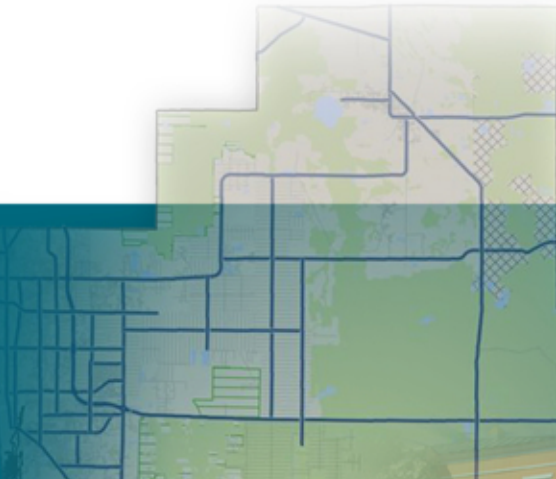


## Section 4

### Conceptual Plans and Potential Benefits



## SECTION 4.1: OVERVIEW OF CONCEPTUAL PLANS

The MMP is intended to provide strategic guidance for future policy recommendations that reduce vehicle miles of travel (VMT) and vehicle hours of travel (VHT); protect habitats, environmentally-sensitive lands, and agriculture; and identify infrastructure planning guidelines. To achieve these goals, four conceptual plans have been developed and documented in this section, each of which will provide the basis for the policy recommendations provided in Section 5:

- A **Conceptual Land Use Plan**, the purpose of which is to identify area-wide land use and urban design strategies that respond to and influence the County's development and economic goals.
- A **Conceptual Mobility Plan**, the purpose of which is to incorporate multi-modal transportation alternatives, including transit, which respond to and support the identified land use strategies.
- A **Conceptual Wildlife Crossings and Habitat Preservation Plan**, the purpose of which is to ensure that the protection and interconnectivity of existing and potential future environmentally-sensitive lands is considered in the development of the MMP.
- A **Conceptual Infrastructure Plan**, the purpose of which is to provide guidelines for coordinating infrastructure needs with VMT-reducing principles and promoting efficient and consolidated infrastructure planning.

As previously discussed in Section 3, the development of these four conceptual plans was guided by the themes and concepts that emerged from the detailed public involvement process undertaken during this project, including:

- Recognizing and enhancing previous efforts to protect Collier County's rich and diverse natural resources.
- Addressing Collier County's expansive geographic area and the need to facilitate interconnectivity within the county, as well as enhance regional connectivity:
  - Regional connectivity (facilitating inter- and intra-county travel)
  - Local connectivity (movement within sub-areas of the county)
  - Neighborhood/project-level connectivity (connectivity and circulation within a neighborhood)
- Incentivizing the connection of land use and multi-modal infrastructure.
- Incentivizing a mix of compatible uses appropriate to the scale and nature of the area.
- Addressing the long-term sustainability of the County economic framework.

## SECTION 4.2: CONCEPTUAL LAND USE PLAN

The Conceptual Land Use Plan compares the existing conditions of the county to build-out projections and identifies land use concepts that will affect travel demand patterns and potentially reduce VMT or VHT, including:

- Influence of urban design on travel demand patterns
- Area-wide land use strategies
- Location and sequence of development

### Influence of Urban Design on Travel Demand Patterns

The influence of urban design, or the physical layout of the community, on travel demand patterns is arguably one of the most heavily-researched topics in urban planning. The MMP Project Team includes

Dr. Robert Cervero, one of the most highly regarded travel researchers in the United States. His research on urban form and travel patterns will be used to help establish the framework for potential land use-related VMT reduction strategies to be considered as part of the MMP.

In *Travel and the Built Environment*,<sup>2</sup> weighted average elasticities were computed as a way to quantify the effects that the built environment has on travel. The built environment is grouped into five influences, commonly referred to as the “D-Variables”:

- Land use **density** (and its non-residential counterpart “intensity”) creates an economy of scale that supports cost effective and efficient delivery of transportation services.
- Land use **diversity** is needed to create a balanced, sustainable land use mix at high enough concentrations (densities and intensities) to make multi-modal travel options viable solutions.
- Sustainable land use **design** at all levels (regional, sub-area, neighborhood/project level) is critical to incorporate appropriate transit and bicycle/pedestrian friendly options through:
  - Travel **distance** (and its analog, time) helps form the basis for trip-making decisions.
  - **Destination accessibility**, or the ease of access to the trip attraction, also influences trip-making decisions.

Table 4-1 presents the calculated weighted average elasticities of VMT with respect to the built environment (“D-Variables”). The elasticity represents the quantitative effect that each variable has on VMT. A negative elasticity indicates that the variable contributes to a reduction in VMT and the further the elasticity is from zero, the greater the effect.

<sup>2</sup>Reid Ewing and Robert Cervero, “Travel and the Built Environment,” *Journal of the American Planning Association* 76:3, pp. 265–294, May 11, 2010.

**Table 4-1**  
**Weighted Average Elasticities of VMT**

Variable	Weighted Average Elasticity
Density	-0.04
Diversity	-0.09
Design	-0.12
Destination Accessibility	-0.20
Distance to Transit	-0.05

Source: Ewing and Cervero; “Travel and the Built Environment”

As shown in Table 4-1, destination accessibility (developing in a central location) and design (street connectivity) have the greatest influence on reducing VMT. Ewing and Cervero noted their surprise in the weak relationship between density and VMT, especially given the extensive amount of research touting the benefits of higher densities. The authors also noted that density is inherent in many of the other “Ds” that reduce VMT and encourage alternative travel modes variables (e.g., high-density areas typically have mixed-uses and short/interconnected streets and are centrally located).

The urban environment is commonly made up of a combination of several of the D-Variables, and it is that combination that can have the most significant effect on VMT. For example, the elasticities presented in Table 4-1 do not capture the interactive effects of promoting sustainable land use patterns along with measures such as transportation demand management (TDM) (e.g., parking management). Constraints on or higher prices for parking, for example, promote alternative modes (e.g., transit) and at the same time encourage higher densities. Over time, pursuing such policies in tandem is likely have a greater impact on reduced VMT than revealed by the -0.04 elasticity for the Density variable.

### *Internal Capture of Mixed-Use Development*

Mixed use development refers to the clustering of different land use types (e.g., residential, commercial, institutional, recreational, etc.). This clustering may occur within the same building (e.g. ground-floor retail with office and residential above), within a cluster of buildings, or within a small geographic area (e.g., neighborhood or development project). Achieving the right mix-of-uses is critical to increasing internal capture and reducing auto-dependency, in turn reducing VMT. In 2011, a study published in the *Journal of Urban Planning and Development* explicitly measured the internal capture rate of large-scaled mixed-use developments including both commercial and residential activities. The results of this study indicate that approximately 30 percent of the trips were internal captures—mainly on-site walking trips that replaced what would otherwise be car trips to off-site destinations.<sup>3</sup> To create a true live-work environment, there must be a diverse mix of housing types (including work-force housing) and non-residential uses.

In 2011, Pasco County, Florida, adopted a multi-modal impact fee schedule calculating reduced impact fee rates for both Transit Oriented Design (TOD) and Traditional Neighborhood Design (TND). TOD consists of mixed-use development designed to maximize access to transit service. TND is similar to TOD except that the development is not concentrated around transit service but rather a network of well-connected streets and blocks, public spaces, and mix of non-residential uses within walking distance of residences. As part of the Pasco County study, the reduction in VMT for both TOD and TND development criteria established by the County was quantified through an analysis of the URBan EMISsions (URBEMIS) 9.2 software program. URBEMIS is used to estimate the reduction in travel from the “standard” travel levels

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<sup>3</sup>R. Ewing, M. Greenwald, M. Zhang, J. Walters, M. Feldman, R. Cervero, L. Frank, and J. Thomas, “Traffic Generated by Mixed-Use Developments: A Six-Region Study Using Consistent Built Environmental Measures,” *Journal of Urban Planning and Development* 137:3, pp. 248–261, 2011.

associated with each alternative development form. Variables such as residential density, the mix of land uses, the presence of local-serving retail, presence and proximity to transit service, the presence of bicycle and pedestrian facilities, and the density of the road network were reviewed when quantifying travel reductions. The results of this study estimate that TND development generates approximately 89 percent of the travel of their non-TND counterparts and that TOD development generates approximately 80 percent of their non-TOD counterparts.<sup>4</sup>

According to Ewing and Cervero, it is widely accepted that an increased mix of uses reduces travel distances while encouraging alternative travel modes: “Linking where people live and work allows more to commute by foot...”<sup>5</sup> They also noted that a jobs-housing balance has a stronger relationship to walking than overall land use mix. Placing people closer to where they work, shop, and recreate reduces the distance they need to travel and provides them with travel options by making alternative modes such as walking and biking more feasible. Another well-known travel demand researcher, Todd Litman, stated that “Increased land use mix tends to reduce per capita vehicle travel, and increases use of alternative modes, particularly walking for errands. Neighborhoods with good land use mix typically have 5-15 percent lower vehicle miles.”<sup>6</sup>

Along with the benefits of reduced VMT, mixed-use developments also have many economic and environmental benefits, especially with concern to vertical mixed-use. Clustering multiple uses onto the same piece of land increases the efficiency of that land and reduces the overall development footprint. Economically, having multiple uses on the same

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<sup>4</sup>Tindale-Oliver & Associates, Inc., “Pasco County Multi-Modal Mobility Fee Study, Final Report,” July 2011.

<sup>5</sup>Reid Ewing and Robert Cervero, “Travel and the Built Environment,” *Journal of the American Planning Association* 76:3, p. 276, May 11, 2010.

<sup>6</sup>Todd Littman, “Smart Growth—More Efficient Land Use Management,” Table 4, *Victoria Transportation Policy Institute TDM Encyclopedia*, 2011. Retrieved from <http://www.vtppi.org/tdm/tdm38.htm>.



piece of land will likely increase the value of that land and generate additional property tax revenue and reduce public infrastructure needs. From the personal economic side, reducing auto-dependence lowers travel expenses by saving in fuel and wear-and-tear expenses and increases tolerance to fluctuations in fuel prices.

Mixed-use development also can reduce the cost of providing and maintaining parking infrastructure. Shared parking (e.g., parking for office workers during the work day that can be used by nearby movie theaters and restaurants during non-work hours) maximizes the use of infrastructure based on peak needs of different land uses. In addition, shared parking shrinks the parking physical footprint, thus enhancing walkability. This also is an example of synergies between the “D” Variables – diversity of uses creates designs that are pedestrian friendly.



Mixed-use development example – Bayfront (Naples, Florida)

#### *Influence of Urban Design on Alternative Modes*

According to the U.S. Census Bureau’s 2009 American Community Survey, 89 percent of Collier County’s workers traveled to work via automobile (76% drove alone), 1.2 percent uses public transportation, 2.6 percent walked or biked, and the remaining either used another mode or worked at home. One of the MMP’s strategies to reduce VMT is to increase the use of alternative modes, specifically public transportation, walking, and biking.

The previously-discussed strategies of encouraging good urban form and mixed-use development encourage the use of and increase the accessibility to alternative travel modes. However, in order to fully maximize the use of alternative modes and reduce auto dependence, minimum population and employment densities need to be met. Extensive research on the relationship between density and alternative modes has led to some generally accepted density guidelines to support alternative modes, specifically transit. Table 4-2 cites the transit service density thresholds listed in the 2010 CAT Transit Development Plan (TDP). These thresholds are used to determine the need for fixed-route transit service in geographic areas of the county. While the thresholds in Table 4-2 are specific to Collier County, it is generally accepted that in order to provide consistent transit service (30 minute headways), a minimum density of 7 dwelling units per acre is needed.

**Table 4-2  
Transit Service Density Thresholds**

Transit Service Threshold Level	Dwelling Unit Density Threshold	Employment Density Threshold
Minimum	4.5 - 5.99 DU/Acre	4.0 - 4.99 Employees/Acre
High	6.0 - 7.99 DU/Acre	5.0 - 6.99 Employees/Acre
Very High	≥ 8.0 DU/Acre	≥ 7.0 Employees/Acre

Source: Collier Area Transit TDP, 2010

As previously mentioned, TOD is a land use pattern that is designed to provide access to transit service. While most often associated with rail-transit, the principles applied to TODs can be used to encourage alternative modes, even when premium transit service is unavailable. At the heart of TOD is the goal of creating compact, mixed-use centers that encourage walking, biking, and transit use. Creating these centers tend to lead to increases in alternative mode share.

Increased use of alternative modes is achieved through a balance of variables, similar to creating good urban form. By creating areas with a diverse mix-of-uses, interconnected street grid, increased densities, and improved access to employment and other non-residential uses, the percentage of people who can benefit from alternative modes can be increased.

