



# **U.S. 1 Corridor Planning Study**

## **Technical Memorandum**

Project Limits: Pineda Causeway (State Road (S.R.) 404)  
to Park Avenue in Brevard County

FM #: 433604-1-12-01

Date: February 2020

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- Appendix B: Drainage Correspondence with the City of Rockledge
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## 1 Report Purpose

This report is intended to document the U.S. 1 Corridor Planning Study that evaluated multi-modal improvements to the approximately nine-mile section of U.S. 1 from Pineda Causeway (State Road (S.R.) 404) to Park Avenue in the City of Rockledge and Brevard County. Additional information about the existing conditions is available under separate cover in the *U.S. 1 Corridor Planning Study Existing Conditions Technical Memorandum*. Additional information is also available under separate cover in the *U.S. 1 Corridor Planning Study Future Conditions Technical Memorandum*.

## 2 Introduction

### 2.1 Study Area Description

As shown in **Figure 1**, the limits of the study begin at S.R. 404 and extend nine-miles north to Park Avenue. The corridor traverses both the City of Rockledge and Brevard County and is bound by the Florida East Coast Railway (FECR) on the west and the Indian River Lagoon on the east. Within the study limits, U.S. 1 is a four-lane divided suburban arterial with an access classification 3 and a provisional context classification of C3C-Suburban Commercial. South of S.R. 404, U.S. 1 is a six-lane divided, suburban arterial and at Park Avenue, (the northern terminus) U.S. 1 transitions to a six-lane divided urban arterial.

### 2.2 Project Description

The project is documented in the Space Coast Transportation Planning Organization's (TPO) Adopted Fiscal Year (FY) 2019 Transportation Project Priorities FY 2020 to FY 2024 list as number seven in the highway component section as a four-lane to six-lane widening project. Local agency planning documents are provided under separate cover in the *U.S. 1 Corridor Study Existing Conditions Technical Memorandum*.

As part of the planning process, the Space Coast TPO submitted an application to the Florida Department of Transportation (FDOT) requesting a corridor planning study be conducted in FY 2019. This process is consistent with FDOT's internal process of conducting a corridor planning study for projects that may advance to the Project Development and Environment (PD&E) Study phase.

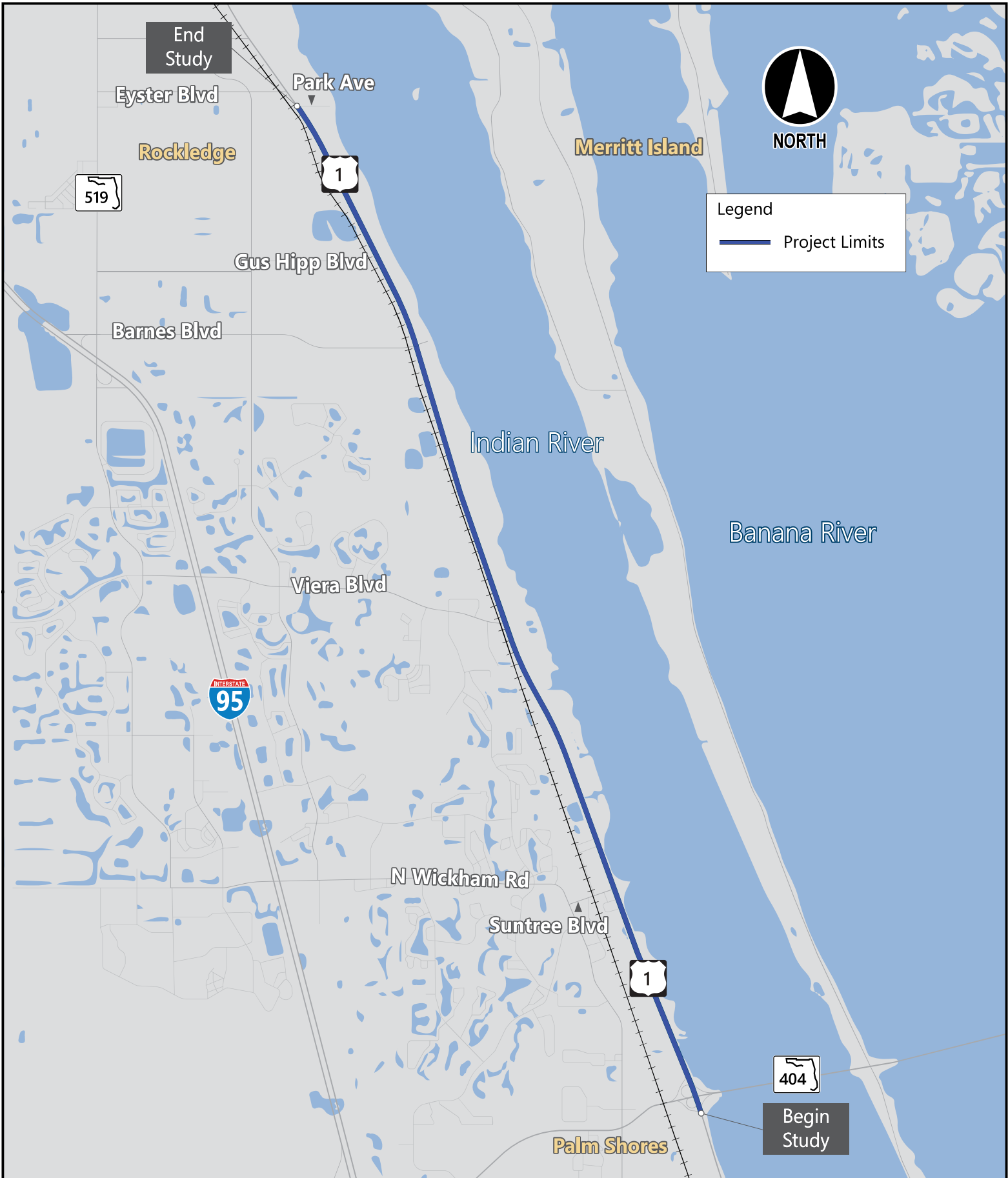
As shown in **Figure 2**, in the existing condition, U.S. 1 is a four-lane divided rural roadway centered within 100 to 175-feet of right of way. The median width varies from 20 to 40-feet throughout the corridor and the travel lanes are 12-feet-wide. There are eight-foot unpaved inside shoulders and eight-foot outside shoulders (with 5-feet paved) on both edges of pavement. It should be noted that bicycle lane signing and pavement markings are present throughout intermittent locations along the corridor.

The project is being conducted to evaluate alternatives to improve mobility needs along U.S. 1. This involves the evaluation of the following alternatives:

1. A four-lane, high speed curbed typical section that includes the addition of a six-foot-wide sidewalk on the west side of U.S. 1, a 12-foot-wide shared use path on the east side of U.S. 1, and the addition of Type E curb and gutter.

2. A six-lane, high speed curbed typical section that includes the addition of a six-foot-wide sidewalk on the west side of U.S. 1, a 12-foot-wide shared use path on the east side of U.S. 1, and the addition of Type E curb and gutter.
  - a. It should be noted that this option was preliminarily evaluated and then eliminated due to the lack of need and the resultant impacts and costs.
3. Spot improvements that can be implemented separately from the four-lane improvements include:
  - a. A new traffic signal at the existing northbound U.S. 1 to westbound S.R. 404 left turn lane.
  - b. The addition of crosswalks to complete all the legs of the intersections at the Suntree Boulevard, Viera Boulevard, and Barnes Boulevard intersections.
  - c. The addition of a 6-foot-wide sidewalk on the east side of U.S. 1 from Viera Boulevard to Barnes Boulevard.
  - d. Turn lane improvements at Viera Boulevard (an improvement identified as part of the Viera Boulevard PD&E Study – FM 428238-1). This includes the addition of a dual northbound U.S. 1 to westbound Viera Boulevard left turn lane and the addition of a dual eastbound Viera Boulevard to southbound U.S. 1 right turn lane.
  - e. The addition of a northbound left turn lane into Rockledge Gardens / Boater's Exchange.
  - f. Corridor wide bicycle lane improvements.
  - g. Corridor wide access management improvements.

