Scenario 3 would lead to a *neutral* net fiscal impact for the County.

Although this set of hypothetical scenarios for Collier County assumes population forecasts specific to the study area, it highlights the financial consequences of land use decisions over the long-run and the potential of Collier County’s comprehensive plan to create a positive fiscal impact. It shows how the costs of low-density, sprawling new towns adds up over time.

Planners and policymakers in the region will want to take note, before another 20 years of development makes the problem even worse. The results are clear: Smarter growth with more compact development patterns reduces long-term costs.

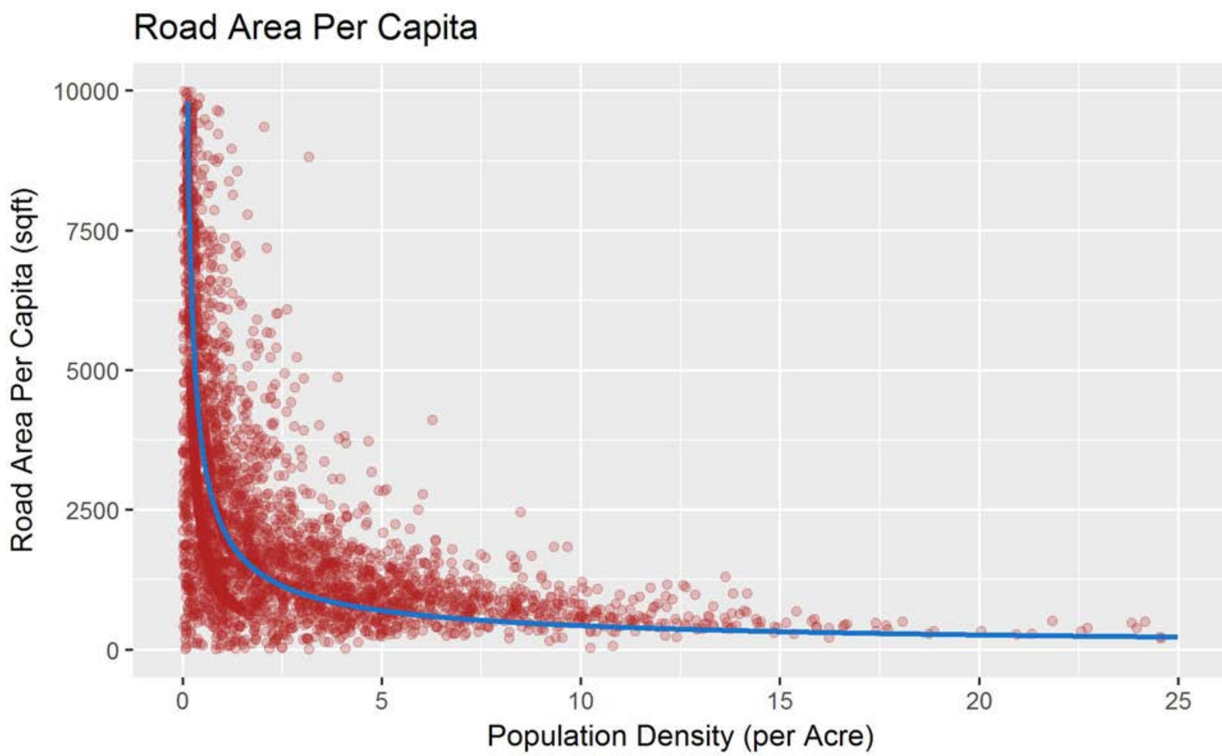
Finally, SGA conducted this analysis for Collier County using data particular to the County. While influencing factors and magnitudes of change may differ from County to County, depending on the various policy and spending decisions of the local government, the overall trends shown in Appendix A of higher density corresponding to lower quantities of infrastructure per capita do hold.

Collier County should consider the fact that higher density levels in a compact new town footprint are not only beneficial from an economic, social equity, and environmental standpoint, they also make sound financial sense. In the context of the RLSA, the County could reduce costs by $3.7

billion over 20 years by consolidating build out at density levels already present in other parts of the County. These levels of density can be made congruent with the character of the community. Continuing to build new towns at low-density levels would yield heavy capital costs for major infrastructure items. These costs can be mitigated with a “smart growth” approach to new development.