#### **Influence of Area-Wide Land Use Strategies on Travel Demand Patterns**

To help measure the influence of area-wide land use strategies on VMT and VHT, the Project Team employed the use of the Collier County MPO adopted 2035 Travel Demand Model. The travel model is a tool for predicting travel behavior and, because it is based largely upon land use input variables (e.g., residential and employment characteristics), it demonstrates sensitivity to changes in those variables. Additionally, because the model is segmented into discrete travel analysis zones (TAZs), each with its own set of unique socioeconomic characteristics and land use variables, the model is also sensitive to spatial allocations. Last, the model uses a defined roadway network map that describes the existing and planned roadway infrastructure in operation details, (e.g., the number of lanes and type of facility).

#### *Baseline Scenario Travel Demand Model*

The travel demand model is initially developed using existing land use/socioeconomic and roadway conditions of a “validation year.” This model is tested and refined during a validation process until it reaches

an acceptable level of tolerance in replicating the actual roadway traffic conditions. This validated model then becomes the tool for measuring changes in land use and roadway network. The current MPO model was validated to 2007 conditions and was used during the recent LRTP Update in the development and adoption of the MPO’s 2035 Needs Plan. This model is being used in the MMP to evaluate a variety of potential strategies.

The first application of the 2035 model is to evaluate what is being termed the “baseline” build-out condition. This condition represents the “business as usual” scenario based upon a reasonable extrapolation of the development potential outlined in the current Collier County FLUE. Because the FLUE extends the development potential in many areas well beyond the currently adopted zoning, a number of planning assumptions were made as to where and to what intensity future land use development would occur. In developing a build-out land use scenario, the Project Team relied upon the earlier work performed during the East of 951 Horizon Study and the associated County CIGM. Additional guidance was provided in more recent work (e.g., the MPO 2035 LRTP Update, the Five-Year Review of the Rural Lands Stewardship Area Overlay, the Golden Gate Estates Bridge Study), and through discussions with a number of stakeholders. Reasonableness checks were performed, and where “unreasonable” land use variables were identified, adjustments were made. Changes were made in the Coastal Urban Area (CUA) when a review of the initial dataset revealed what were believed to be unrealistic employment values in some of the CUA zones and a corresponding underestimation of employment in some TAZs in other sub-areas. Additionally, unrealistic residential and employment values were noted on some lands that were either already in conservation or were destined for conservation in the future. Following these adjustments, the Project Team believes the base line forecast represents a realistic expectation of undoubtedly one of many

build-out scenarios that could occur under the existing adopted land use plan parameters.

A build-out model was developed that reached out well beyond the 2035 horizon year of the MPO planning program. For purposes of this project, build-out is estimated to be 2080; however, the use of 2080 as the estimated build-out year is strictly a planning tool to provide a temporal perspective. From a practical perspective, the end date for build-out is irrelevant since build-out is simply a snapshot of a set of “conditions” (e.g., land use, infrastructure, environmental, etc.) representing near-100-percent utilization. When it actually occurs is far less important than what it will look like when that point is reached.

To run a future year forecast, called a “simulation” or an “assignment,” it was necessary to agree on a future roadway network upon which the model could load trips generated by the programmed land uses in each TAZ. For the MMP, it was agreed that the MPO’s adopted 2035 Needs Plan network would serve as the build-out network to test conceptual scenarios, since this is the most long-term network adopted by Collier County.

As part of this effort, two “baseline” model runs were performed: 1) an “all or nothing” unconstrained assignment that essentially ignores any constraints created by mounting congestion, and 2) a constrained assignment, where the model tries to balance the traffic along different possible routes in order to minimize the levels of congestion. The first unconstrained assignment yields traffic volumes along the programmed network in ways that demonstrate “desire lines” of travelers. The second assignment yields the more “real-world” travel-time based version that incorporates the motorist’s decision-making process when the shortest path becomes too congested/slow and the motorist decides on a different, albeit longer, path from one TAZ to another because it is actually faster. Although the all-or-nothing modeling assignment is

valuable when trying to understand how much traffic is moving in different directions throughout the network, the constrained modeling assignment is the model application used when testing different land use and/or network modifications.

The results of the constrained network assignment baseline scenario model run are then compared to various scenarios tested as part of the MMP. By comparing the baseline model run results to alternative scenarios, a determination can be made as to whether any of the potential strategies identified during the scenarios result in measurable reductions in VMT or VHT.

#### *Conceptual Land Use Scenario*

As part of the MMP, a land use scenario was developed based largely on input received from the public. This scenario is conceptual in nature, and the purpose is not to project where or when development will occur but to quantify potential VMT reductions based on the identified strategies.

The conceptual land use scenario tests the effect of increasing and decreasing population and employment (or some mix thereof) within specific areas of Golden Gate Estates, Orange Tree, and the RFMUD Receiving Areas. The goal of strategically increasing and decreasing population and employment within specific areas of these sub-areas is to test the concepts of destination accessibility, density, and diversity.

#### *Conceptual Land Use Scenario – Population Adjustments*

The proposed Collier County Watershed Management Plan recommends a potential TDR program within the North Golden Gate Estates (NGGE) Flowway, located in the eastern most portion of NGGE, as a tool for preserving land and, at a minimum, reducing impacts within the Flowway for watershed management purposes. Under this scenario, it was assumed that this TDR program would have some effect on

transferring future development rights out of the Flowway and that the areas receiving these transferable development rights would be the three northern most RFMUD Receiving Areas depicted in Figure 4-1.

In addition to the North Golden Gate Flowway, the public input process led to the recommendation to include a wildlife habitat corridor connecting North Belle Meade and the Florida Panther National Wildlife Reserve as part of the TDR area. As such, the proposed NGGE TDR area was expanded beyond the NGGE Flowway to include this conservation area in support of increased habitat connectivity. Figure 4-1 illustrates the area identified for inclusion in the TDR/Habitat Corridor program assumed under this scenario. For testing purposes, 50 percent of the growth in population/dwelling units within the proposed TDR/Habitat Corridor area was transferred evenly to the four RFMUD Receiving Areas.

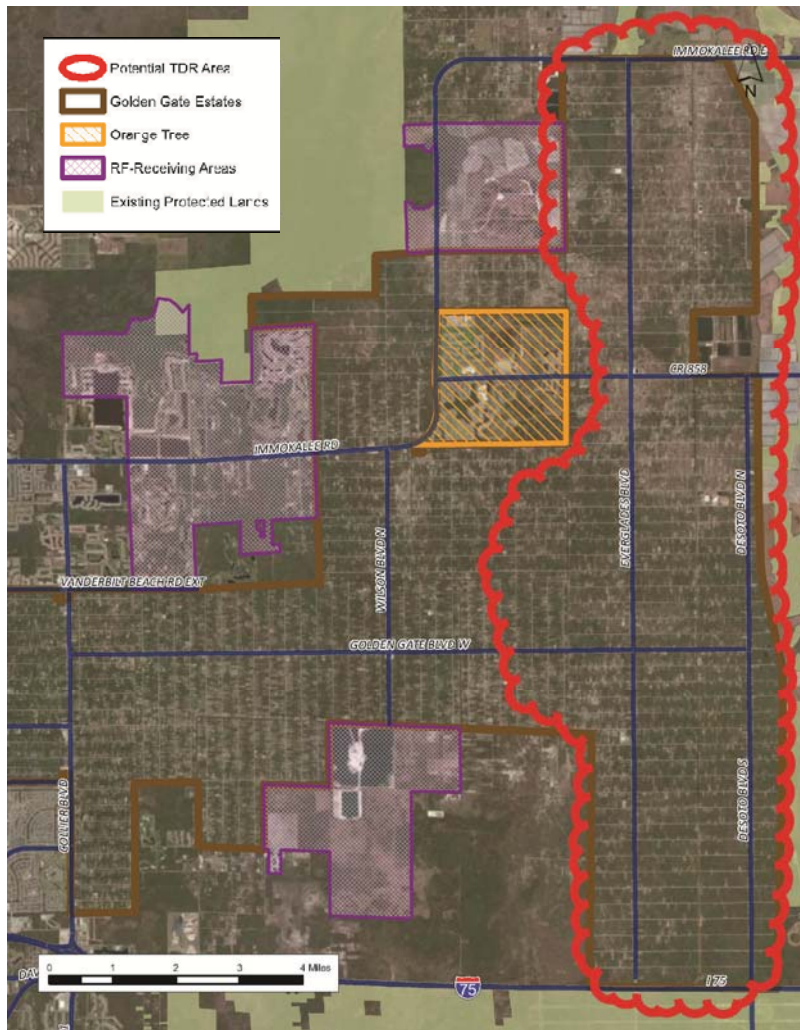
#### Conceptual Land Use Scenario – Employment Adjustments

As previously discussed, NGGE is presently a large platted residential area with low levels of retail or other employment-generating land uses. The lack of nearby commercial or employment uses requires residents of NGGE to travel to other areas of the county, primarily the CUA, for work or shopping trips. As part of this scenario, increases in employment within specific areas of NGGE, as well as the Orange Tree and RFMUD Receiving Areas, were identified to determine if placing higher levels of employment-generating uses within these sub-areas would generate a reduction in VMT or VHT.

Changes to employment levels within NGGE were identified based on the Golden Gate Area Master Plan and employment growth projected to occur within the proposed TDR area. The Golden Gate Area Master Plan has identified specific sites within NGGE as locations appropriate for commercial development. These locations include commercial centers at four intersections-1) Golden Gate and Wilson boulevards; 2) Golden Gate and Everglades boulevards; 3) Pine Ridge Road and Collier Boulevard; and 4) Immokalee Road and Everglades Boulevard-as well as the Randall Boulevard Commercial Sub-district. Using 190,000 square feet of potential neighborhood commercial development at Golden Gate and Wilson boulevards as a proxy (150,000 square feet recently approved plus the potential to increase by an additional 40,000 square feet), an additional 200,000 square feet of retail development was assumed for each neighborhood center located at the remaining three intersections. In addition, this scenario also assumes build-out of the Randall Boulevard Commercial Sub-district in accordance with the Golden Gate Area Master Plan.

Within the Orange Tree sub-area are several PUDs that identify future retail and office development. Under this scenario, 400,000 square feet of retail and 100,000 square feet of office development were added to the Orange Tree sub-area consistent with these existing PUDs.





**Figure 4-1  
Proposed Golden Gate TDR and Wildlife Habitat Corridor**

To achieve the increased employment growth specified above, employment within the proposed TDR/Habitat Corridor area (specifically from the southern area of North Belle Meade outside the formal NGGE sub-area) was transferred first to satisfy employment increases within

the NGGE neighborhood nodes, Randall Boulevard Commercial Sub-district, and Orange Tree PUDs. Remaining employment growth within the TDR/Habitat Corridor area was then transferred to the RFMUD Receiving Areas to help preserve, to some extent, the baseline employment to population ratios of the four Receiving Areas affected by the increase in population transferred in from the proposed TDR/Habitat Corridor area. The additional non-residential development described above was converted into employees using information obtained from the U.S. Energy Information Administration’s Commercial Buildings Energy Consumption Survey (CBECS).<sup>7</sup>

#### Conceptual Land Use Scenario Results

For the Conceptual Land Use Scenario, it was assumed that the combined dwelling unit, population, and employment totals of the overall scenario area would remain constant, but individually, the sub-area totals would change. Table 4-3 summarizes the changes made to the sub-area totals, reflecting the spatial reallocation of build-out population, dwelling units, and employment.

<sup>7</sup>U.S. Energy Information Administration, “2003 Commercial Buildings Energy Consumption Survey: Building Characteristics Tables” (revised June 2006). The average square-feet-per-worker for retail and office buildings from the CBECS and used to convert the non-residential square footage into employees includes retail (other than mall)—1,246 square feet per worker, and office—434 square feet per worker.

**Table 4-3  
Comparison of Baseline and Conceptual Land Use Scenario  
Demographic Variables**

Area	Baseline Population	Baseline Employment	Scenario 1 Population	Scenario 1 Employment	Population Change	Employment Change
Golden Gate Estates	88,000	7,500	75,900	8,200	-12,100	700
Orange Tree	9,000	4,500	9,000	5,000	0	500
RF Receiving A	5,500	3,500	8,800	4,400	3,300	900
RF Receiving B	16,500	7,500	19,800	8,400	3,300	900
RF Receiving C	5,500	4,000	8,700	4,800	3,200	800
RF Receiving D	21,500	10,500	24,800	11,400	3,300	900
Other	15,500	24,500	14,500	19,800	-1,000	-4,700
<b>Total</b>	<b>161,500</b>	<b>62,000</b>	<b>161,500</b>	<b>62,000</b>	<b>0</b>	<b>0</b>

Source: Distribution of demographic variables - Baseline Scenario vs. Conceptual Land Use Scenario

To test the effect of the population, employment and dwelling unit reallocation on VMT and VHT, the road network used in the travel demand model is the 2035 LRTP Needs Plan Network plus the potential bridges identified within Golden Gate Estates that are not already included in the 2035 Needs Network. This network is the result of the Connectivity Test #2 described in more detail as part of the Conceptual Mobility Plan. The connectivity of the local road network enhanced by the potential bridges coupled with the reallocation of population and employment growth provided the greatest reduction in VMT and VHT within the test sub-area (when compared to using the 2035 Needs Plan Network less all the potential bridges).