As noted in **Section 5.5.3**, some of these spot improvements also account for the additional planned/programmed improvements, including those under construction and/or completed as part of other planning efforts.



End Study

Eyster Blvd

Rockledge



Park Ave



Merritt Island



NORTH

Legend

— Project Limits

Gus Hipp Blvd

Barnes Blvd

Indian River

Banana River

Viera Blvd



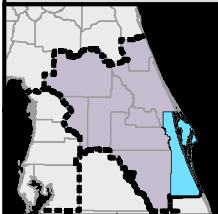
N Wickham Rd

Suntree Blvd



Begin Study

Palm Shores



Florida Department of Transportation  
District 5

**US 1 Corridor Planning Study**

from Pineda Causeway (State Road 404)  
to Park Avenue  
Brevard County, Florida

Financial Project ID: 433604-1  
Federal Project No: n/a

**PROJECT  
LOCATION MAP**

**FIGURE  
1**



### **3 Purpose and Need**

#### **3.1 Purpose**

The purpose of this project is to evaluate capacity, multi-modal, and Transportation Systems Management and Operations (TSM&O) alternatives to improve mobility for all users of U.S. 1.

#### **3.2 Need for Improvement**

The need for improvement was initially based on potential capacity improvements that may be needed to provide an acceptable Level of Service (LOS) for segments and major intersections along U.S. 1, however, as the future conditions were evaluated it was determined that a six-lane widening was not needed by the 2045 design year. Following coordination with the Project Visioning Team (PVT), capacity options were eliminated. The items driving the need for the project include the lack of multi-modal features, safety, intersection and drainage improvements, traffic operations, and access management.

### **4 Traffic**

#### **4.1 Future Traffic Volume Methodology and Assumptions**

Future year 2045 operational analysis were conducted to determine the LOS for the roadway segments and the study area intersections in future year 2045 conditions. Future traffic volumes were projected by using the preferred growth rate and growing existing traffic to the future year. The growth rate was determined by comparing growth rates determined by a historic trends analysis, the model growth analysis, and the Bureau of Economic and Business Research (BEBR) growth analysis. The selected growth rate of 0.74% was the average of the Central Florida Regional Planning Model (CFRPM) model growth rates and BEBR medium growth rates. The segment's Average Annual Daily Traffic (AADT) and Intersection Turning Movement Counts (TMC's) were grown to year 2045 at a linear rate using the selected growth rate identified above. Further information on the determination of the growth rates and future volumes can be found in the *U.S. 1 Corridor Planning Study Future Technical Memorandum*.

Several improvements are either scheduled or already under construction along the corridor, which affects the intersection geometry and signalization of several intersections for the No-Build alternative. Intersection improvements at the U.S. 1 and Suntree Boulevard intersection are currently under construction (FM 436237-1) to include the addition of a northbound left turn lane (for dual northbound lefts) along with the modification of the eastbound approach to provide dual right turn lanes, with a dedicated right turn and a shared through right lane, and a dedicated left turn lane. Improvements at the Viera Boulevard intersection include the addition of a second eastbound right turn lane and a second northbound left turn lane. There is also a grade-separated crossing of the FECR under construction on S.R. 404 between Wickham Road and U.S. 1. Finally, the FDOT has approved for construction the following improvements at the intersection of U.S. 1 and the S.R. 404 eastbound off ramp:

- Signalization of the intersection.
- Construction of an additional eastbound right turn lane and removal of the eastbound right turn channelization.
- Extension of the auxiliary lane from the S.R. 404 westbound off ramp joining U.S. 1 southbound. This will become a third southbound through lane at the S.R. 404 eastbound off ramp intersection.
- Addition of an exit lane for the U.S. 1 southbound off ramp going to S.R. 404 eastbound.

All of the above improvements are scheduled to be completed prior to year 2045 and have been included in the No-Build analysis, which can be found in the *U.S. 1 Corridor Planning Study Future Conditions Technical Memorandum*.

## 4.2 Year 2045 No-Build with Spot Improvements Arterial Analysis

After applying the planned intersection improvements (also included in the No-Build Scenario) and the recommended intersection improvements, the No-Build with Spot Improvements alternative was analyzed using Synchro Software (version 10.0) arterial analysis. This analysis takes into account the corridor specific attributes to make a determination on the projected LOS for each segment. This analysis shows whether or not the intersection improvements are sufficient to keep the corridor segments operating at an acceptable LOS through year 2045. The year 2045 projected roadway operations are provided in **Table 1**, **Table 2**, and **Figure 3** for the AM and PM peak hour.

**Table 1: Year 2045 AM Projected Roadway Operations:  
No-Build with Spot Improvements Alternative**

| Segment                                | Northbound  |                  | Southbound  |                  |
|--|-------------|------------------|-------------|------------------|
|  | Speed (mph) | LOS <sup>1</sup> | Speed (mph) | LOS <sup>1</sup> |
| S.R. 404 to Suntree Boulevard          | 37.7        | B                | 47.6        | A                |
| Suntree Boulevard to Viera Boulevard   | 50.3        | A                | 44.6        | A                |
| Viera Boulevard to Barnes Boulevard    | 50.3        | A                | 42.5        | A                |
| Barnes Boulevard to Gus Hipp Boulevard | 49.1        | A                | 46.7        | A                |
| <b>Full Corridor</b>                   | <b>47.2</b> | <b>A</b>         | <b>44.1</b> | <b>A</b>         |

<sup>1</sup> Level of Service

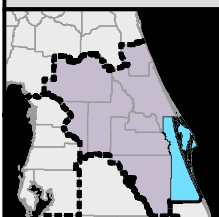
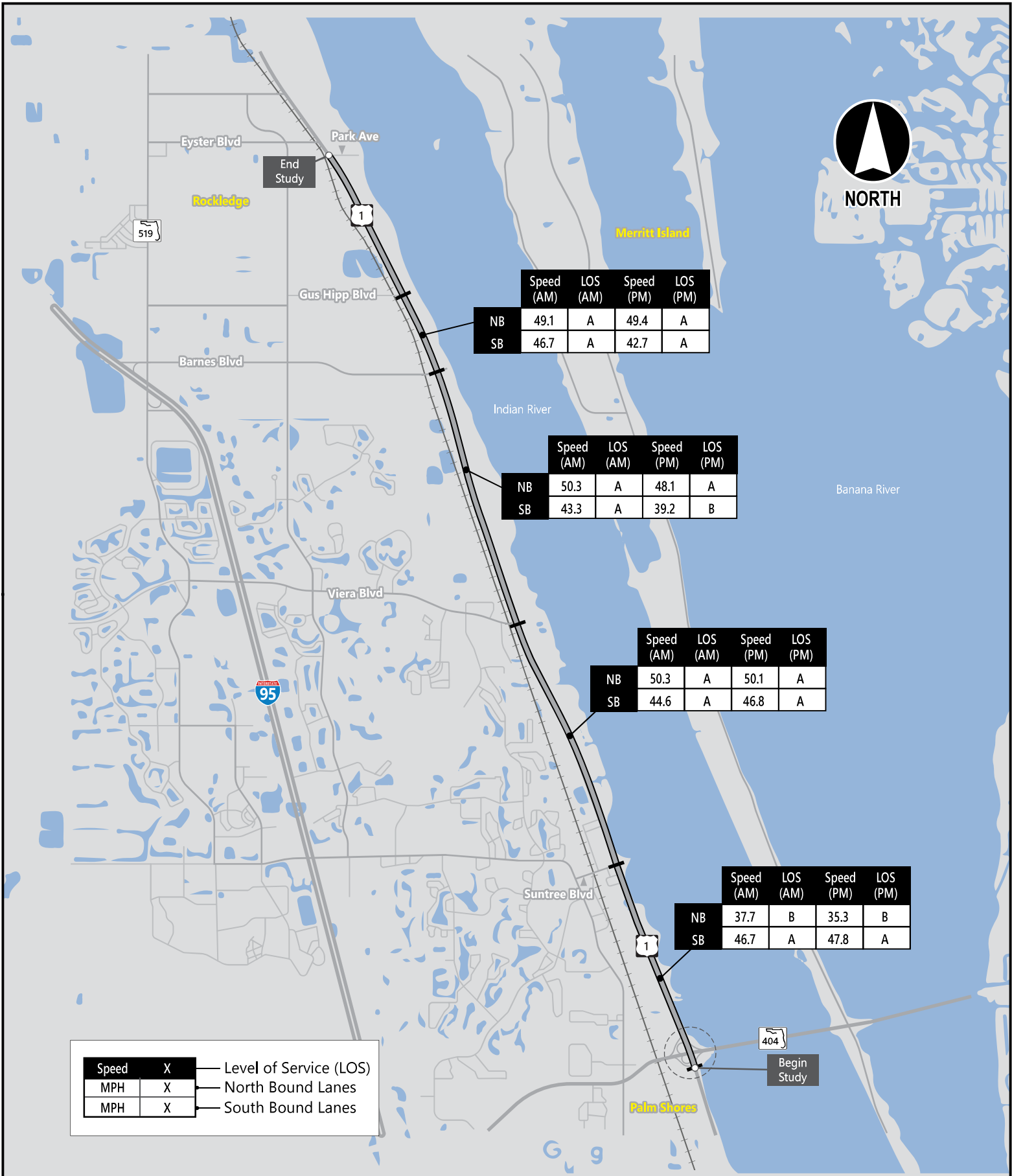
**Table 2: Year 2045 PM Projected Roadway Operations:  
No-Build with Spot Improvements Alternative**