Appendix A – Technical Output

Road Area



	Scenario 1	Scenario 2	Scenario 3
Unit Cost ($ / sq. ft.)	$30	$30	$30
Est. Road Area per Capita (sq. ft.)	$591	$560	$291
Est. Road Area Needed (sq. ft.)	204,416,055	191,084,609	101,073,725
Est. Cost of Road Needed ($)	$6,132,481,652	$5,732,538,260	$3,032,211,742

Road Area Per Capita by Population Density

Dependent variable:	log(Road_Per_Capita)
Mean:	5,511
Standard Deviation:	9,178
OLS:	
=7.644+ -0.604*ln(population per acre)	
log(PopDensity)	-0.604
Standard Deviation:	-0.007
	t = -82.170
	p = 0.000***
Constant	7.644
Standard Deviation	-0.012
	t = 660.070
	p = 0.000***
Observations	4749
R^2	0.587
Adjusted R^2	0.587
Residual Std. Error	0.789 (df = 4747)
Sum Squared Residuals	
F Statistic	6,751.920*** (df = 1; 4747)
Akaike criterion	-2245.39
Log-likelihood	-5613.84
Note:	*p**p***p<0.01

School-Age Children Forecast

School Age Children Per Housing Typology

Housing Mix

	Multi-Family		Single-Family		
			Attached	Detached	
Density	0-1 Rooms	2-3 Rooms	2-3 Rooms	2-3 Rooms	4+ Rooms
2.18			0.10	0.30	0.60
2.43			0.10	0.50	0.40
2.75			0.15	0.60	0.25
3.0			0.25	0.60	0.15
7.0			0.30	0.70	
8.0	0.10	0.10	0.80		
11.0	0.20	0.20	0.60		
14.0	0.20	0.20	0.60		

Source: U.S. Census PUMS Data 2011-2015, Collier County, Households that have moved within 5 years.

School Age Children (SAC) Estimates by Scenario

Scenario 1		Scenario 2		Scenario 3	
Density	SAC	Density	SAC	Density	SAC
2.75	23,356	3	21,098	14	9,523
2.18	3,858	2.18	3,858	11	16,075
2.43	2,859	2.43	698	8	2,872
				7	1,082
				2.18	3,858
Total:	**30,074**		**25,654**		**33,410**

Projected New Schools

Schools Planned		Proportion
Elementary	9	33%
Middle	3	33%
High School	2	33%
Total	**14**	

	# Per School	$ per School
Elementary School Average	479	9,248,993
Middle School Average	571	13,073,234
High School Average	662	15,793,844

		Scenario 1	Scenario 2	Scenario 3
Projected Children:		30,074	25,654	33,410
Schools:				
Elementary		20	17	23
Middle		17	14	19
H.S.		14	12	16
Total		**51**	**43**	**57**
Costs	**Total Costs**	**$628,338,648**	**$529,784,280**	**$704,570,789**

Source (Average from 2011 to 2015):
http://www.fldoe.org/finance/fco/cost-of-construction/public-schools.stml

School Staffing

	Scenario 1		Scenario 2		Scenario 3	
Year	**SAC**	**Staff Salary**	**SAC**	**Staff Salary**	**SAC**	**Staff Salary**
2017		-		-		-
2018	1,504	9,552,787	1,282	8,146,614	1,670	10,610,561
2019	3,007	19,105,573	2,565	16,293,227	3,340	21,221,122
2020	4,511	28,658,360	3,847	24,439,841	5,011	31,831,683
2021	6,015	38,211,147	5,129	32,586,455	6,681	42,442,244
2022	7,518	47,763,933	6,412	40,733,069	8,351	53,052,805
2023	9,022	57,316,720	7,694	48,879,682	10,021	63,663,366
2024	10,526	66,869,506	8,976	57,026,296	11,691	74,273,927
2025	12,029	76,422,293	10,259	65,172,910	13,361	84,884,488
2026	13,533	85,975,080	11,541	73,319,524	15,032	95,495,050
2027	15,037	95,527,866	12,823	81,466,137	16,702	106,105,611
2028	16,540	105,080,653	14,106	89,612,751	18,372	116,716,172
2029	18,044	114,633,440	15,388	97,759,365	20,042	127,326,733
2030	19,548	124,186,226	16,670	105,905,978	21,712	137,937,294
2031	21,052	133,739,013	17,953	114,052,592	23,383	148,547,855
2032	22,555	143,291,800	19,235	122,199,206	25,053	159,158,416
2033	24,059	152,844,586	20,517	130,345,820	26,723	169,768,977
2034	25,563	162,397,373	21,800	138,492,433	28,393	180,379,538
2035	27,066	171,950,159	23,082	146,639,047	30,063	190,990,099
2036	28,570	181,502,946	24,364	154,785,661	31,733	201,600,660
2037	30,074	191,055,733	25,654	162,932,275	33,410	212,211,221
Total		2,006,085,193		1,710,788,883		2,228,217,822