Table 4-4 summarizes the results of the travel demand model run for the conceptual land use scenario. As shown, under this scenario the countywide VMT decreases by 0.1 percent while VHT increases by 0.1 percent. Within the test sub-area (illustrated in Figure 4-1), both VMT and VHT decrease by 1.8 percent and 7.3 percent, respectively.

The results of the travel demand model indicate that the reallocation and concentration of population and employment growth within the test sub-area reduced the need to leave the sub-area and travel greater distances on higher congested roads (as was done under the baseline scenario) to make the same type of trip. In addition, though statistically insignificant, the countywide results indicate that the test sub-area has become more “attractive” for travel under this scenario, drawing in slightly more travel on congested and/or lower speed roads (VHT) in exchange for a slightly reduced trip length (VMT) when looking at the countywide statistics.

**Table 4-4  
Comparison of Results from Baseline Model and  
Conceptual Land Use Scenario**

Land Use Scenario	Network	Countywide		Test Sub-Area	
		VMT	VHT	VMT	VHT
Baseline	Connectivity Test #2 (GGE Potential Bridges)	32,373,871	1,907,166	5,958,653	275,959
Conceptual Land Use Scenario	Connectivity Test #2 (GGE Potential Bridges)	32,339,053	1,908,757	5,851,255	255,880
	<b>Difference</b>	(34,818)	1,591	(107,398)	(20,079)
	<b>Percent Change</b>	-0.1%	0.1%	-1.8%	-7.3%

Source: Change in VMT and VHT of the Conceptual Land Use Scenario compared to results of baseline travel demand model run for the Collier County Master Mobility Plan. Refer to the Conceptual Mobility Plan, Connectivity Test #2 for a detailed explanation of the network used to test this scenario.

### Location and Sequence of Development

Development that provides a mix of uses to satisfy typical daily needs is located to take advantage of existing infrastructure and public services, and is proximate to employment will maximize accessibility and reduce VMT. This type of development, referred to as “location-efficient” development, also maximizes accessibility to surrounding uses and reduces VMT. According to Todd Litman, “per-capita travel is often 20 to 50 percent lower in location-efficient developments than in automobile-dependent, urban fringe locations.”<sup>8</sup>

Developments outside of the built/urban environment must be self-sustaining, especially in terms of employment and non-residential services, to achieve the same VMT-reducing impact as development within the urban area. As a local example, the majority of the RLSA sub-

area is currently undeveloped but, as the county progresses towards build-out, this area is expected to see a large amount of development. If that development does not meet sufficient thresholds for employment and non-residential uses, the population within the RLSA will have to travel to other areas within the county or outside of the county, to satisfy their employment, commercial, and recreational needs. This will result in longer travel-distances and higher VMT. Creating self-sufficient development within the RLSA will not completely eliminate the need for inter- or intra-county travel; however, self-sufficient development will increase localized daily/routine travel.

### SECTION 4.3: CONCEPTUAL MOBILITY PLAN

The Conceptual Mobility Plan is, in large part, driven by the outcomes of the Conceptual Land Use Plan since travel demand (trips) generated by land uses are essentially an exchange of movements between origins and destinations. As we travel from home to work or to school or go shopping from one store to another or go the park or the beach, each

<sup>8</sup>Todd Littman, “Location Efficient Development and Mortgages,” *Victoria Transportation Policy Institute TDM Encyclopedia*. Retrieved from <http://www.vtpi.org/tdm/tdm22.htm>.

trip can be measured in terms of VMT. Although creating the right balance/mix is critical, it is also important to create the proper design of both land uses and the transportation infrastructure connections that facilitate modal choice. Many single occupancy vehicle (SOV) trips made each day could easily be made instead by transit, bicycle, or walking, if the proper infrastructure and associated level of service were available.

As Collier County continues to grow towards build-out, additional travel demand will be generated that will need to be satisfied by the mobility system of the future. Accommodating the travel demand of the future will be a challenge, given the financial constraints inherent in the current transportation funding paradigm. It is clear that mobility planning is not just about building roads; it is about achieving a balanced and sustainable mixed-use built environment that delivers options and choices, as well as financially-feasible multi-modal solutions coupled with strategies that reduce demand.

There are a number of cornerstone principals that serve to create a cohesive, integrated, and efficient mobility system, thereby enhancing the provision of multi-modal choice, including:

- Connectivity Within and Between Modes
- Circulation and Access
- Transportation Demand Management strategies
- Operational efficiencies

#### **Connectivity Within and Between Modes**

One of the primary factors for improving alternative mode share is connectivity. Enhanced system-wide interconnectivity between land uses, between geographic areas (e.g., neighborhoods, sub-areas, regions, etc.), and between modes, improves the chances of achieving a well-balanced and efficient transportation system.

Connectivity starts at the project level, where a mix of land uses should be able to interconnect with roads, transit and non-motorized options. When residents who want to shop at a neighboring commercial center must get in their cars and travel outside the development on the arterial network, it wastes fuel, increases emissions, and inconveniences the resident and the motoring public on the arterial. Instead, having an interconnection to the neighboring development affords direct access by car or, better yet, by non-motorized travel, thus reducing congestion and emissions, improving system operations, and providing additional opportunities for exercise. Some of the techniques used to improve project level connectivity are:

- Reduce intersection spacing
- Provide safe pedestrian and bicycle connections
- Limit block lengths
- Reduce street pavement widths
- Limit/discourage non-grid network patterns (e.g., cul-de-sacs)
- Limit/discourage design limited access (e.g., gated communities)
- Encourage connections between developments

Communities that desire limited public access can also be designed to retain privacy while providing internal connectivity between residential and non-residential uses. The Island Walk community, located along Vanderbilt Beach Road and Collier Boulevard is a local example of this concept. Within Island Walk, which is gated, basic retail services are provided to serve residents of this community. In addition, a shopping center to the east of Island Walk at the corner of Vanderbilt Beach Road and Collier Boulevard, provides grocery, bank, and other retail uses. A future road (currently in the permitting stages) is planned to connect Island Walk to this shopping center so that residents do not have to exit onto the heavily-traveled Vanderbilt Beach Road to access this shopping

center, providing enhanced connectivity and access from the gated community to the nearby retail services.

Beyond the neighboring developments, the value derived from concepts that improve connectivity extends to entire sub-areas and inter-county travel. Connectivity at the sub-area level is met by providing sufficient local collector roads that afford mobility options to users within the sub-area, allowing travel within close proximity for shopping, school, personal business and employment opportunities, without having to travel along major arterials

Connectivity is also important between modes. Different forms of transit rely on supporting alternative modes to provide the interconnections. Municipal fixed-route service relies heavily on pedestrian and bicycle modes, and commuter transit service (e.g., express bus, commuter rail, etc.) relies on both interconnecting fixed-route transit and auto modes, with the interconnection point(s) frequently being park-and-ride and transfer facilities.

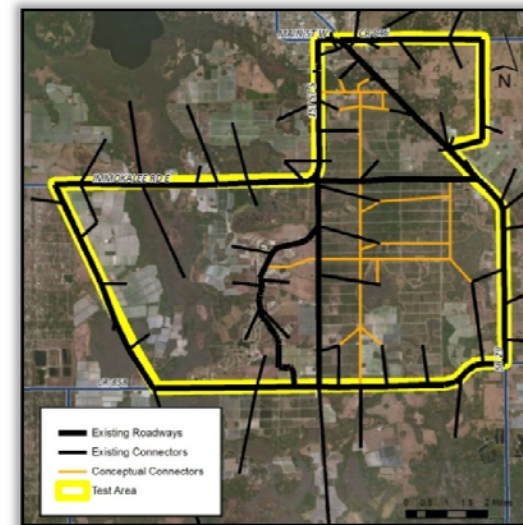
Connectivity at the regional level is needed to serve commuters and special generators (e.g., regional employment centers, airports, colleges and/or universities, etc.). Workforce housing is often a prime determinant of commuter-based demand, as seen frequently in the Southwest Florida region, where employees live in one county and commute each day to work in another county.

### Connectivity Tests

In an effort to evaluate local connectivity concepts within the MMP, two connectivity tests were completed. The purpose of these two connectivity tests was to quantify the effect that simple connectivity concepts have on VMT or VHT, both within the applicable sub-area and on a countywide level.

### Connectivity Test #1 – Sub-Area Road Connectivity

The first connectivity test evaluated the ability of a more refined and interconnected roadway system to improve mobility and reduce VMT and VHT. To evaluate this option in the model, a test sub-area was chosen with the RLSA where a cluster of TAZs is surrounded by arterial roadways. While immediately adjacent to one another, the TAZs within this sub-area are connected only to the surrounding arterial network, limiting the interaction between TAZs. This connectivity test included creating a more refined grid of local collector roads within this test sub-area and connecting the TAZs to the new collector roads as well as the adjacent arterials. A conceptual illustration of this is provided in Figure 4-2.



**Figure 4-2**  
**Conceptual Illustration of Sub-Area Connectivity Test**

Following a run of the travel demand model, the results of the test network were compared with the baseline 2035 Needs Plan Network. The results of this comparison are presented in Table 4-5, which



demonstrates that there was a decrease in VMT of 1.3 percent and a decrease in VHT of 9.8 percent within the RLSA sub-area. The results of this connectivity test provide a decrease in VMT countywide of 4.8 percent, but a corresponding increase in VHT countywide of 25.9.

The results of the travel demand model indicate that the added test network has made the RLSA sub-area more “attractive” for travel resulting shorter trip lengths within the sub-area, as well as fewer trips leaving the sub-area for what were likely much longer trips on adjacent

roadways. In the case of measuring VHT, there was a reduction in the sub-area VHT, as the addition of the new roads added needed capacity to the system, resulting in less congestion and thus lowering the VHT. The Project Team does not feel that the high increase in VHT outside the sub-area accurately reflects the travel demand patterns realized from this test scenario since the results indicate that a significantly greater number of trips outside of the sub-area would need to be made on more congested roads to achieve this higher VHT.

**Table 4-5  
Comparison of Results from Baseline Model and Connectivity Test #1**

Land Use Scenario	Network	Countywide		Test Sub-Area	
		VMT	VHT	VMT	VHT
Baseline	2035 Needs Plan Network	32,235,217	1,912,503	8,018,565	736,045
Baseline	Connectivity Test #1 (Sub-Area Road Connectivity)	30,686,307	2,407,578	7,913,288	663,779
	<b>Difference</b>	(1,548,910)	495,075	(105,277)	(72,266)
	<b>Percent Change</b>	-4.8%	25.9%	-1.3%	-9.8%

Source: Change in VMT and VHT of Connectivity Test #1 compared to results of baseline travel demand model run for the Collier County Master Mobility Plan

**Connectivity Test #2 – Golden Gate Estates Potential Bridges**

As previously discussed in Section 2, following completion of the East of CR 951 Horizon Study, Collier County undertook a study to identify potential bridge locations in Golden Gate Estates. The goal of the East of CR 951 Bridge Study, which is to provide connections that improve

mobility within the GGE sub-area, runs in tandem with the broader goal of improving mobility under the MMP. As part of this effort, 12 potential bridge sites were identified, which were presented previously in Section 2, Map 2-11. Each potential bridge connection was evaluated and ranked based on the following criteria:



**Table 4-6  
Comparison of Results from Baseline Model and Connectivity Test #2**

Land Use Scenario	Network	Countywide		Test Sub-Area	
		VMT	VHT	VMT	VHT
Baseline	2035 Needs Plan Network	32,235,217	1,912,503	5,923,988	279,518
Baseline	Connectivity Test #2 (GGE Potential Bridges)	32,373,871	1,907,166	5,958,653	275,959
	<b>Difference</b>	138,654	(5,337)	34,665	(3,559)
	<b>Percent Change</b>	0.4%	-0.3%	0.6%	-1.3%

Source: Change in VMT and VHT of Connectivity Test #2 compared to results of baseline travel demand model run for the Collier County Master Mobility Plan

### Circulation and Access

While connectivity between land uses and infrastructure is important, circulation and access are just as critical to enhancing the movement and travel within and throughout the county.

#### *Neighborhood/Project Level Circulation and Access*

Future circulation and access potential at the local neighborhood/community level is largely dictated by the planning of new development with the design guidelines promoted by the local jurisdictions. On-site circulation within developments defines how convenient it is for people to move throughout the development. Mobility options are an important component of a good circulation system, whether it be walking, biking, riding a local transit bus, or driving. Access is characterized by the convenience of being able to connect to places of interest within the development. All too often, poorly planned communities do not afford convenient and safe access to essential goods and services within the development or in adjacent developments.