| Segment                                | Northbound  |                  | Southbound  |                  |
|--|-------------|------------------|-------------|------------------|
|  | Speed (mph) | LOS <sup>1</sup> | Speed (mph) | LOS <sup>1</sup> |
| S.R. 404 to Suntree Boulevard          | 36.9        | B                | 48.0        | A                |
| Suntree Boulevard to Viera Boulevard   | 50.1        | A                | 46.8        | A                |
| Viera Boulevard to Barnes Boulevard    | 47.7        | A                | 38.2        | B                |
| Barnes Boulevard to Gus Hipp Boulevard | 49.4        | A                | 42.7        | A                |
| <b>Full Corridor</b>                   | <b>46.2</b> | <b>A</b>         | <b>42.6</b> | <b>A</b>         |

<sup>1</sup> Level of Service

As shown in **Table 1** and **Table 2**, with the planned and recommended intersection improvements, all segments of the U.S. 1 corridor are anticipated to operate within acceptable LOS standards in year 2045 during both the AM and PM peak hours. The results show that the segments operate better than the target LOS during the future peak periods without the need to increase overall corridor capacity. As such, U.S. 1 is recommended to be maintained as a four-lane facility throughout the study corridor. Further information on future segment analysis can be found in *U.S. 1 Corridor Planning Study Future Conditions Technical Memorandum*.







### 4.3 Year 2045 No-Build with Spot Improvements Alternative Projected Interchange Operations

The U.S. 1 intersection at the S.R. 404 Eastbound off ramp is being signalized independent of this corridor study. Signalization is proposed at the S.R. 404 westbound on ramp intersection. Both intersections were analyzed with the procedures in HCM 6th Edition using Synchro Software (version 10.0). **Table 3** below gives a summary of the intersection LOS for the No-Build with Spot Improvements alternative. As shown in the table, the northbound left turn movement at the S.R. 404 westbound on ramp does not meet the LOS standard (LOS C) in either the AM or PM peak hour conditions, however, it is no longer expected to fail with delays being reduced to less than one minute for both peak hour conditions. Both intersections are projected to operate at LOS B or better in both the AM and PM peak hour conditions. At the intersection with the S.R. 404 eastbound off ramp, the scheduled intersection improvements successfully mitigate any potential operational deficiencies at the intersection, and all of the movements, as well as the intersection overall, operate at an acceptable LOS. Further information on the operation of the interchange can be found in *U.S. 1 Corridor Planning Study Future Conditions Technical Memorandum*.

**Table 3: Year 2045 Projected Interchange Intersection Operations: No-Build with Spot Improvements Alternative**

| Intersection                  | Intersection Control Type | Movement       | Year 2045 AM Peak Hour |                    |                  | Year 2045 PM Peak Hour |                    |                  |
|-------------------------------|---------------------------|----------------|------------------------|--------------------|------------------|------------------------|--------------------|------------------|
|                               |                           |                | v/c <sup>1</sup>       | Delay <sup>2</sup> | LOS <sup>3</sup> | v/c <sup>1</sup>       | Delay <sup>2</sup> | LOS <sup>3</sup> |
| U.S. 1 @ S.R. 404 EB Off Ramp | Signalized (planned)      | EBL            | 0.36                   | 34.7               | C                | 0.34                   | 36.7               | D                |
|                               |                           | EBR            | 0.86                   | 50.3               | D                | 0.85                   | 52.3               | D                |
|                               |                           | NBT            | 0.79                   | 15.6               | B                | 0.88                   | 17.7               | B                |
|                               |                           | SBT            | 0.65                   | 11.6               | B                | 0.57                   | 5.8                | A                |
|                               |                           | <i>Overall</i> | <i>0.81</i>            | <i>18.5</i>        | <i>B</i>         | <i>0.87</i>            | <i>17.2</i>        | <i>B</i>         |
| U.S. 1 @ S.R. 404 WB On Ramp  | Signalized (proposed)     | WBR            | 0.44                   | 0.9                | A                | 0.53                   | 1.3                | A                |
|                               |                           | NBL            | 0.87                   | 51.7               | D                | 0.89                   | 50.7               | D                |
|                               |                           | NBT            | 0.67                   | 1.0                | A                | 0.76                   | 1.6                | A                |
|                               |                           | SBT            | 0.88                   | 15.7               | B                | 0.82                   | 14.8               | B                |
|                               |                           | SBR            | 0.11                   | 4.7                | A                | 0.18                   | 6.2                | A                |
| <i>Overall</i>                | <i>0.91</i>               | <i>9.8</i>     | <i>B</i>               | <i>0.92</i>        | <i>9.3</i>       | <i>A</i>               |                    |                  |

<sup>1</sup> Volume to Capacity Ratio (Maximum v/C for approach)