School Transportation Costs

Students Bused	Household Size	Avg. Bus Capacity	**Cost / Mi.**
38%	2.59	80	$3.00.

Scenario 1

Density	Units	People	SAC	Acres	Buses	Mi. / Bus	Total Miles (Daily per Trip)	Per year
2.75	98,549	255,243	23,356	35,836	112	18	1,975	710,993
2.18	11,024	28,553	3,858	5,057	18	16	292	105,175
2.43	9,996	25,890	2,859	4,114	14	17	231	83,147
Total	119,570	309,686	30,074	45,007				
							Total	899,314

Scenario 2

Density	Units	People	SAC	Acres	Buses	Mi. / Bus	Total Miles (Daily per Trip)	Per year
3.0	103,929	269,176	21,098	34,643	101	19	1,874	674,573
2.18	11,024	28,553	3,858	5,057	18	16	292	104,981
2.43	2,440	6,319	698	1,004	3	17	56	20,293
Total	117,393	304,048	25,654	40,704				
							Total	799,847

Scenario 3

Density	Units	People	SAC	Acres	Buses	Mi. / Bus	Total Miles (Daily per Trip)	Per year
14.0	34,530	89,433	9,523	2,466	46	7	325	117,075
11.0	58,287	150,964	16,075	5,299	77	8	594	213,781
8.0	8,783	22,747	2,872	1,098	14	8	112	40,346
7.0	7,028	18,203	1,082	1,004	5	13	66	23,604
2.18	11,024	28,553	3,858	5,057	18	16	292	104,982
Total	119,652	309,900	33,410	14,924				
							Total	499,787

EMS Costs

Density	People	Acres	EMS Cost	# Calls	Acres / Call	Mi. / Call	Total Miles	Cost per Mi.[29]	Total Cost / Yr.
Scenario 1									
2.75	255,243	35,836	1,760	18,357	2.0	10.109	185,576	$10	$1,855,759
2.18	28,553	5,057	1,395	2,054	2.5	10.138	20,818	$10	$208,181
2.43	25,890	4,114	1,549	1,862	2.2	10.123	18,850	$10	$188,504
	309,686	45,007			Total		225,244		$2,252,445
Scenario 2									
3.0	269,176	34,643	1,920	19,359	1.8	10.100	195,530	$10	$1,955,303
2.18	28,553	5,057	1,395	2,054	2.5	10.138	20,818	$10	$208,181
2.43	6,319	1,004	1,555	454	2.2	10.123	4,601	$10	$46,007
	304,048	40,704			Total		220,949		$2,209,491
Scenario 3									
14.0	89,433	2,466	8,960	6,432	0.4	10.02	64,459	$10	$644,590
11.0	150,964	5,299	7,040	10,857	0.5	10.03	108,871	$10	$1,088,708
8	22,747	1,098	5,120	1,636	0.7	10.04	16,422	$10	$164,215
7	18,203	1,004	4,480	1,309	0.8	10.04	13,148	$10	$131,475
2.18	28,500	5,057	1,395	2,054	2.5	10.14	20,818	$10	$208,181
	309,847	14,924			Total		223,718		$2,237,169

[29] Cost per mile vary by location. This analysis did not have Collier County specific mileage costs, and costs factors used are based on Smart Growth America's estimates for other communities. Loudoun County, Virginia, for example has EMS costs of $11 / mile. (https://www.loudoun.gov/DocumentCenter/View/110361). We use $10 per mile as a conservative estimate.