VMT reductions accrue from a reduced number of trips that leave a development, as residents are able to satisfy their shopping, personal business, school, and recreational needs within their communities (or in adjacent communities). Large-scale planned developments with a properly balanced mix of uses, including essential services, coupled with integrated local-scale transportation infrastructure can achieve high internal capture rates, often reducing the external trips by as much as 30%. Examples of community/neighborhood level infrastructure include:

- Local street connections/interconnections to essential service areas
- Local transit service
- Local sidewalk and bike path networks that connect residential areas to destinations

- Low-speed vehicle networks (e.g., greenways) that provide alternative motorized travel options

#### *Sub-Area Circulation and Access*

At the sub-area level, circulation is characterized by the ability to move along the external transportation system, e.g., collector and arterial roadways, transit lines, and greenway/pathways. Access in this context is the demonstrated by the ease with which one can “connect” to that system. Single access, gated communities must funnel all traffic into and out of the development thru one or two access points, as opposed to a more traditional grid network with multiple access connections to the collector/arterial network.

Minor/major collectors and arterial roadways provide the basic linkages for circulation within a subarea, and provide the connections to other sub-areas. Examples of sub-area level infrastructure include:

- Interconnected local collector roads
- Interconnected minor/major collectors sufficient to reduce travel on arterial-level highways
- Area transit service, including BRT, light rail
- Transit/transfer stations and park-and-ride facilities
- Arterial pathways/greenways.

#### *Regional Circulation and Access*

At the regional level, the circulation component is the domain of highways and transit, frequently sporting high-speeds and limited access. Access connections to modes are well controlled in order to provide optimum service levels. A well-planned regional circulation system provides the connections outside the study area, often to frequently used destinations in neighboring jurisdictions, e.g., the regional airports and universities. Examples of regional level infrastructure include:

- Arterial highways
- Limited access highways
- Express bus service, and BRT
- Commuter rail
- Park-and-ride facilities
- Regional pathways/greenways

#### **Complete Streets**

Complete Streets are essentially streets for everyone, as they are designed and operated to enable safe access for pedestrians, bicyclists, motorists, and public transportation users of all ages and abilities. Complete Streets make it easier to cross the street, walk to shops, and bicycle to work. They allow buses to run on time and make it safer for people to walk throughout the city.

Through the adoption of a Complete Streets policy, communities direct their transportation planners and engineers to routinely design and operate the entire right-of-way to enable safe access for all users. This means that every transportation project will make the street network better and safer for drivers, transit users, pedestrians, and bicyclists—improving the city with more realistic mobility options.

There is no single design prescription for Complete Streets; each one is unique and responds to its community context. Complete Streets also vary by type of roadway, as each has a different purpose and function—a Complete Street design for a major arterial corridor with limited access points will look very different from a Complete Street design for a collector road traversing a town center. Complete Streets also vary by geographic area—a Complete Street in a rural area will look very different from a Complete Street in an urban area.

Making travel choices more convenient, attractive, and safe means that people do not need to rely solely on automobiles. Coordinated with

effective land use policy, users of Complete Streets can replace congestion-clogged trips in their cars with alternate forms of transportation. In addition, Complete Streets concepts can help optimize existing right-of-way within constrained corridors.



Conceptual illustration of a Complete Street

### Transportation Demand Strategies

Transportation Demand Management (TDM) is a set of strategies to influence travel behavior and increase the efficiency of a transportation system. TDM strategies typically seek to influence the manner in which commuters travel to and from their workplace to discourage peak-hour, SOV travel and thereby lower traffic congestion and improve air quality through lowered vehicle emissions. TDM programs that change travel behaviors shift trips away from peak travel times and/or eliminate vehicle trips. TDM strategies that accomplish these goals include carpooling, vanpooling, transit usage, flex work programs, telework, bicycling and walking, and parking management techniques.

TDM strategies can benefit local governments and commuters in several ways. Implementation may:

- Expand travel options for drivers and non-drivers
- Increase roadway safety
- Mitigate traffic congestion

- Reduce the need for expanded road and parking facilities
- Save money for commuters by reducing vehicle operating expenses and lowering fuel costs
- Save money for commuters by providing alternatives to vehicle ownership
- Save money for employers through increased employee retention and by decreasing tax liabilities
- Reduce environmental harm associated with automobile use
- Promote efficient land use objectives
- Support a feeling of community
- Encourage physical activity and improve public fitness
- Increase productivity, employment, wealth, and tax revenues

Strategies used for TDM can affect each of these benefits in different ways. Several strategies that may be considered are listed and briefly described below.

- **Encouraging Non-Motorized Travel** - Programs that encourage walking and bicycling to work can reduce drive-alone commute trips. Bus pass programs, marketing and promotional events, educational courses, the provision of showers and lockers, and creating integrated facilities all encourage the use of non-motorized transportation options.
- **Carsharing** - A number of private, for-profit companies offer vehicles for periodic use by individuals who reserve them on a per-hour basis for a per-mile fee. Individuals who either do not own or do not regularly use an automobile can take advantage of car-sharing services (such as Flexcar, Zipcar) when needed.



- **Ridesharing** - Ridesharing involves two or more individuals traveling together in one vehicle to consolidate commute trips and reduce travel costs. Carpooling typically involves two or more individuals traveling in a participant's vehicle; gas costs may be shared, or the responsibility for providing the vehicle and/or driving may be shared. Vanpooling typically uses a passenger van supplied by employers, organizations, or for-profit agencies that is driven by a vanpool participant to transport between 5 and 15 commuters in a single vehicle. Fares typically are shared by all passengers, and federal tax incentives help to subsidize vanpooling.
- **Shuttle Services** - Circulators provide service in areas or at times of high demand to bypass congested areas and typically connect parking or transit centers to commercial areas. Demand-response paratransit provides on-demand dial-a-ride service or deviated fixed-route service in areas of low demand. Jitney services are privately-operated transit vans or buses that provide service in heavily-congested corridors. Reverse commute services provide shuttles from low-income urban communities to suburban employment centers. Free transit zones provide an incentive for transit use in major commercial areas.
- **Emergency Ride Home** - Users of alternative transportation modes gain security in knowing that if they experience an emergency situation and cannot use their regular mode of transportation, they will receive a ride home using a taxi, company vehicle, or free rental car for use during qualified emergencies, up to a fixed number of times per year.
- **Commuter Financial Incentives and Disincentives** - Encouraging mode shift away from drive-alone travel through financial

incentives and disincentives is highly effective. Parking cash-out programs, federal tax incentives, direct-to-commuter cash incentives, discounted parking for individuals who rideshare, parking disincentives (increased costs) for drive-alone commuters, and voucher programs are just a few of the alternatives available to employers, developers, and local governments.

- **Congestion and Road Pricing** - Toll roads, congestion pricing, cordon tolls, and high occupancy toll (HOT) lanes force drivers to pay to drive on specific roads, in specific areas, or at specific times. This strategy can be used to influence the congestion in certain corridors and generate revenue for road maintenance and transit.
- **High Occupancy Vehicle (HOV) Lanes** - HOV lanes provide additional encouragement to drivers to carpool or vanpool. These lanes restrict access to all vehicles except those with multiple passengers, offering lane exclusivity on the most congested roadways. In most cases, buses may also use these lanes to provide time saving incentives for transit users.
- **Parking Pricing** - Ample free parking is a very strong inducement to driving alone. Conversely, structuring competitive parking fees can be a highly effective disincentive to solo driving. These strategies can be combined to discourage driving and encourage ridesharing. Examples of these strategies include charging higher prices for premium parking spots while offering free or discounted parking to rideshare vehicles. In addition, limiting the number of parking spaces available provides a convenience-related disincentive to driving alone.

- **Parking Management** - A combination of strategies can provide a reduction in the number of parking spaces necessary in high activity commercial centers. These strategies include shared parking, regulated parking use, flexible minimum parking-space requirements, maximum parking-space requirements, parking facility taxes, overflow parking plans, and parking facility design for demand management.
- **Variable Work Schedules** - Companies can offer employees a flexible work schedule, which allows employees to arrive at and leave work during less congested times of day. Typically, flexible work hours require that employees choose a schedule around a number of fixed “core hours,” such as 10:00 AM through 3:00 PM. Alternate options include staggered shifts or a compressed workweek, in which employees work longer hours each day but fewer days per week.
- **Telework** - Allowing employees to work from home on a periodic or regular basis can help to eliminate multiple trips per week. This TDM strategy can also help to lower costs for employers by minimizing work-space needs and serving as a positive recruitment and retention tool.

TDM programs typically influence travel behavior and the way commuters travel to and from work, and if properly managed and supported can have a significant impact on reducing VMT. TDM programs implemented by local or regional governments could realistically expect to reduce travel by 10 to 30 percent<sup>9</sup>. In the age of ever-improving technology, the need to travel to a physical office is

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<sup>9</sup>“Transportation Management Programs,” *Victoria Transportation Policy Institute TDM Encyclopedia*. Retrieved from <http://www.vtppi.org/tdm/tdm42.htm>.

diminishing. A Seattle area project measuring the impact of telecommuting in a small sample of workers found that VMT was significantly reduced as a result of telecommuting, from 63.25 miles per person on non-telecommuting days to 29.31 miles on telecommuting days.<sup>10</sup> While these results may not be typical, they do show the significance that commuter-related travel has on VMT and how TDM programs like telecommuting can have VMT reducing qualities.

### Operational Efficiencies

While the key to reducing GHG emissions is through the reduction in VMT, an additional benefit to the reduction of GHGs can come from improving the operational efficiencies of the transportation system. All modes of the system can benefit from strategies that improve operations, whether it takes the form of improvements in the traffic signal system, improved transit operations, or a better connected bicycle and pedestrian network.

One of the metrics used to evaluate the efficiency of the system is VHT and it is generally related to VMT, although they are independent results to changes in travel demand factors. While VMT may go down when certain stimuli are applied to the system, the same stimuli may increase congestion causing travel speeds to decrease and travel times to lengthen. There may, in fact, be fewer and shorter trips being made on more congested facilities yielding reduced VMT and increased VHT. Because congestion may be counter-productive when it comes to reducing GHG emissions, it is important to strike a balance if strategies that lower VMT have the result of increasing VHT. The goal of course is to reduce both VMT and VHT overall throughout the entire system, but for individual strategies it may not always be possible to see VMT and VHT decrease at the same time.

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<sup>10</sup>Dennis K. Henderson and Patricia L. Mokhtarian, “Impacts of Center-Based Telecommuting on Travel Emissions: Analysis of the Puget Sound Demonstration Project,” *Transportation Research Part D* 1(1), p. 29, 1996.

On the highway system, increased congestion must be offset by a more efficient roadway network, and recommended VHT reduction strategies that are directed at reducing vehicular travel time are generally related to system operations and performance, and include the following:

- **Bottleneck Relief and Capacity Enhancement** - Small- and medium-scale congestion relief investments have the potential to pay big dividends when it comes to measures that improve traffic flow. The weakest links in the system (e.g., intersections and transit transfer points) can cause the entire system to function at less than optimum efficiency. By reducing transit headways, improving local collector connectivity, optimizing signal timing strategies, and removing unwarranted signals, measurable improvements in capacity can be attained to help utilize the existing infrastructure to its maximum capabilities.
- **Reduce Congestion and Delay** - Reducing congestion and delay not only reduces emissions but also saves fuel, and reduces travel costs. Enhancing the transit system through increased service routes and shorter headways can reduce congestion through mode shift, and reduce the delay through improved system performance. Alternatives to major highway improvement projects that optimize the current system operations should be explored first, such as including enhanced intersection treatments, including thru-lane fly-overs and queue jumps.
- **Operational and Intelligent Transportation System (ITS) Strategies** - Investing in advanced technologies that help to optimize the performance of the multi-modal transportation system through an integrated architecture of management systems, creates a multi-modal system of smart vehicles, smart

highways, smart transit systems, smart pathways and smart users.

ITS strategies include not only “high-tech” improvements to vehicles and infrastructure, such as real-time traffic information, advanced traveler information/advisories, and real-time operational system adjustments, but also includes a collection of “management systems” intended to provide the logistical support for day to day management of the multi-modal transportation system. Incident management systems, special event management plans, and construction management systems that warn of incidents, closures, detours and special event traffic patterns, are critical elements to maintaining an efficient and fully operational transportation system. The benefit-to-cost ratio of systems-operations measures (enabled by ITS) has been estimated at 9 to 1, whereas the conventional approach to adding roadway capacity has a benefit-to-cost ratio of 2.7.<sup>11</sup>

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<sup>11</sup>Stephen Ezell, “Explaining International IT Application Leadership: Intelligent Transportation Systems,” The Information Technology & Innovation Foundation, January 2010).

## **SECTION 4.4: CONCEPTUAL WILDLIFE CROSSINGS AND HABITAT PRESERVATION PLAN**

In Phase One of the MMP, numerous data sets were compiled and evaluated, generating an extensive set of data layers that allow for the identification of environmentally-significant lands and areas of potential wildlife conflicts. The location of existing protected lands and the need to minimize impacts to other environmentally-significant lands is part of the foundation for the base concepts and alternatives developed for the MMP. At the same time, wisely-located roads, improvements at wildlife/vehicular impact locations, and the use of wildlife crossings, in combination with other habitat protection initiatives, can become an opportunity to balance the county's projected build-out growth with habitat and wildlife protection.