<sup>2</sup> Average delay in seconds per vehicle

<sup>3</sup> Level of Service

## 4.4 Year 2045 Intersections Analysis

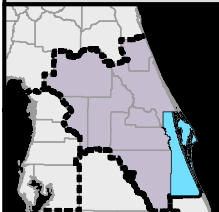
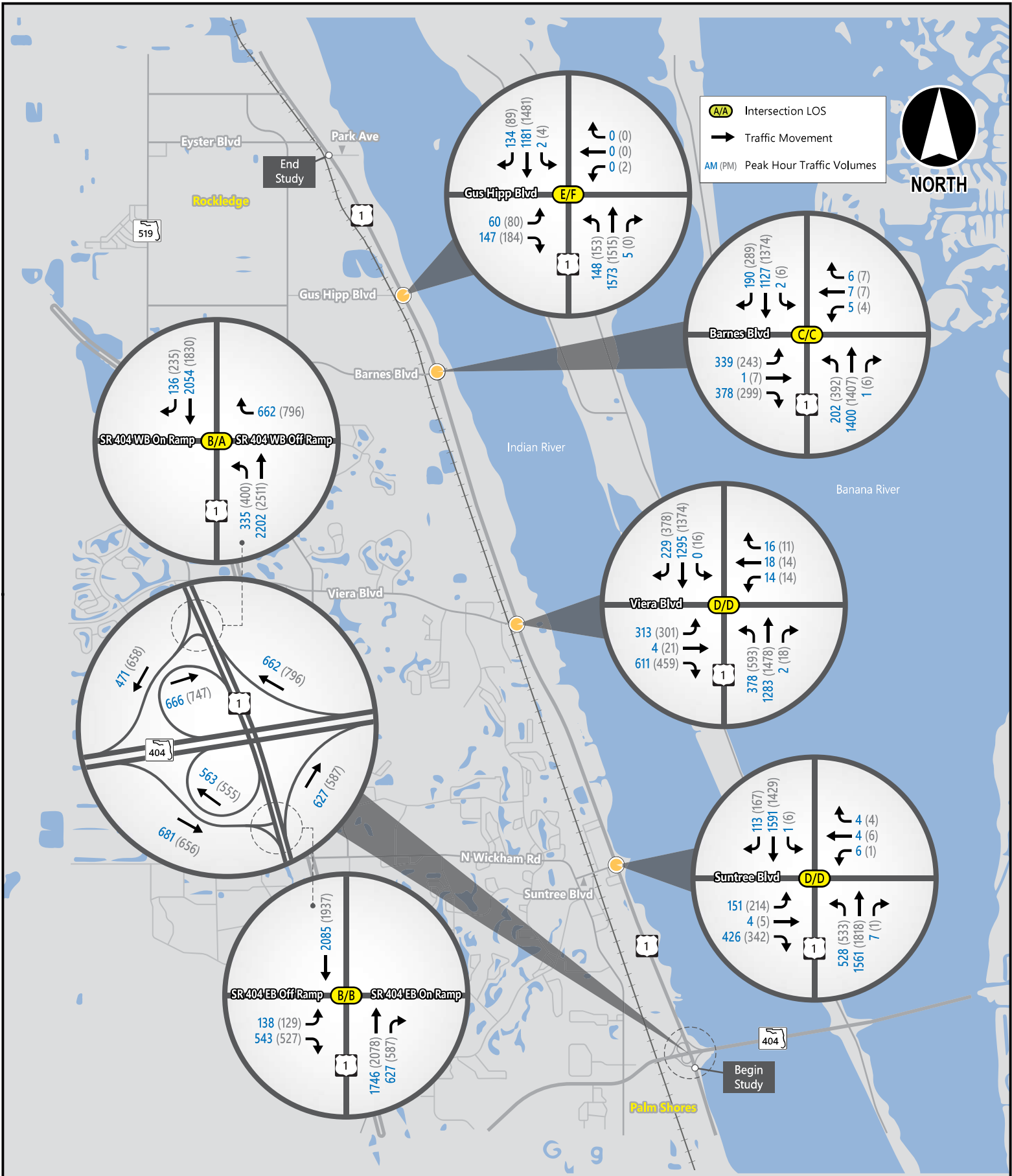
A summary of the year 2045 projected intersection operations for all study area intersections is provided in **Table 4** for the AM and PM peak hours. Because no spot improvements are recommended for the study corridor intersections, the intersections' performance are the same in the No-Build Alternative and with the Spot Improvements Alternative. The signal timings were optimized under the assumption that signal timings will be regularly maintained through year 2045.

**Table 4: Year 2045 Projected Intersection Operations**

| Intersection                | Intersection Control Type | AM Peak Hour |                  | PM Peak Hour |                  |
|-----------------------------|---------------------------|--------------|------------------|--------------|------------------|
|                             |                           | Delay        | LOS <sup>1</sup> | Delay        | LOS <sup>1</sup> |
| U.S. 1 @ Suntree Boulevard  | Signalized                | 40.3         | D                | 42.1         | D                |
| U.S. 1 @ Viera Boulevard    | Signalized                | 38.3         | D                | 45.5         | D                |
| U.S. 1 @ Barnes Boulevard   | Signalized                | 27.4         | C                | 34.3         | C                |
| U.S. 1 @ Gus Hipp Boulevard | Stop Controlled           | 39.9         | <b>E</b>         | 141.5        | <b>F</b>         |

<sup>1</sup> Level of Service

As presented in **Table 4**, all the study area intersections are anticipated to operate at an acceptable LOS in year 2045, except for the intersection at Gus Hipp Boulevard in both the AM and PM Peak Hour. The planned improvements for the Suntree Boulevard and Viera Boulevard intersections are sufficient to keep the intersections operating at the target LOS in year 2045, so no further improvements are recommended. The LOS for Gus Hipp Boulevard is based on worst case movement at the intersection, and the intersection does not meet signal warrants in the future condition. Therefore, the intersection at Gus Hipp Boulevard is recommended to remain in its existing configuration until further coordination takes places between Brevard County and Virgin Trains to determine the appropriate treatments at this location. The year 2045 projected intersection operations are presented in **Figure 4** for the AM and PM peak hours. Further information on the operation of the intersections can be found in *U.S. 1 Corridor Planning Study Future Conditions Technical Memorandum*.



## **5 Alternative Analysis and Development**

### **5.1 No-Build Alternative**

The No-Build Alternative assumes that only the programmed improvements will be implemented for U.S. 1 by the year 2045. For the sake of this planning study, this includes the eastbound S.R. 404 improvements, the improvements at Viera Boulevard discussed in other sections and the improvements at Suntree Boulevard also discussed in other sections. The primary advantages of the 'No-Build' Alternative are that it does not require any capital or expenditure of transportation funding beyond what is currently planned, and it would result in no additional physical, natural or social impacts. The No-Build Alternative will remain under consideration throughout the study process. Advantages associated with the implementation of the No-Build Alternative include:

- No right of way acquisition, residential relocations or business displacements.
- No design, right of way, or construction costs.
- No inconvenience to the traveling public and property owners during construction.
- No impacts to utilities.
- No impacts to the adjacent natural, social, cultural or physical environment.

The potential disadvantages of the 'No-Build' Alternative include:

- Does not improve multi-modal mobility.
- Does not improve traffic operations.
- Safety is not improved.
- Access management is not improved.

### **5.2 TSM&O and Multi-Modal Alternatives**

#### **5.2.1 Overview**

Transportation Systems Management and Operations (TSM&O) is a program to actively manage transportation systems through non-capacity improvements that rely on a range of strategies. TSM&O includes a wide variety of strategies, solutions, and alternatives, ranging from "low-tech" safety improvements such as implementing a sidewalk, to advanced Intelligent Transportation System (ITS) deployments such as Adaptive Signal Control Technology (ASCT) and Advanced Traffic Management System (ATMS). To better integrate TSM&O practices and strategies into the FDOT planning process, the District developed the TSM&O Strategy Guide.

This program allows users to indicate issues, challenges, and "symptoms" experienced within a transportation study area. Based on the inputs for this study, the program generated a number of potential TSM&O strategies for consideration. Following this step, coordination with the FDOT District Five TSM&O Group took place to determine appropriate TSM&O strategies given the context of the study area.

The following sections describe the issues identified, the relevant solutions generated by the TSM&O Strategy Guide, and the final recommendations based on the analysis and coordination with the District Five TSM&O Engineer.

### 5.2.2 Issues and Challenges Identified along the U.S. 1 Corridor

To determine potential TSM&O strategies for the U.S. 1 study corridor, a number of issues and symptoms identified along the corridor were loaded into FDOT District Five's TSM&O Strategy Guide.

- **Minimal Bike/Pedestrian Infrastructure:** There are no sidewalks or trails located along the U.S. 1 study corridor. Five-foot shoulders are present in both directions, with “keyholes” provided between through lanes and right turn lanes along the roadway to accommodate bicyclists using the shoulder. As previously mentioned, bicycle lane signing, and pavement markings are present throughout intermittent sections of the corridor.
- **Excessive Speeding (10% over speed limit):** This segment of U.S. 1 is noted as a high-speed corridor. The “Excessive Speeding” issue was used as a stand-in for high-speed corridor.
- **Evacuation Route Designation:** U.S. 1 is designated as an evacuation route. There are certain TSM&O strategies that can be deployed to enhance the roadway during evacuation scenarios. Strategies may include installing new ITS infrastructure, deploying an Advanced Traffic Management System, and/or deploying Integrated Corridor Management with accompanying diversion routes.
- **Poor Trip Connectivity / Planning:** There is one Space Coast Area Transit bus route located along the portion of U.S. 1 from Viera Boulevard to Barnes Boulevard. The Rockledge/Viera #7 bus route only travels northbound along the U.S. 1 portion of the route and includes two bus stops on the corridor. Apart from this route, there is no transit option along the U.S. 1 study corridor.
- **Potential Diversion Route:** The U.S. 1 corridor is a parallel facility to I-95. Three major crossroads provide direct connections to the interstate (Wickham Road via Suntree Boulevard, Viera Boulevard, and Barnes Boulevard). In the event of a major incident on I-95 in this region, interstate traffic could be diverted onto U.S. 1 around the incident, and back onto I-95.

### 5.2.3 TSM&O Strategy Guide Recommendations

Based on the information outlined above, the TSM&O Strategy Guide provided the following relevant recommendations.

- Communications/Network Upgrade (Fiber)
- Install Bluetooth
- Install closed-circuit television (CCTV)
- Controller Upgrades
- Install Arterial Dynamic Message Signs (ADMS)
- Integrated Corridor Management System (ICMS)
- Active Arterial Management
- Complete Streets
- Traffic Signal Re-timing
- Update Transit Routes
- Travel Demand Management
- Adaptive and Intelligent Streetlights
- Bicycle Alert System
- Pedestrian Safety System
- Enhance Bike/Pedestrian Infrastructure
- Midblock Crossing
- Transit Roadside Feature Upgrades
- Advanced Traffic Management System (ATMS)

#### **5.2.4 Meeting with the FDOT District Five TSM&O Engineer**

After identifying TSM&O strategies that may fit the context of the U.S. 1 study corridor, a meeting was held with the District Five TSM&O Engineer to obtain insight relating to potential TSM&O improvements. This section describes the major discussion items during the meeting with the FDOT District Five TSM&O Engineer, Jeremy Dilmore.

- The U.S. 1 study corridor is already part of the Brevard County ATMS.
- The corridor does not have fiber, but the County may no longer want it.
  - Suggested asking the County if they still want the fiber.
- Jeremy agreed with installing additional CCTVs and Bluetooth devices, as necessary.
- Traffic signal controllers along the corridor were previously upgraded to Advanced Transportation Controllers (ATC).
- Existing blankout signs will be sufficient for diversion route purposes and additional blankout signs can be installed along the corridor, as necessary, for increased traveler information.
  - Individual ADMS signs are several times more expensive than blankout signs.
- Existing bus stops (and potentially new bus stops based on transit route updates) could be outfitted with additional amenities, including transit kiosks. These kiosks could improve the user experience, potentially drawing in “choice riders.” With effective advertising on the kiosk, the device could potentially generate revenues exceeding its operations and maintenance costs, reallocating the savings to the transit agency’s general budget.

- Jeremy agreed with the diversion route designation and integration with the District Five ICMS program, however, there are plans in place to designate the U.S. 1 corridor as a diversion route and integrate it into the District Five ICMS program in the near-term.
- Jeremy agreed with adding a sidewalk or trail along the northbound side of the corridor. This would provide pedestrian access to two bus stops and two parks along the northbound side of the corridor.

### 5.2.5 Final TSM&O Recommendations

Based on a review of the U.S. 1 study corridor, as well as coordination with the Space Coast TPO and the FDOT District Five TSM&O Engineer, the following TSM&O strategies have been recommended for further consideration:

- **Integrated Corridor Management (ICM) Diversion Route Designation:** Establish the U.S. 1 study corridor as a diversion route for I-95, providing motorists with an alternative route in the event of a major incident on the interstate. The Integrated Corridor Management System would be able to move the daily traffic volumes off the interstate onto the local arterial network using pre-engineered signal timing plans. Diversion routes are typically parallel facilities with the available capacity and are equipped with the appropriate ITS infrastructure to support dynamic control of the corridor, including ATC controllers, fiber, CCTV, Bluetooth, and travel information signs (such as ADMS or blankout signs). The U.S. 1 corridor from Babcock Street north to S.R. 520, including the entire study corridor segment, has been identified in the FDOT District five ICMS Ten-Year Plan as a candidate diversion route facility for I-95.
  - Note: Integration with the FDOT ICM program will be completed as part of a separate FDOT project.
- **Communication/Network Upgrade (Fiber):** Install fiber optic cable to improve data transfer capacity and security for the roadway and network. Fiber will enable advanced traffic operations and strategies such as ATMS, Adaptive Signal Control, and ICM Diversion Routes.
- **Install Bluetooth:** Install Bluetooth readers along the U.S. 1 study corridor to capture real-time traffic information, improving the operation of the roadway.
- **Install CCTV:** Install CCTV devices to capture real-time imaging and video of activities and incidents along the corridor, providing situational awareness to operators, first responders, road rangers, and the traveling public.
- **Install Blankout Signs:** Install blankout signs along the corridor to provide motorists with basic detour guidance to support the recommended designation as a diversion route under the FDOT ICM program for I-95.
  - ADMS was identified as a need in the Space Coast TPO ITS Master Plan. However, given the primary purpose for the signs would be related to diversion route detouring, it was determined that the less expensive blankout sign was a more cost-effective method for providing the appropriate detour information to users.
  - If it is determined that additional blankout signs are required beyond the study area for the detour to be most effective, additional coordination will take place.



- **Traffic Signal Re-timing:** Over time, traffic conditions and travel patterns may change enough to render current signal timings obsolete. Poor signal timing can lead to increased congestion, poor travel time reliability, and a potential increase in congestion related crashes. Traffic signal re-timing is a basic TSM&O strategy that is often the first step in improving operations at an existing signal. For major corridors, re-timing may include revising corridor-wide signal coordination.
  - Note: Re-timing signals would likely be handled under a separate traffic signal re-timing effort.
- **Update Transit Routes:** There is currently one route that covers only a portion of the U.S. 1 study corridor. Updating the transit route network via new or altered routes to better serve the entire study corridor may encourage additional ridership and improve mobility for transportation-disadvantaged individuals.
  - Note: Updating transit routes would be handled by Space Coast Area Transit.
- **Transit Roadside Feature Upgrades:** Currently, the two bus stops within the U.S. 1 study corridor do not have any amenities on-site. Implementing transit roadside feature upgrades such as covered shelters, seating, lighting, and static/dynamic information systems, in conjunction with updated transit routes, may provide a positive experience for transit users. These enhancements may persuade “choice riders” to consider transit as an alternative to single-occupant vehicle (SOV) transportation. The FDOT is currently working with transit agencies to develop a transit kiosk program that can provide additional revenues to transit agencies for reinvestment in their general budgets.
  - Note: This would require coordination with Space Coast Area Transit.
- **Enhance Bicycle/Pedestrian Infrastructure:** Provide a sidewalk, shared-use path, or trail along the U.S. 1 study corridor to increase safety and improve mobility for alternative modes of transportation. There are currently five-foot-wide shoulders along the entire corridor, but no sidewalks or trails. Installing a sidewalk or trail along the roadway would move pedestrians away from the high-speed corridor, therefore improving pedestrian safety and comfort. Similarly, sidewalks could improve the mobility of pedestrians and improve accessibility to the two public parks located on the northbound side of the study corridor, as well as the only two bus stops along the corridor. Additional bicycle/pedestrian enhancements may include trails, wayfinding improvements, and bike-sharing opportunities.
- **Adaptive and Intelligent Streetlights:** Install adaptive and intelligent streetlights along to improve lighting and visibility for motorists, bicyclists, and pedestrians. This advanced technology automatically adjusts the brightness of streetlights based on need, time of day, and other factors. Operators are also able to access the streetlights remotely to adjust brightness and runtime of the LED bulbs based on various conditions. This technology can improve brightness as needed, reduce maintenance costs, provide longer bulb life, and improve customer satisfaction.
- **Specific Spot Improvements:** Signalizing the northbound U.S. 1 to westbound S.R. 404 intersection, adding crosswalks at all signalized intersections, adding a shared use path or sidewalk on the east side of U.S. 1 between Viera Boulevard to Barnes Boulevard, adding northbound U.S. 1 to westbound Viera Boulevard dual left turn lanes, and the potential for a roundabout at Gus Hipp Boulevard.