### **Development History from an Environmental Perspective**

Understanding historic development patterns in Collier County is important for wisely planning for our future growth and understanding potential impacts to the extensive natural resources and habitats throughout the county. In addition to its moderate winter weather, Collier County has a wide range of natural habitats that have attracted people to visit and live here. From barrier islands, coastline, estuaries, bays and rivers to vast expanses of inland mosaics of uplands and wetlands, Collier County became a unique destination for sportsmen and people seeking moderate winters at the start of the last century. As word of Collier County's unique characteristics spread, more people began to make Collier County their home.

As is common in most coastal counties, development has been most intense along the coastline. Accommodating an increasing population while protecting the ecological environment has long been, and will continue to be, a special challenge. In response to coastal development pressures, unique estuarine and island systems have been protected within as Rookery Bay National Estuarine Research Reserve, Ten

Thousand Island National Wildlife Refuge, Everglades Nation Park, Wiggins Pass State Park, and other areas.

The region located between the coastal development and the agricultural lands of the eastern areas of county was comprised of small areas of agriculture, few residents and vast areas of native habitats. During the 1960s, this area was developed with a large network of roads to become the development known as Golden Gate Estates (GGE). Today, many people enjoy living in GGE with its sense of space and affordable homes. At the time the roads were built, however, consideration of the negative effects of such a development on surface water flows/levels, wildlife habitat, and habitat connectivity was not as prevalent as it is today and the resulting roadway system development has left a lasting impact on Collier County's environment. Historic sloughs and overland sheetwater flows of water has been interrupted, over-drainage of wetlands has occurred, and the displacement of past wildlife corridors is evident today.

Efforts by Collier County, the Big Cypress Basin of the South Florida Water Management District (SWFMD), and the federal government to mitigate and even reverse some of the negative impacts of past development have begun and will continue. As previously discussed, Collier County is currently developing a Watershed Management Program to further identify and prioritize opportunities to improve conditions within various watersheds, including areas within GGE.

While visitors and sportsmen were discovering coastal Collier County, settlers and residents were developing a growing expanse of productive agricultural lands inland. The agricultural lands near and around the community of Immokalee have become one of the most productive areas for winter vegetables in the United States; at the same time, however, agriculture has also negatively impacted surface water flows/levels, wildlife habitat, and habitat connectivity. Vegetables,

citrus, and cattle production continue to be a vital part of Collier County's economy. In recognition of future development pressures on these agricultural lands, the RSLA Overlay was established to provide for the conservation of agricultural and other environmentally-sensitive lands within this area.

### Protected Natural Areas

A major objective of the MMP is to consider environmentally-sensitive areas and minimize the effects of future development on those areas. Therefore, early on in the process, protected areas throughout Collier County were identified for the purposes of determining what lands held the potential for future development versus what lands are currently or have the potential to be protected from development by county, state or federal policy.

Section 2 provides a brief discussion of the environmentally-sensitive lands identified as protected lands for the purposes of projecting future development patterns. The term "protected lands" is used to cover a range of conditions that may exist to provide reasonable assurances the natural habitat values of a given area will remain over time. The most basic and familiar case is when a property is owned outright by a local, state, or federal governmental entity; or by a conservation organizations. Other types of "protection" can include conservation easements or other forms of legally binding agreements that restrict development or other uses of a property.

Collier County contains a wide range and large extent of protected natural lands. In addition to coastal areas under protection, protection of a significant percentage of Collier County's inland habitats has occurred with the establishment of:

- Big Cypress Preserve
- Picayune Strand State Forest

- Fakahatchee Strand Preserve State Park

Other significant areas of inland habitat protected by the federal government, state, and Collier County include:

- Dinner Island Wildlife Management Area
- Okaloacoochee Slough State Forest
- Corkscrew Regional Ecosystem Watershed
- Pepper Ranch Preserve
- Florida Panther National Wildlife Refuge

County's RLSA program is unique in that it creates ecological value as a type of currency. In order to entitle land development under the program, areas of higher environmental value must be placed under an easement. The RLSA program is anticipated to result in the protection of well over 100,000 acres of environmentally significant lands within eastern Collier County. The RLSA program identifies and incentivizes protection of the most significant areas based on best available science when the program was created in 2002. The program identifies three special types of lands for protection, as generally described below:

- Flowway Stewardship Areas (FSA)-Lands which serve to provide regional hydrological connectivity.
- Habitat Stewardship Areas (HSA)-Native habitats of sufficient size, which taken together, form a connected mosaic of uplands and wetlands capable of supporting significant wildlife utilization.
- Water Retention Area (WRA)-Water retention areas establish by agricultural practices which are comprised primarily of native habitats.

Within the RFMUD, areas of high ecological value have also been identified. These environmentally-sensitive lands (Sending Lands) are



eligible to transfer their residential density to less environmentally-sensitive lands (Receiving Lands) through a TDR program.

The location and extent of the previously-described protected lands, as well as FSA, HSA, and WRA areas, are shown on Map 4-1. This map is intended to provide a current “snapshot” of lands currently under protection and lands that can reasonably be expected to be protected in the future and is a more detailed visual display than the map of environmentally-sensitive areas previously presented in Section 2 (Map 2-9). As Collier County’s Watershed Management Program is finalized and potentially adopted by the County, additional areas of lands targeted for protection is anticipated to increase. An example of this is the potential to enhance the NGGE Flowway to include a wildlife corridor, linking North Belle Mead and the Florida Panther National Wildlife Reserve, as discussed under the Conceptual Land Use Plan (Conceptual Land Use Scenario).

#### **Wildlife/Listed Species**

One of the most widely known and publically-recognized (in pictures) wildlife species in Collier County is the Florida panther. As development pressure increased, the Florida panther retreated from a range that once included the entire southeast United States, to an area of southwest Florida that includes Collier County. Much of what is now known about panther today is the result of research by the Florida Fish and Wildlife Conservation Commission (FWC) and the U.S. Fish and Wildlife Service (FWS). As panther research continues, strategies and approaches to protecting the panther and compensating for impacts to panther habitat may change as our understanding of panthers evolves.

The Florida panther is known to be a wide-ranging species that can require a significant acreage of land as “home range” for each panther. The challenge of efforts towards the recovery of the Florida panther population in southwest Florida involves the long-term availability of

sufficient lands and maintaining habitat connectivity of those lands. The U.S. FWS has identified two areas of lands important to the panther population, Primary Zone and Secondary Zone, and defines each as follows:<sup>12</sup>

- **Primary Zone**-Those lands comprised primarily of non-urban and natural habitats that can fully support panther utilization for life cycle needs, including breeding, resting/denning, stalking, feeding, and may act as landscape connections or buffers to adjacent land uses.
- **Secondary Zone**-Those lands adjacent or contiguous with Primary Zone that are lower quality habitat and do not currently provide the full support for panther but could do so with some degree of habitat restoration.

Development activity, including roadway widening and new road construction, which is proposed within either the Primary or Secondary Zone or that may have an effect on panthers or panther habitats, must be coordinated with and approved by FWS. The location and extent of Primary and Secondary Zones for the Florida panther within Collier County are shown on Map 4-2. As part of the FWS review process for new roads or road improvements, special consideration are given to:

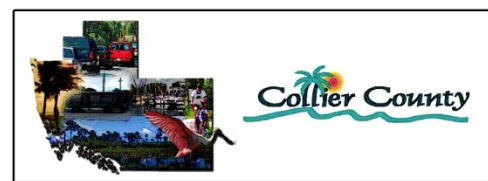
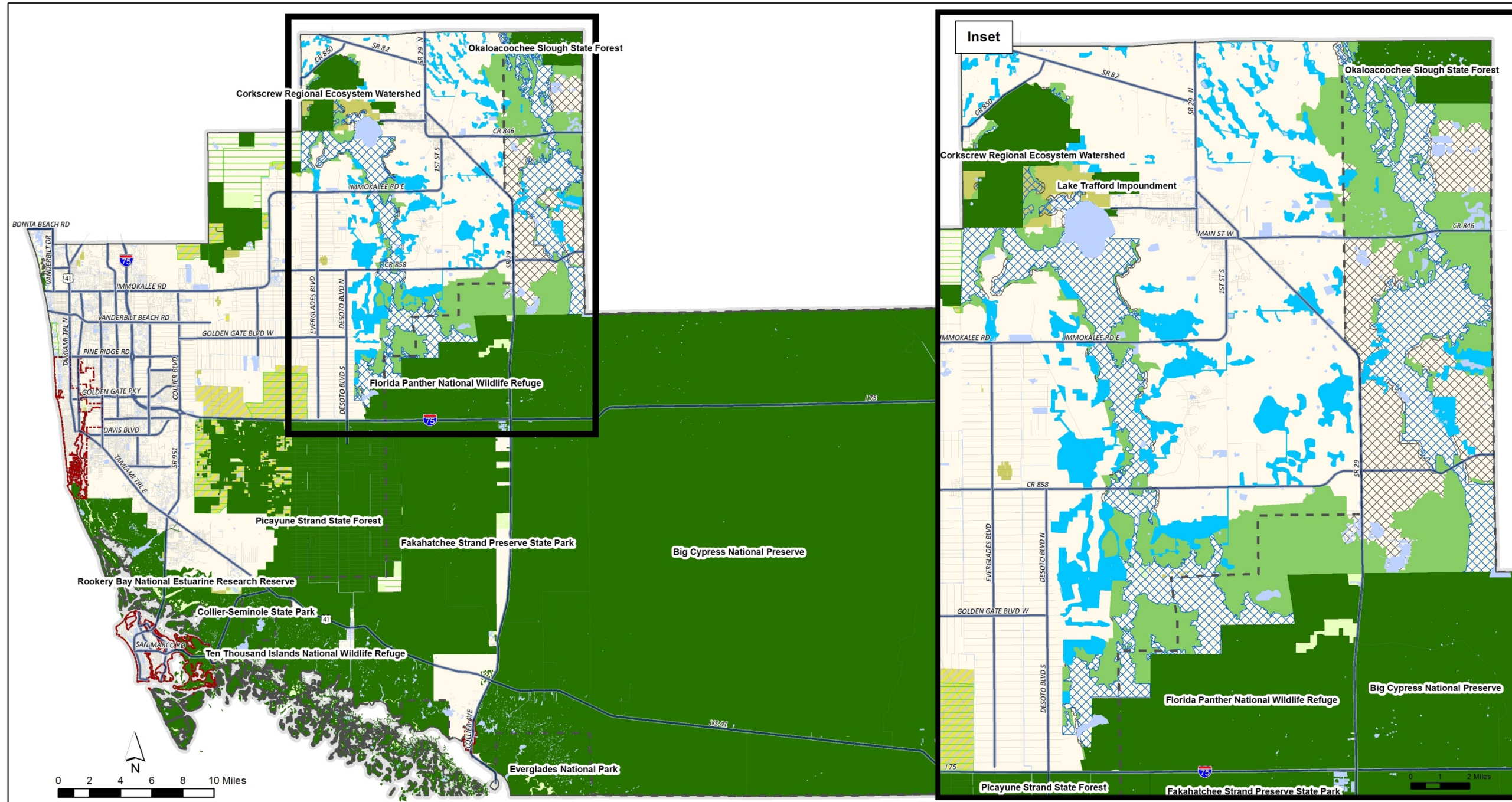
- 1) The direct impact of the roadway footprint on habitats potentially used by panther.
- 2) The potential increase in vehicular traffic within the panther zones.
- 3) The degree of disruption the project will have on panther and other wildlife movement through the area.

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<sup>12</sup> U.S. Fish and Wildlife Service, Vero Beach, Florida.