### 5.3 Design Criteria

The typical section alternative was analyzed based on current FDOT criteria contained in the FDOT Design Manual (FDM) 2019 and the FDOT PD&E Manual. The need for proper horizontal curvature, design speeds, grades, and horizontal clearances have been considered. The design criteria used in the concept development of the study are listed in **Table 5** below.

**Table 5: Design Criteria**

| US1 from Pineda Causeway to Park Avenue Design Criteria |                                      |                                 |
|---|--------------------------------------|---------------------------------|
| Subject   | Design Speed = 50 mph                | Reference                       |
|   | High Speed Curbed Roadway            | FDM <sup>1</sup>                |
| <b>Typical Section Elements</b>                         |                                      |                                 |
| Lane Widths   | 12 ft.                               | Table 210.2.1                   |
| Median Widths   | 30 ft.                               | Table 210.3.1                   |
| Shoulder Widths (Outside)                               | 6.5 ft.                              | Section 210.5.1                 |
| Shoulder Widths (Median)                                | 4 ft (4-Lane Typical)                | Section 210.5.1                 |
|   | 6.5 ft. (6-Lane Typical)             |                                 |
| Lane Cross Slopes                                       | -0.02, -0.02 (4 Lane Typical)        | Figure 210.2.1                  |
|   | -0.02, -0.02, -0.03 (6 Lane Typical) |                                 |
| Shoulder Cross Slopes (Outside)                         | -0.02 (4 Lane Typical)               | Section 306                     |
|   | -0.03 (6 Lane Typical)               |                                 |
| Shoulder Cross Slopes (Inside)                          | -0.02                                | Section 306                     |
| Border Width  | 29 ft.                               | Table 210.7.1                   |
| Clear Zone  | 24 ft.                               | Table 215.2.1 & Section 215.2.4 |
| Lateral Offset  | Varies (See Table 215.2.2)           | Table 215.2.2                   |
| Canal Lateral Offset                                    | 60                                   | Section 215.3.2                 |
| Front Slope   | 0-5' Fill = 1:6                      | Table 215.2.3                   |
|   | 5'-10' Fill = 1:6 to CZ, then 1:4    |                                 |
|   | 10'-20' Fill = 1:6 to CZ, then 1:3   |                                 |
|   | >20' Fill = 1:2 with guardrail       |                                 |

**Table 5: Design Criteria Continued**

| Subject  | Design Speed = 50 mph<br>High Speed Curbed Roadway | Reference                     |
|--|--|-------------------------------|
|  |  | FDM <sup>1</sup>              |
| <b>Typical Section Elements</b>  |  |                               |
| Back Slope   | 1:4 or 1:3 with Standard Width Trapezoidal Ditch   | Table 215.2.3                 |
| <b>Pedestrian/Bicycle Facilities</b>   |  |                               |
| Sidewalk Width   | 6 ft.  | Table 222.1.1                 |
| Vertical Clearance Over Walkway  | 7 ft.  | Section 222.2.1.2             |
| Maximum Sidewalk Grade (When Not Adjacent to Roadway)  | 5%   | Section 222.2.1.3             |
| Maximum Sidewalk Cross Slope   | 2%   | Section 222.2.1.3             |
| Bicycle Lane Width   | 6.5' Outside Shoulder                              | Section 223.2.1.1 & 210.5.1   |
| <b>Horizontal Geometrics</b>   |  |                               |
| Maximum Deflection<br>(Without Horizontal Curve)   | 0° 45' 00"   | Section 210.8.1               |
| Desired Length of Horizontal Curve<br>(Based on Design Speed)                                  | 750. ft.   | Table 210.8.1                 |
| Minimum Curve Length   | 400 ft.  | Table 210.8.1                 |
| Superelevation   | $e_{max} = 5\%$                                    | Section 210.9 & Table 210.9.2 |
| Maximum Degree of Curve (D)  | 2° 30' 00"   | Table 2.10.9.1 & 2.10.9.2     |
| Roadway Transitions<br>• Merging Taper = L<br>• Shifting Taper = L/2<br>• Shoulder Taper = L/3 | L = WS   | Section 210.2.5               |
| <b>Vertical Geometrics</b>   |  |                               |
| Maximum Grade  | 6.00%  | Table 210.10.1                |
| Minimum Grade  | 0.30%  | Section 210.10.1.1            |
| Maximum Change in Grade Without Vertical Curve   | 0.60%  | Table 210.10.2                |
| Minimum VPI Spacing  | 250 ft.  | Section 210.10.1.1            |
| Stopping Sight Distance (min)<br>(Grade ≤ 2%) (Upgrade & Downgrade)                            | 425 ft.  | Table 210.11.1                |

**Table 5: Design Criteria Continued**

| Subject  | Design Speed = 50 mph<br>High Speed Curbed Roadway | Reference                    |
|--|--|------------------------------|
|  |  | FDM <sup>1</sup>             |
| <b>Vertical Geometrics</b>   |  |                              |
| Vertical Curves  | $L = KA$   | Table 210.10.3<br>& 210.10.4 |
|  | $A =  g_1 - g_2 $                                  |                              |
|  | $L_{min} = 300 \text{ ft. Crest}$                  |                              |
|  | $K_{min} = 136 \text{ Crest}$                      |                              |
|  | $L_{min} = 200 \text{ ft. Sag}$                    |                              |
|  | $K_{min} = 96 \text{ Sag}$                         |                              |
| Vertical Clearance (Roadway<br>Bridge Over Roadway)                      | 16.5 ft.   | Table 260.6.1                |
| Vertical Clearance (Ped. Bridge<br>over Roadway)                         | 17.5 ft.   | Table 260.6.1                |
| Vertical Clearance<br>(Roadway or Ped. Bridge Over<br>Railroad)          | 23.5 ft.   | Table 260.6.1                |
| Vertical Clearance (Overhead<br>DMS)                                     | 19.5 ft.   | Section 210.10.3             |
| Vertical Clearance (Sign<br>Structure)                                   | 17.5 ft.   | Section 210.10.3             |
| <b>Shared Use Path</b>   |  |                              |
| Design Speed<br>≤4% Downgrade<br>>4% Downgrade                           | 18 mph<br>30 mph                                   | Section 224.9                |
| Maximum Cross Slope  | 2%   | Section 224.5                |
| Minimum Cross Slope Transition<br>Length                                 | 75 ft.   | Section 224.5                |
| Horizontal Clearance   | 4 ft.  | Section 224.7                |
| Vertical Clearance   | 8 ft.  | Section 224.8                |
| Minimum Radii<br>18 mph, 2%<br>18 mph, -2%<br>30 mph, -2%<br>30 mph, -2% | 74 ft.<br>86 ft.<br>261 ft.<br>316 ft.             | Table 224.10.1               |
| Minimum Stopping Sight<br>Distance                                       | Varies (See Table 224.10.2)                        | Table 224.10.2               |
| Maximum Grade  | 5%   | Section 224.6                |
| Minimum Length of Vertical<br>Curve<br>$s > L$<br>$s < L$                | $L = 2s - (900/A)$<br>$L = As^2/900$               | Section 224.11               |

1 FDOT Design Manual (2019)  
A Algebraic Grade Difference  
s Stopping Sight Distance

## 5.4 Build Alternatives

Two build alternatives were developed for this study. One represented the “ultimate vision” for the corridor and included a new four-lane curbed typical section and complete reconstruction of the roadway. The second alternative includes spot improvements to improve the corridor at key locations. Each option is described below:

1. The ultimate vision for the corridor is a four-lane, high speed urban typical section with a 50-mph design speed. The typical includes a 30-foot median, 12-foot travel lanes, 6.5-foot outside shoulders, and Type E curb and gutter. Pedestrians and cyclists are accommodated with the addition of a six-foot sidewalk on the west side of U.S. 1 and a 12-foot shared use path on the east side of U.S. 1.
2. Spot improvements include signaling the northbound U.S. 1 to westbound S.R. 404 turn lane, completing the addition of crosswalks on all legs of the signalized intersections (Suntree Boulevard, Viera Boulevard and Barnes Boulevard), adding a second northbound left and second eastbound right at Viera Boulevard (a result of the Viera Boulevard PD&E Study – FM 428238-1), and adding a dedicated left turn into Rockledge Gardens. To improve pedestrian mobility, a 6-foot sidewalk will be constructed on the east side of U.S. 1. This option could be conducted in two phases with Phase 1 starting at Viera Boulevard and terminating at Rockledge Drive. Phase 2 continues from Rockledge Drive to Barnes Boulevard. Other items such as access management and bicycle lane continuity should also be considered in future phases of project development. It should be noted these improvements meet the needs of the corridor through the year 2045.

## 5.5 Selected Alternative(s) Description

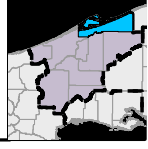
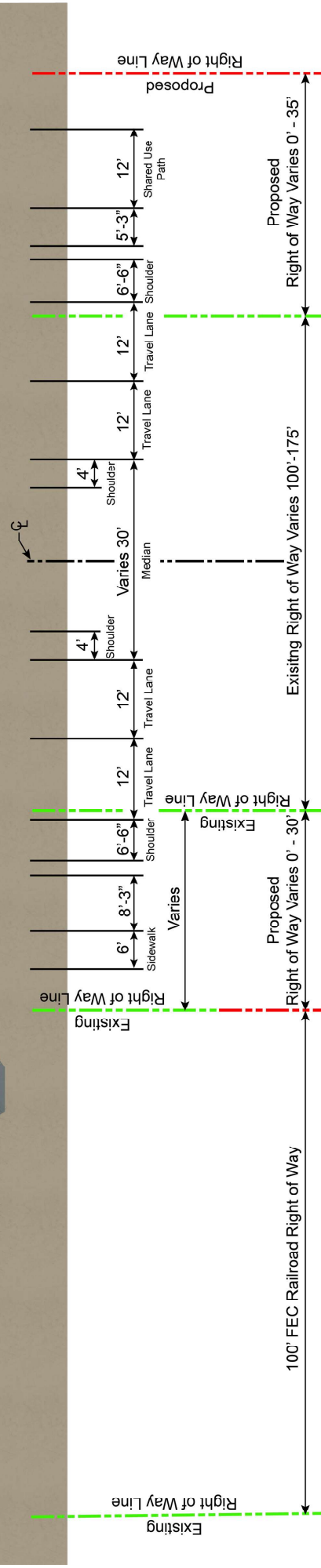
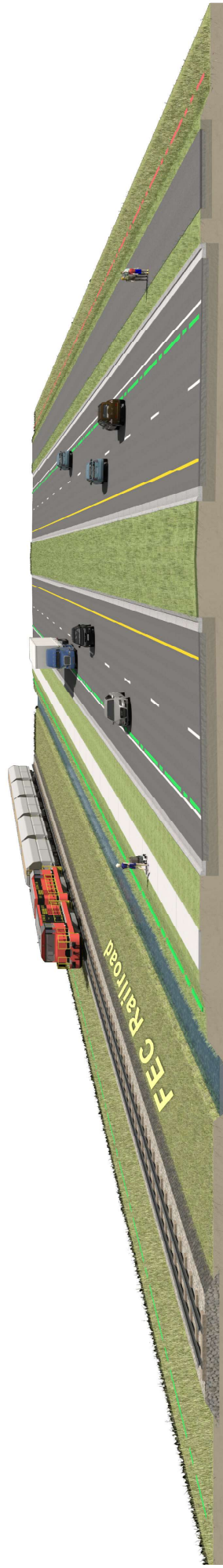
The selected alternative includes the spot improvements option, which provides for shorter-term improvements and the four-lane ultimate, which involves a total reconstruction of U.S. 1.

### 5.5.1 Design Exceptions and Variations

There are no Design Exceptions or Design Variations for the four-lane typical section.

### 5.5.2 Four-Lane Typical Section and Alignment

The proposed four-lane high speed curbed typical section, shown in **Figure 5**, represents the ultimate vision for the corridor. This typical section includes a 30-foot median, inclusive of 4-foot inside shoulders, 12-foot travel lanes, and 6.5-foot outside shoulders, which will accommodate cyclists on the roadway. Pedestrians and cyclists will also be accommodated on a new 6-foot sidewalk on the west of U.S. 1 and a 12-foot shared use path on the east. The conversion to an urban section means stormwater will be captured in a closed drainage system eliminating the existing drainage swales and reducing the over-all right of way requirements. Based on the design criteria (discussed above) and the typical section elements, a total right of way width of 139-feet is required. Based on the existing right of way, a variable width purchase of 0 to 30-feet is required on the west and 0 to 35-feet is required on the east. A best fit alignment was developed to maximize the use of the existing right of way while minimizing impacts to the surrounding developments. The improvements begin at the north end of the S.R. 404 interchange and continue on a tangential alignment until approaching American Boulevard. From there, it goes through two back to back normal crown curves before returning to a tangential alignment. The alignment then curves to the north near the Florida Memorial Gardens and begins to parallel the FECR right of way along the west side of the road.



**US 1 Corridor Planning Study**  
 from Pineda Causeway (State Road 404)  
 to Park Avenue  
 Brevard County, Florida  
 Financial Project ID: 433604-1  
 Federal Project No: n/a

**PROPOSED 4-LANE  
 TYPICAL SECTION**

**FIGURE  
 5**

Right of way impacts to both the Florida Memorial Gardens and FECR are avoided. The alignment then separates from the FECR and follows the existing curved roadway geometrics entering the City of Rockledge.

This alignment implements all approved access management changes within the corridor. All intersection improvements discussed in the “spot improvements” (below) are also implemented with this alignment concept. Please see the concepts in **Appendix A** for additional details.

### 5.5.3 Spot Improvements

The spot improvements are intended to provide shorter-term improvements throughout the corridor. The recommended operational spot improvements are discussed below. These include a description of the recommendations resulting from this study, what’s currently in construction and consideration of prior planning efforts. It should be noted that the spot improvements meet the needs of the corridor through the year 2045.