Map 4-1  
Natural Resource Protection Areas

# Collier County Master Mobility Plan



Federal and State Park Land	Flowway Stewardship Area	Big Cypress Area of Critical State Concern Boundary
Collier County Acquired Lands	Habitat Stewardship Area	RFMUD-Sending Areas
Lands in Conservation	Water Retention Area	
Natural Resource Protection Area	RLSA "Open" Lands in the Big Cypress Area of Critical State Concern	

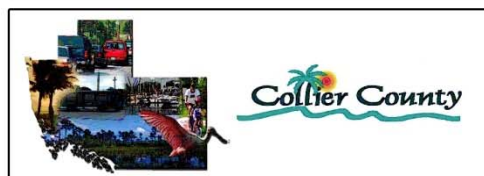
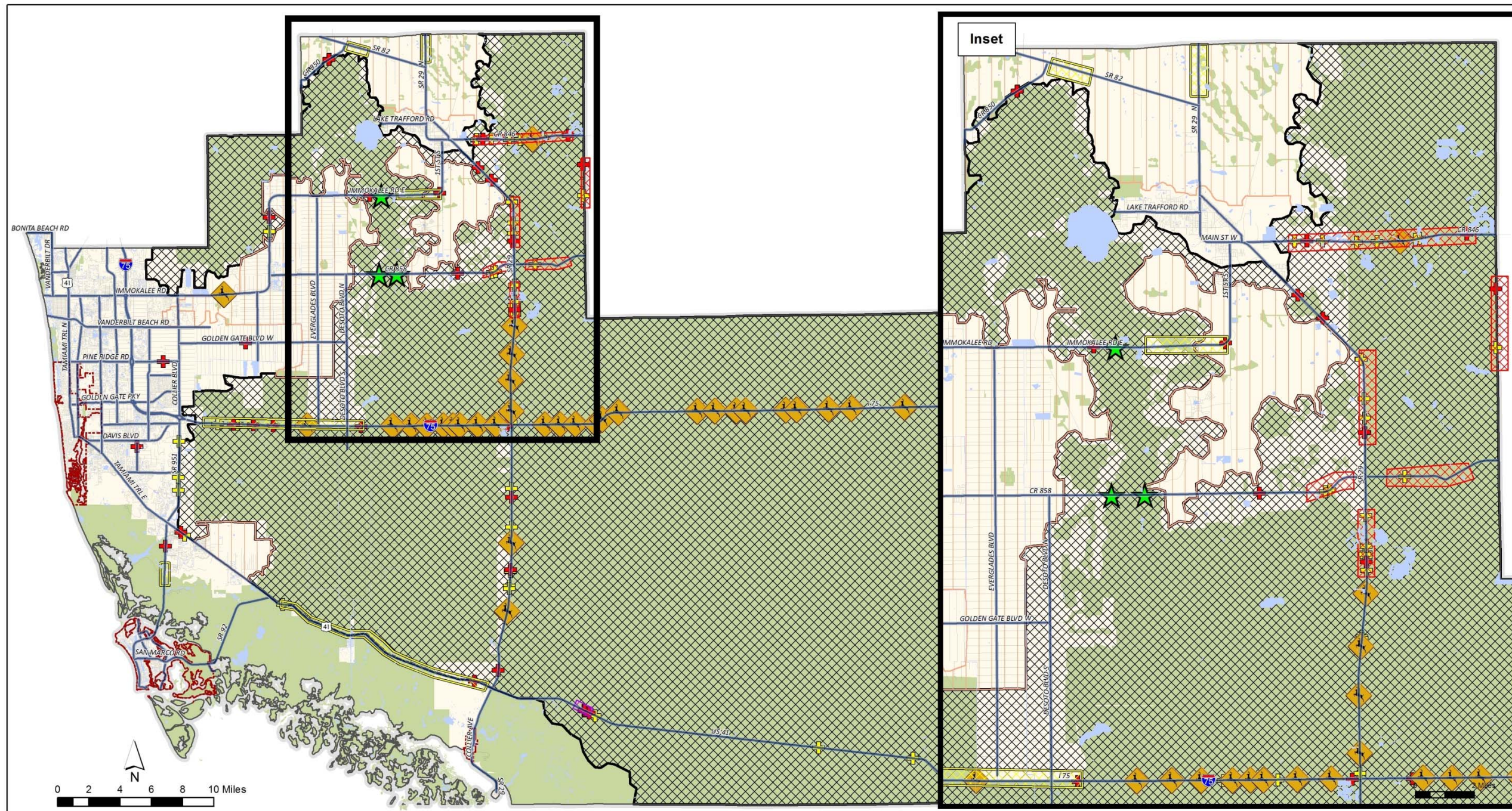
## Natural Resources

Source: GIS data provided by Collier County GIS Services, US Fish and Wildlife Service, and Florida Fish and Wildlife Conservation Commission



Map 4-2  
Wildlife Linkages Map

# Collier County Master Mobility Plan



Existing Wildlife Crossings	Prior to 2006	Pending Wildlife Underpass	Primary Panther Habitat Zone
Pending Wildlife Underpass	2006 to Current	Area of Proposed Wildlife Underpass	Secondary Panther Habitat Zone
		Area of Potential Wildlife Underpass	Protected & Environmentally Sensitive Lands

## Wildlife Linkages

Source: GIS data provided by Collier County GIS Services, US Fish and Wildlife Service, and Florida Fish and Wildlife Conservation Commission



Habitat compensation must be provided for the direct impacts of the roadway footprint and associated water quality treatment areas, and minimization measures may be required regarding the indirect impacts of a project such as increased traffic and disturbance; therefore, the expense of such compensation and minimization requirements must be considered for any roadway expansions within the Primary and Secondary Zones. The issues of increased traffic and maintaining wildlife movement opportunities have traditionally been addressed through the installation of wildlife crossings. In the long-term, the planning of VMT-reduction strategies has the potential to reduce the number of lane miles ultimately needed to support the county's build-out population, reducing the overall infrastructure costs and potential impacts to wildlife protection and overall conservation goals.

Listed wildlife species, other than the Florida panther, are also known to occur in Collier County, and site-specific information for species such as the gopher tortoise, scrub jay, red-cockaded woodpecker, Florida black bear, caracara, and other federal and state listed species will warrant consideration in more detailed roadway planning efforts beyond the scope of this study.

#### **Wildlife Linkages**

As ecologically valuable as each individual area of protected land in Collier County is, the interconnectivity of many of these lands is vital to maintaining the integrity of the overall system. Maintaining water and/or wildlife connections through the landscape must be considered as part of future planning for roadway improvements or new mobility corridors.

The Watershed Management Program currently in progress, and any resulting restoration plans adopted by the County need to be considered for opportunities and constraints for future detailed mobility corridor planning efforts. These restoration efforts also need to be compared

against currently planned and future roadway/corridor improvements to identify possible modifications to accommodate water flow and water quality issues. In addition, an opportunity exists for coordination between bridges and wildlife crossings. In some cases, with a moderate design change to a roadway bridge, it can also serve as a wildlife crossing by providing a dry area under the bridge.

Wildlife crossings are a significant component of the existing roadway system in Collier County. Map 4-2 illustrates the location of existing crossings, areas of potential wildlife crossings and pending wildlife crossings under construction or identified as part of a current work program. These crossings typically involve the elevation of a roadway over structural culverts or bridges that allow wildlife to cross under the roadway. Directional fencing is often used to encourage, or "funnel," wildlife towards the crossing. The locations for these crossings have primarily been determined based on the long-term monitoring of panther movements and panther mortality caused by collisions with vehicles.

Based on past discussions between Collier County and FWS, areas that have been identified as requiring the addition of wildlife crossings with any proposed roadway improvements or expansion are also shown on Map 4-2. The designation of these areas is intended to show regions that will require careful evaluation of the need for installation of wildlife crossings should roadway improvements or new corridors be considered for that area. For the purposes of the MMP, these areas are to be considered for crossings as the county progresses towards build-out.

In addition to habitat compensation expenses, the expense of constructing a wildlife crossing as part of a roadway/corridor project is a significant issue. Collier County is currently investigating alternative wildlife crossings designs with the FWS and FWC in an effort to balance the functionality of crossings with construction costs. Even so, the costs

of crossings will remain significant and must be factored in for any road network planning efforts.

State and federal agencies typically require land on both sides of the road at a proposed wildlife crossing location (the ingress/egress points for wildlife) be in some form of protection or conservation. Obviously, building an expensive crossing only to have it rendered useless by development or other activities on either side is not desirable. For this reason, the feasibility and true cost of installing a wildlife crossing must also consider the need to acquire lands on either side of the crossing, or the ability to secure these lands through conservation easements or other forms of protection.

Alternatives to wildlife crossings have been used in some circumstances and are currently being investigated by FDOT. Wider clearing of vegetation within road rights-of-way, night-time speed zones, and panther warning signs have all been used with limited success. One alternative currently being developed for deployment and evaluation in Collier County on US 41 near the junction with Turner River Road is the Roadside Animal Detection System (RADS). This system will use a series of interconnected motion sensors placed along both side of the road right-of-way to detect wildlife movement within the right-of-way and activate flashing lights to alert motorists of the presence of wildlife. Should this system prove to significantly reduce vehicular conflicts with medium to large mammals, the potential exists to use such a system elsewhere in the county, either in addition to or as a cost-effective alternative to wildlife crossings.



Wildlife Crossing, Immokalee Road at Twin Eagles (Collier County)

#### **SECTION 4.5: CONCEPTUAL INFRASTRUCTURE PLAN**

The provision of infrastructure throughout Collier County from now until population build-out will be affected by a variety of factors: actual locations and concentrations of development; the extent to which the infrastructure/service already exists; key demographic variables (e.g., persons per household, students per household, age, etc.); and changes to technology or processes that affect the way public services are delivered in the future (e.g., e-government, virtual schools, etc.).

As previously discussed in Section 2, recent planning efforts undertaken by Collier County have identified needs based on current policies and practices where the costs far exceed available revenue. In 2005, Collier County commissioned the East of CR 951 Horizon Study, which calculated build-out infrastructure needs for the eastern county based the projected build-out population and three different Level of Service (LOS) scenarios: “status quo,” “intermediate,” and “premium.” As documented in the Horizon Study, the required facilities and associated costs (where provided) for each LOS scenario were calculated and



compared to projected revenue. This exercise revealed that it is not financially feasible for the County to continue constructing infrastructure in the same manner as has been done in the past.

As the county continues to grow, current infrastructure planning levels are unsustainable without significant changes. This Conceptual Infrastructure Plan will identify strategies to coordinate infrastructure needs with VMT-reducing principles and promote efficient and consolidated infrastructure planning, therefore reducing the cost burden to the citizens of Collier County.

The discussion of each public infrastructure/service type provided in this Conceptual Infrastructure Plan is centered around a set of key variables that influence VMT, the efficiency of the service provided, and cost reduction potential through reduced need and consolidated infrastructure planning. These variables include:

- Land use pattern (densities, mix of uses, etc.)
- Network connectivity
- Co-location opportunities
- Provision of centralized facilities

#### **Fire Rescue and EMS**

The provision of Fire Rescue and EMS infrastructure is highly affected by densities and geographic coverage, as the location of a fire/EMS station is driven by response time within the service area. If the service area expands and the existing station(s) cannot continue to serve the area with an adequate response time, then additional equipment, an additional station, or expansion/relocation of an existing station must be considered to maintain the desired response time. In addition to constructing the station, the County must also fund its annual operation costs. Increased development within a station's existing service area will result in increased use of that station and, beyond a certain point,

response time may likely be maintained with increased staffing and vehicles. The location and compactness of land use and development will greatly affect the number of fire and EMS stations needed within Collier County by build-out.

In addition to land use, road network connectivity and congestion levels will have a great impact on response times. Improved connectivity of the existing and future road network (e.g., through the provision of bridges in GGE or grid street patterns in future RLSA towns) would allow for better emergency response times. In addition, dedicated carpool or HOV lanes could provide a work-around for emergency vehicles during levels of high congestion.

In addition to response times, the funding of Fire Rescue/EMS is closely tied to the concentration and mix of land use since revenue is generated on a per-property basis (typically either through ad valorem or a non ad valorem assessment). In Collier County, fire rescue service is currently funded with a dedicated millage rate within each Fire Control District. To illustrate how revenues are affected by densities, residents per station is compared to the millage rates by Fire District in Table 4-7.<sup>13</sup> The results of this comparison illustrate that, in general, the fire districts with fewer persons per station require a higher millage to fund operating costs, as the per-capita costs are higher. In addition, areas with fewer persons per station are more likely to be located in the less urbanized areas of the county, where property values are lower and generate less revenue per mill than in the urbanized coastal areas.

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<sup>13</sup>Fire District boundaries do not align with planning and other sub-areas for which the County or other organizations (e.g., U.S. Census, BEBR, etc.) develop population figures. As such, population for each fire control district was calculated using the 2035 LRTP base year (2007) population data by TAX using GIS analysis. Since no significant growth has occurred within the county over the past several years, the LOS figures calculated from this exercise are considered reasonable estimates.

**Table 4-7  
Level of Service Summary by Fire Control District**

Fire District	Number of Stations <sup>1</sup>	Population (2007) <sup>2</sup>	Level of Service	Milage Rate <sup>3</sup>
Big Corkscrew Fire	3	17,125	5,709	3.5000
East Naples Fire	5	82,853	16,571	1.5000
Golden Gate Fire	4	73,233	19,058	1.5000
Immokalee Fire	2	19,273	9,637	3.0000
Isle of Capri Fire	1	1,943	1,943	2.0000
North Naples Fire	7	94,168	13,453	1.0000
Ochopee Fire	2	1,828	914	4.0000

(1) Source: 2011 Annual Update and Inventory Report (AUIR)

(2) 2035 LRTP base-year model population data by TAZ

(3) Collier County Property Appraiser, 2011 proposed millage rates

Fire and EMS stations require a significant annual operating cost relative to the initial capital investment. Even if a fire station is constructed through a developer agreement, the County must ensure that a sufficient tax base is in place to generate the required operating revenue.

### Public Schools

The provision of public school infrastructure and transport needs is largely affected by land use, as development within the service area of a public school must generate enough students to support the school. If the service area of a school is low density, it will take a larger geographic area to generate the same number of students that reside within a smaller, higher-density geographic area. As such, students within the low density area will likely have to travel a greater distance during peak travel hours, either by school bus or private transport, to reach the school. Related to the goals of the MMP, opportunities for VMT reduction related to school transport activities can be considered.

The District School Board of Collier County (DSBCC) provides bus transportation for students living outside a two-mile distance from the

school.<sup>14</sup> Opportunities for VMT reduction exists related to encouraging more compact development patterns in targeted areas, thereby allowing more students to reside within a walkable radius of the school and reducing peak hour school-related traffic. In addition, improved connectivity of the existing and future road network (e.g., through the provision of bridges in GGE or grid street patterns in future RLSA towns) would allow for more efficient student transport and school site access, as identified in the East of 951 Bridge Study.

Although only an illustrative example, the density of land use also has the potential to affect the number of schools needed at population build-out. Under a more compactly developed land use scenario, infrastructure cost savings could be realized by having one slightly larger school serve this area instead of two smaller schools operating on separate sites to serve a lower density, but larger geographic area.

Presently, the DSBCC and Collier County have worked together to coordinate the location of public schools with the FLUM to ensure that existing and proposed school facilities are located consistent with existing and proposed residential areas they serve and are proximate to appropriate existing and future land uses, and serve as community focal points. This includes the coordination of public school facilities relative to the location of other public facilities (e.g., parks, libraries, and community centers) to the extent possible and coordination of existing and planned public school facilities with supporting infrastructure.<sup>15</sup>

In addition, opportunities exist within the MMP for recommendations relating to the co-location of school facilities with other government services, including parks, libraries, etc. The DSBCC currently has several interlocal agreements to co-locate county community parks at public

<sup>14</sup> 6a-3.001, Florida Administration Code (FAC); exceptions to this distance apply if hazardous walking conditions are determined as provided in 6a-3.0171, F.A.C.

<sup>15</sup> GMP, Public School Facilities Element, Objective 3.

school sites. In addition, the *Collier County 10-Year Parks and Recreation Master Plan* (May 2011) includes a recommendation for continuing this practice as new school sites are developed.

### Parks and Recreation

The use of parks and recreation facilities is tied to the surrounding land use patterns since residents and visitors of Collier County must travel to parks and recreation sites to enjoy them. To ensure that parks are provided within reach of all residents and visitors, the County has developed policies to guide the planning and development of new or expanded park and recreation sites:

- The County shall develop a community and regional park system to provide useable open space to meet the recreational needs of residents within the community (GMP, ROSE, Goal 3).
- The Collier County Parks and Recreation Department will develop a Community and Regional Park Plan by 2010 to provide larger parks and recreational facilities as well as passive open space within a 15 to 20 minute drive of residents within the coastal Urban Designated Area, the Immokalee Urban Designated Area, and Northern Golden Gate Estates (this excludes Conservation designated areas, Agricultural/Rural designated areas, Southern Golden Gate Estates, and the outlying Urban Designated Areas of Copeland, Port of the Islands, Plantation Island and Chokoloskee) (GMP, ROSE, Objective 3.1).
- Within PUDs in Collier County, a minimum amount of usable open space shall be reserved for active and passive recreation areas, such as playgrounds, golf courses, lakes, beach frontage, waterways, nature trails, etc. Minimum usable open space requirements range from 30 percent for PUDs that include a mix of residential and non-residential to 60 percent for PUDs

that include only residential development (Collier County LDC, Section 4.07.02(G)).

- Within the RLSA, the County has identified parks/open space requirements for RLSA developments within Stewardship Receiving Areas (SRA). Specific parks/open space requirements are identified Table 4-8 (Collier County LDC, Section 4.08.07(J)).

**Table 4-8  
RLSA Parks/Open Space Characteristics**

RSLA Development Type	Open Space/ Public Green Space	Community Park Space
Town	Minimum 35% of SRA	200 sq ft per dwelling unit
Village	Minimum 35% of SRA	n/a
Hamlet	Minimum 1% of gross acres	n/a
CRD 100 Acres or Less	Minimum 1% of gross acres	n/a
CRD 100+ Acres	Minimum 35% of SRA	n/a

Source: Collier County LDC, Section 4.08.07(J)

One of the goals of the Parks and Recreation Master Plan was to determine if the County is currently achieving the parameters identified in Objective 3.1 of the GMP by providing parks in proximity to existing residents. To determine this, a drive-time analysis was conducted as part of the Master Plan. The results of this analysis indicate that the coverage area of existing and future community parks relative to existing county population is very good; however, a significant portion of the existing population lacks the presence of a regional park, including the GGE, Corkscrew, and Immokalee areas. Regional park land planned to be acquired over the next 10 years, including Big Corkscrew Island, Pulling Park, and Big Cypress, will help to address the lack of regional park land in these areas and serve population growth projected over the next 10 years. Increased densities resulting from more compact development also will lower the drive time to reach nearby parks (and

other services such as schools, libraries, government buildings, etc.) since fewer people will have to drive longer distances than under a less compact development pattern.

As noted previously, the County has set forth policies to ensure recreation/open space within future PUDs or RLSA Towns and Villages. The placement of recreation/open space directly within these developments will reduce travel time within neighborhood/community level parks and recreation facilities. Consistent with current policy, Collier County will still seek to provide recreation programs, including organized athletics, to residents of these areas. The County currently explores all opportunities to coordinate with outside agencies to maximize programs for community needs. However, funding shortages for the operations of these programs often limits the ability of the county to carry out such agreements.

In addition, parks provide an excellent opportunity for the County to co-locate other government services, including schools and libraries. As previously noted, the County and DSBC currently operate several community parks on public school sites.

### **Libraries**

Similar to parks, the use of public libraries is partially tied to the surrounding land use patterns. Although residents and visitors of Collier County must travel to a library to enjoy on-site benefits, the Collier County Public Library also provides Internet-based resources, including downloadable audio books and e-books. Increased emphasis on e-resources may reduce some need for travel to a library; however, public libraries will continue to be a focal point in the community, similar to parks and schools, by providing meeting space, computer and Internet access, and other programs and services. Libraries provide an excellent opportunity for the County to co-locate with other government functions, such as parks/community centers, as well as public schools

(for the provision of “after school hours” or “summertime” library services).

### **Government Buildings**

Collier County’s main government complexes are located in the CUA, with satellite government offices located in GGE and Immokalee to serve the needs of residents and others located east of CR 951. As more development occurs east of CR 951, increased emphasis will need to be placed on satellite facilities and e-government services as an opportunity to reduce VMT, reducing the need for citizens and visitors to travel longer distances. In addition, the provision of e-government services allows for some county business to be conducted via the Internet, rather than physically driving to the County building.

Related to the goals of the MMP, there are several considerations regarding general government buildings:

- Increased emphasis on full service satellite facilities as development continues to occur east of CR 951, which reduces the need for residents, employees, and others to travel to county offices located closer to the CUA.
- Increased emphasis on e-government services, which reduces the need for travel to a physical government office.
- Continued co-location with other government functions, such as libraries, law enforcement sub-stations or DSBC satellite offices.

### **Public Utilities (Potable Water and Sanitary Sewer)**

While central water and sewer systems do not have a direct bearing on VMT, there is a clearly a nexus between where future development will occur and the policies that require the provision of central utilities to support an expanding land use pattern. Collier County has adopted, as part of the GMP Public Facilities Element, separate Potable Water and Sanitary Sewer sub-elements that set forth the policy framework for the delivery of potable water and sanitary sewer services to lands within the unincorporated areas of Collier County.

Current policies are flexible enough to allow for these facilities to be provided through the Collier County Water-Sewer District, private utilities, or other public utilities that operate within portions of the unincorporated County. In addition to the policies supporting the delivery of potable water and sanitary sewer services to residential and commercial customers, the Sub-Elements also contain provisions related to water conservation and irrigation, provisions regulating the reuse of treated effluent for irrigation purposes, and policies regarding the establishment of new potable water sources to meet the demand of future residents and businesses.

Through its GMP, the County has implemented policies to ensure that public and private sector water and sewer service utilities provide the service needed and maintain system integrity in their respective service areas, in a manner that meets or exceeds the minimum level of service standards adopted in the County's Growth Management Plan. Additionally, public sector potable water and sanitary sewer service utilities are expected to expand as needed to provide for future growth within the respective service areas.

#### *Potable Water*

The County has carefully mapped out those areas where the delivery of central potable water services is anticipated, either by the County, or by

other authorized provider. In general, Collier County policies permit the development of potable water supply systems as follows:

- Within the designated Urban Areas on the Future Land Use Map, including the small urban areas of Immokalee, Copeland, Chokoloskee, Plantation Island, and Port of the Islands
- Within the areas depicted on the Collier County Water District Boundaries map (Section 2, Figure 2-24)
- Within the Existing and Future Potable Water Service Areas map (Section 2, Figure 2-25), including the Rural Transition Water and Sewer District
- Within Sending Lands in the RFMUD when Density Blending is used
- In Stewardship Receiving Areas, i.e., Towns, Villages, Hamlets and CRDs within the RLSA

Consistent with the growth policies in the FLUE, the provision of central potable water service by the County is limited to the following:

- Service areas depicted on the Collier County Water District Boundaries maps (Section 2, Figure 2-24)
- Existing and Future Potable Water Service Areas maps (Section 2, Figure 2-25), which includes the Rural Transition Water and Sewer District
- Areas where the County has legal commitments to provide facilities and services as of the date of adoption of the Growth Management Plan
- At the County's option, within the RLSA (e.g., in Towns, Villages, Hamlets, and CRDs) although, at present, the County has no plans to serve any portion of the RLSA



Within the RLSA, GMP policies *require* that Towns, Villages, and those CRDs greater than 100 acres in size be served central potable water facilities. Hamlets and CRDs 100 acres or less in size *may* be served by central potable water facilities, although some CRDs may be required to be served by central potable water facilities, depending upon the nature of the uses permitted. The policy allows Collier County, the private sector, an independent water authority, or some other non-County utility provider to provide these facilities.

For lands located within the Collier County Water-Sewer District where County water service is not currently available, non-County potable water supply systems are allowed only on an interim basis until County service is available.

Individual potable water supply wells may be permitted on an interim basis until County water service is available as follows:

- Within the areas depicted on the Collier County Water District Boundaries map (Figure 2-24)
- In all Urban designated areas outside of the areas depicted on Section 2, Figure 2-25;
- In Towns, Villages and CRDs with interim service to a maximum of 100 acres within such areas
- In the Rural Transition Water and Sewer District, depicted on the Existing and Future Potable Water Service Areas map (Section 2, Figure 2-25)
- In Sending Lands within the Rural Fringe Mixed Use District when Density Blending is used, as provided for in the Density Rating System of the Future Land Use Element

Additionally, individual potable water supply wells may be permitted where potable water supply systems are not anticipated, e.g., lands outside of the Urban Areas, outside of areas depicted in Figure 2-23

(located in Section 2), and outside of Stewardship Receiving Areas within the RLSA.

#### *Sanitary Sewer*

Similarly to the identification of potable water service areas, to be consistent with the growth policies of the FLUE, the County is limited to providing central sanitary sewer service to the following:

- Service areas depicted on the Collier County Sewer District Boundaries maps (Figure 2-26)
- Existing and Future Sewer Service Areas maps, which includes the Rural Transition Water and Sewer District (Figure 2-27)
- Sending Lands within the RFMUD when Density Blending is used, as provided for in the Density Rating System of the Future Land Use Element
- Areas where the County has legal commitments to provide facilities and services as of the date of adoption of the Growth Management Plan
- At its option, within the RLSA (e.g., in Towns, Villages, Hamlets, and CRDs); although at present the County has no plans to serve any portion of the RLSA

Similar to potable water, GMP policies *require* that Towns, Villages and those CRDs greater than 100 acres in size within the RLSA be served by central sewer facilities. Hamlets and CRDs 100 acres or less in size *may* be served by central sewer facilities, although some CRDs may be required to be served by central sewer facilities, depending upon the nature of the uses permitted. The policy allows Collier County, the private sector, an independent wastewater authority, or some other non-County utility provider to provide these facilities.

### **Law Enforcement and Correctional Facilities**

Unlike fire and EMS stations, law enforcement stations have more flexibility related to their location since officers typically respond to incidents during patrol rather than directly from the station. More compact land use patterns can, however, influence the coverage area required during patrol, with smaller coverage areas potentially reducing overall VMT. In addition, CCSO facilities (with the exception of correctional facilities) typically do not draw a substantial number of civilian visitors, to the same extent as other County buildings, such as libraries and parks. This also provides more flexibility in having sub-station co-located with other government functions.

With correctional facilities, civilian visitation and inmate transport are two major factors contributing to VMT generated by the presence of this infrastructure. The construction of a centralized jail, as identified as a need by the 2005 Jail Master Plan, will help reduce longer travel distances from outside of the CUA. In addition, the use of technology, such as satellite TV, can allow inmates to participate in court hearings remotely without having to travel to and from the jail and courthouse as often.

### **Solid Waste**

As discussed in Section 2, the 2011 AUIR has identified that the Collier County Landfill will have zero capacity remaining in FY 2042 and although continued changes in programs and consumer education will go far in continuing to decrease the amount of waste per person in the county, additional disposal capacity will be needed long before population build-out. The location of any additional solid waste disposal infrastructure alone will have an impact on VMT and GHG emissions since vehicular transport is the primary mechanism for transporting solid waste from pick up to the disposal site. A centralized disposal location will help reduce VMT related to transport of solid waste from developed areas to the disposal site.

Similar to fire rescue, EMS, and schools, road network connectivity and congestion levels will have a great impact on solid waste transport. Improved connectivity of the existing and future road network (e.g., through the provision of bridges in GGE or grid street patterns in future RLSA towns) would allow for more efficient transport. In addition, land use design can improve efficiency, reducing the number of stops required by a solid waste vehicle. For example, a residential neighborhood designed using a front-back relationship between streets and dwelling units with alleys between houses can allow for solid waste disposal at centralized points down the alley, reducing the number of streets traveled and total pickups by the solid waste vehicle.

### **SECTION 4.6: POTENTIAL BENEFITS OF MMP**

As previously discussed, the combination of several of the D-Variables coupled with other VMT-reducing strategies, such as TDM or operational efficiencies, will produce the greatest reduction in VMT. The policy recommendations for consideration (presented in Section 5) address an array of VMT reducing strategies that, collectively, will have the greatest impact on achieving the goals of the MMP as Collier County moves towards build-out.

Potential benefits that can be realized from implementing some or all of the recommendations of the MMP include economic benefits; health, welfare, and quality of life benefits; and safety benefits.

#### **Economics**

Some of the most significant benefits of the MMP are economic and include the potential for decreased transportation costs, increased economic vitality for the county, and increased property values.

Reducing the distance and time that people spend driving has a direct economic benefit. The 2035 Collier County LRTP indicates that in 2035 there will be nearly 16.3 million VMT per day in the county. According to

the baseline model, the countywide daily VMT will double by build-out at 32.2 million daily VMT. Estimating a reduction of 10 percent would reduce daily VMT by 1.63 million by 2035 or 3.24 daily VMT by build-out. According to AAA's 2010 edition of *Your Driving Costs*, the composite average cost per mile for all vehicles (sedans, SUVs, minivans) is \$0.585, which includes ownership, operation, and maintenance. At \$0.585 per mile, a 10 percent VMT reduction would yield a countywide daily savings of ±\$0.95 million and annual savings of ±\$350 million by 2035. Similarly, a 10 percent VMT reduction would yield a countywide daily savings of ±\$1.9 million and annual savings of ±\$695 million by 2035

Many of the provisions discussed in the Conceptual Infrastructure Plan (Section 4.5) promote increased efficiencies and consolidated services. Along with the benefits discussed in Section 4.5, reduced VMT can realize infrastructure costs savings associated with roadway capacity improvements and maintenance. Reducing VMT reduces the need for extra roadway capacity and, with fewer vehicles on the road, the need for maintenance from wear-and-tear is reduced. According to FDOT's Long Range Estimation System, the generic cost to widen a four-lane urban divided arterial to six lanes is about \$3.526 million per mile, and the resurfacing costs of a four-lane urban roadway are about \$907,000 per mile.

The MMP benefits the economic vitality of the county by increasing mobility, reducing lost time in traffic, building a stronger, more stable, tax base, and increasing the elasticity to rises in fuel costs.

Increasing mobility and reducing the amount of time employees and goods spend in traffic benefits businesses within Collier County. The costs associated with congestion can be enough to prevent economic growth. According to the Texas Transportation Institute's 2011 *Urban Mobility Report*, the average value of a person's time is \$16.30 per hour. As such, for every person-hour spent in traffic, there is an economic loss

of \$16.30. For every 100,000 people with a one-hour total work commute, the economic lost would translate to \$1.63 million per day, or nearly \$424 million per year.

The more dependent a community is on fuel, the less elastic it is to increases in fuel costs. When residents have to spend a higher percentage of their income on fuel, it reduces their amount of disposable income and spending which, in turn, reduces the economic stability of the community. A 2008 survey by AARP found that 85 percent of older adults were either extremely concerned or very concerned about rising fuel prices, leading many to look towards other forms of transportation or to reduce their travel.<sup>16</sup>

Creating compact, mix-use development can lead to a more diversified tax base and increased property values. Not only does having multiple uses on the same piece of land typically increase the value of that land and generate additional property tax revenue, but it also diversifies and strengthens the local tax base. When compared to other counties in Florida, Collier County has one of the highest percentages (approximately 90%) of its tax base generated by residential property. With the tax base dominated by a single use, the County is more susceptible to market fluctuations, as was experienced by the effects of the 2008 recession. By working towards diversifying its land use mix and employment base, Collier County will increase the percentage of non-residential development throughout the county, and achieve a more stable, diversified tax base.

### **Health, Welfare, and Quality of Life**

The MMP will help protect the health and welfare of Collier County's residents by reducing the amount of pollutants in the air and water and

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<sup>16</sup>Laura Skufea, "Is the Cost of Gas Causing Americans to Use Alternative Transportation?" AARP, 2008.

encouraging healthier travel options (i.e., walking and biking). As previously mentioned, reducing VMT reduces the amount of pollutants released into the air and environment, which is a benefit all residents can enjoy.

The land use and design strategies highlighted in the MMP promote unfragmented, compact mixed-use developments that maximize land, transportation, and infrastructure efficiencies. Increasing densities and promoting compact development within or near existing urban areas transfers development from rural outlying areas, thus preserving more land for conservation and low-impact agricultural activity.

Reductions in VMT have a direct effect on the amount of pollutants GHGs emitted into the air. According to the U.S. Environmental Protection Agency (EPA),<sup>17</sup> 0.009 metric tons of CO<sub>2</sub> (or CO<sub>2</sub>) equivalent is emitted per gallon of gasoline. By 2035, if the 10 percent VMT reduction assumed in the economic benefits section was achieved and assuming an average 54.5 miles per gallon,<sup>18</sup> the amount of GHG emitted would decrease by about ±585,000 pounds per day, or ±215 million pounds per year. Similarly, at build-out, the amount of GHG emitted would decrease by about ±1.2 million pounds per day, or ±430 million pounds per year.

The MMP also promotes a greater quality of life by increasing transportation options and equality, especially for older and low-income residents. An aging society needs transportation options. As people age, their ability to safely operate an automobile decreases; however, the need to travel often does not. According to the 2008 AARP survey, 71 percent of older adult households want to be within walking distance

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<sup>17</sup><http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>.

<sup>18</sup>In July 2011, President Obama and 13 major automakers agreed to increase fuel economy requirements to 54.5 miles per gallon for cars and light-duty trucks by model year 2025.

of transit. Similar to older populations, low-income residents are at a disadvantage in an auto-dependent community, as the costs to obtain reliable transportation are often too high. Housing costs, especially for low-income residents and for those on fixed incomes, is often a major factor in determining the distance that people need to drive. Often, the majority of affordable housing is located far from major employment centers, meaning that in order to afford housing, these residents must incur greater transportation costs. The MMP addresses these issues by promoting a fully-integrated multi-modal transportation system and by creating incentives to develop affordable housing close to areas of high-employment.

As both VMT and obesity rates in the United States have increased drastically over the past several decades, there is mounting evidence of the potential link between the influences of the built environment, including the degree of automobile travel, and obesity. Consistent with this research, the Center for Disease Control has implemented community-based strategies, including the promotion of bicycle and pedestrian infrastructure and mixed-use development.<sup>19</sup>

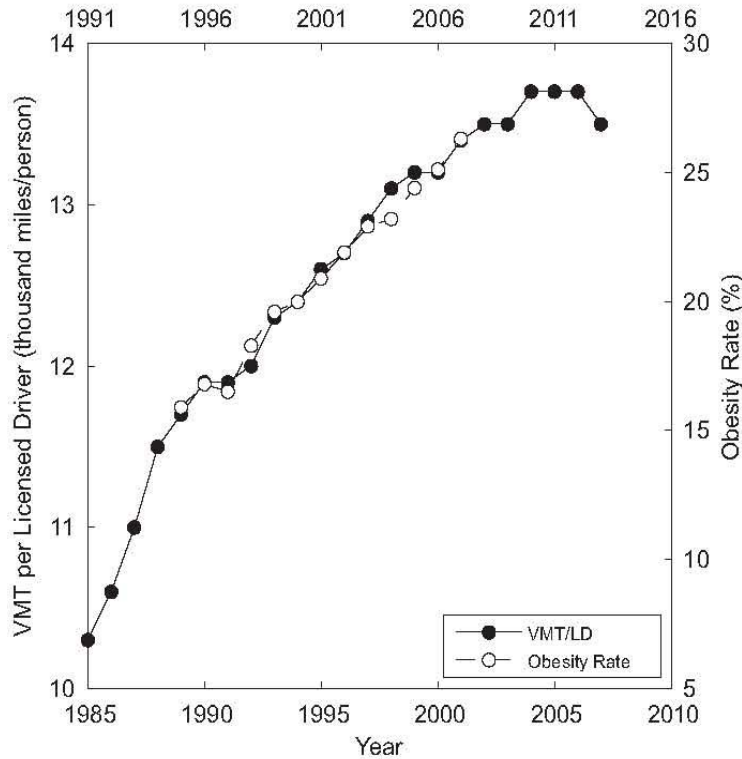
In 2011, an article published in *Transport Policy* highlights the results of a recent study demonstrating the relationship between miles driven per licensed driver and adult obesity rates on a national level using a simple linear regression model. To account for the fact that the effects of obesity are not immediate, obesity rates in the model have been lagged by six years when compared to miles driven.<sup>20</sup>

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<sup>19</sup>Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, "Recommended Community Strategies and Measurements to Prevent Obesity in the United States," *Morbidity and Mortality Weekly Report* 58(RR-7), pp. 1–29, 2009.

<sup>20</sup>S. H. Jacobson et al., "A Note on the Relationship between Obesity and Driving," *Transport Policy*, doi:10.1016/j.tranpol.2011.03.008, 2011.

Figure 4-4 summarizes the results of this study by comparing the time series of VMT per licensed drive to adult obesity rates (with a six-year lag applied to the obesity rate trend).



Source: Jacobson, S.H., et al., page 3  
 Time series for VMT/LD (Licensed Driver) (1985–2007) and adult obesity rate (1995–2007), with a six-year lag applied to the obesity rate trend.

**Figure 4-4**  
**Correlation between VMT/Licensed Driver and Obesity Rates**

As shown, historical obesity rates closely follow the rise in VMT. In 2008, the medical care costs of obesity in the United States were estimated at \$147 billion;<sup>21</sup> a reduction in VMT will not only provide health benefits, but can provide significant economic benefits as well.

### Safety

The more a person drives or rides in an automobile, the more time he/she is exposed to the potential of being involved in a crash; reducing that exposure time decreases the potential of being involved in a traffic crash. This is something that auto insurance companies have understood this for years and is why driving distance is often factored into insurance rates. Reducing VMT can have a positive effect on reducing the number of crashes that occur. Using existing crash statistics and VMT data, the number of potential crashes avoided through an assumed VMT reduction can be calculated. Table 4-9 shows the potential reduction in 2010 crashes assuming a 10 percent reduction in VMT.

Using an average cost per crash of \$142,500,<sup>22</sup> the annual economic benefit of reducing 190 crashes would be nearly \$27.1 million per year. Along with the benefits of reducing the number of traffic crashes the MMP address safety issues design. The provision of facilities such as sidewalks, bike lanes, and off-road bike paths provide non-motorist with the ability to travel without having to share the same space as automobiles. Also, land use and design features like compact mixed-use developments promote a pedestrian and bicycle-friendly environment.

<sup>21</sup>E. A. Finkelstein, J. G. Trogon, J. W. Cohen, and W. Dietz, "Annual Medical Spending Attributable to Obesity: Payer- and Service-Specific Estimates," *Health Affairs* 28(5), pp. w-822–w831, 2009.

<sup>22</sup> Federal Highway Administration – Highway Safety Improvement Program 2005-2009 Historic Crash Cost



**Table 4-9  
VMT Crash Reduction Calculation**

2010 Daily VMT <sup>1</sup>	8,943,065
2010 Crashes <sup>2</sup>	1,904
2010 Crash Rate per 100 Million VMT	58.3
Assumed VMT Reduction	10%
Adjusted Daily VMT	8,048,759
<i>58.3 x (8,048,759 x 365) ÷ 100,000,000</i>	
<b>Calculated Crash Reduction</b>	<b>190</b>

(1) Source: FDOT Public Road Mileage and Miles Traveled, 2010 Report

(2) Source: Florida Department of Highway Safety and Motor Vehicles Traffic Crash Statistics Report 2010