- **Currently Under Construction:** The intersection of Suntree Boulevard will be improved with the addition of a second left turn lane for the northbound U.S. 1 to westbound Suntree Boulevard movement. This will be accomplished by widening towards the median. This project will also add two receiving lanes and a dedicated eastbound to northbound left turn lane.
- **U.S. 1 Corridor Planning Study Recommendation:** Adding crosswalks at the north and east legs of Suntree Boulevard. This requires signal modification (additional heads) to complete this improvement. A structural analysis will be needed to determine if the existing diagonal span wire can support the additional loading or if full signal replacement is required.
- **U.S. 1 Corridor Planning Study Recommendation:** Signalizing the northbound left turn lane from U.S. 1 to westbound S.R. 404 Causeway. This signal will stop southbound U.S. 1 allowing the turn queue to be dissipated avoiding spill back into the thru lane and improving operations. The northbound U.S. 1 travel lanes will not be impacted.
- **Prior Programmed Improvement & U.S. 1 Corridor Planning Study Recommendation:** The Viera Boulevard intersection will be improved by adding a second northbound left turn to U.S. 1 and a second eastbound right on Viera Boulevard. This improvement was cleared and designed as part of the Viera Boulevard PD&E Study (FM 428238-1). This improvement was initially thought to be implemented by the Viera Company. This project would also add crosswalks for the north and east legs of the intersection and revise the free flow southbound U.S. 1 to westbound Viera Boulevard right turn. The left turn lane will be added to the median, while the right turn lane will be added by widening the south side of Viera Boulevard. These improvements will require additional signal heads be added to the existing mast arms. A structural analysis will be necessary to determine if the existing mast arms can support the additional load or will require replacement.

In addition to operational improvements, the spot improvements, discussed below, are also intended to improve pedestrian and bicycle mobility and safety throughout the corridor.

- **U.S. 1 Corridor Planning Study Recommendation:** Incorporation of special emphasis crosswalks and sidewalk landings at all signalized intersections within the corridor. (Suntree Boulevard, Viera Boulevard, and Barnes Boulevard.). To complete these improvements, signal upgrades including pedestrian push buttons and count down heads

will be required for each crossing. These pedestrian features can likely be retrofitted into the existing signal equipment.

- **U.S. 1 Corridor Planning Study Recommendation:** A six-foot sidewalk along the east side of U.S. 1 from Viera Boulevard to Barnes Boulevard. This sidewalk may be developed in two phases. The first from Viera Boulevard to Rockledge Drive, and then, from Rockledge Drive to Barnes Boulevard. The sidewalk will avoid the overhead transmission poles and require the existing drainage swale to be re-graded to maintain existing flow patterns. These improvements do not require any right of way based on preliminary analysis. **U.S. 1 Corridor Planning Study Recommendation:** The addition of a northbound left turn lane into Rockledge Gardens / Boater’s Exchange.
- **U.S. 1 Corridor Planning Study Recommendation:** Corridor wide bicycle lane improvements.
- **U.S. 1 Corridor Planning Study Recommendation:** Corridor wide access management improvements.

Please refer to **Appendix A** for a plot depicting the spot improvements.

## 5.6 Alternatives Comparison and Matrix

**Table 6** provides a comparative evaluation of the alternatives, including the no-build, spot improvements and four lane options.

**Table 6: Alternatives and Comparison Matrix**

|  | No Build Alternative | Spot Treatments w/Sidewalk | 4 Lane High Speed Curbed Roadway |
|--|----------------------|----------------------------|----------------------------------|
| <b>Evaluation Criteria</b>                                     |                      |                            |                                  |
| <b>Potential Right-of-Way Impacts</b>                          |                      |                            |                                  |
| Number of Parcels Impacted                                     | 0                    | 0                          | 65                               |
| Number of Residential Relocations                              | 0                    | 0                          | 1                                |
| Number of Business Relocations                                 | 0                    | 0                          | 2                                |
| <b>Potential Benefits and Estimated Impacts</b>                |                      |                            |                                  |
| Meets Future Year (2045) Level of Service (LOS) D <sup>1</sup> | No                   | Yes                        | Yes                              |
| Provides Bicycle and Pedestrian Features                       | No                   | Yes <sup>2</sup>           | Yes                              |
| Threatened and Endangered Species                              | None                 | Low                        | Moderate                         |
| Archaeological Potential                                       | None                 | Low                        | Low/Moderate                     |
| Historic Sites   | None                 | 0                          | 0                                |



**Table 6: Alternatives and Comparison Matrix Continued**

|   | No Build Alternative | Spot Treatments w/Sidewalk | 4 Lane High Speed Curbed Roadway |
|---|----------------------|----------------------------|----------------------------------|
| <b>Evaluation Criteria</b>                      |                      |                            |                                  |
| <b>Potential Benefits and Estimated Impacts</b> |                      |                            |                                  |
| Contamination Sites                             | None                 | Low                        | Low                              |
| Wetlands (Acres)                                | None                 | 0.71                       | 6.00                             |
| Floodplains (Acres)                             | None                 | 0.00                       | 0.21                             |
| Public Lands (Acres)                            | None                 | 0.00                       | 0.16                             |
| Utilities                                       | None                 | Low                        | Moderate                         |
| <b>Right of Way and Construction Cost Range</b> |                      |                            |                                  |
| Right of Way                                    | No cost              | Low                        | High                             |
| Construction                                    | No cost              | Low                        | High                             |

- 1 The Level of Service (LOS) of a roadway is ranked from A-F. The LOS of service threshold is LOS D for U.S. 1.
- 2 Provides a sidewalk from Viera Blvd to Barnes Blvd, crosswalks at signalized intersections and provides bicycle improvements throughout the corridor.

### 5.6.1 Right of Way Impacts and Costs

As shown in the matrix above, the right of way (ROW) impacts vary between the spot improvement and four-lane alternatives. The right of way impacts and resultant costs were developed by calculating the areas of impact needed to accommodate the improvements; the FDOT then assigned planning level cost estimates based on areas of impact by land use type. The four-lane alternative would impact approximately 65 parcels and result in one potential residential relocation and two potential business relocations. The ROW estimate for the four-lane option is approximately \$7,800,000; however, it should be noted that this is a planning-level estimate that does not include pond sites or detailed drainage analyses. This estimate will require refinement in future phases of project development.

### 5.6.2 Construction Cost Estimates

Construction cost estimates were completed by using the FDOT’s Long Range Estimate (LRE) database. Initial estimates were developed and then reviewed and refined by the FDOT. The four-lane alternative would cost approximately \$68,000,000 to construct. This includes converting the high speed rural facility to a high speed urban facility with a closed drainage system, the addition of sidewalk and shared use path, intersection improvements and turn lane improvements. This estimate does not account for stormwater ponds, mitigation and related items and should be further evaluated in future phases of concept development.

The cost estimates for the spot improvements are as follows:

- A traffic signal for the northbound U.S. 1 to westbound S.R. 404 turn lane – \$210,342
- The addition of crosswalks at Suntree Boulevard – \$49,012



- The addition of crosswalks at Barnes Boulevard – \$91,903
- The addition of a 6-foot-wide sidewalk on the east side of U.S. 1 from Viera Boulevard to Barnes Boulevard – \$1,127,958
- Turn lane improvements at Viera Boulevard – \$431,143
- Turn lane improvements at Rockledge Gardens – To be determined
- Corridor wide bicycle lane improvements – To be determined
- Corridor wide access management improvements – To be determined

### 5.6.3 Access Management (Four Lane Improvements)

According to the Straight-Line Diagrams, provided in Appendix E, this segment of U.S. 1 is an access classification 3. This classification requires 1,320 feet spacing for directional median openings and ½ mile or 2,640 feet spacing for signals and full median openings. Based on the existing access management classification there is only one area that meets the minimum median opening spacing criteria. This is between the two directional medians associated with the U.S. 1 and Pineda interchange.

To improve the access management of the study corridor, several changes are recommended. First, the existing Access Class 3 designation is highly restrictive and typically only applied to rural highways with few access points. As this corridor is urban with residential, industrial, and commercial land uses surrounding it – each of which require significantly more access points than Access Class 3 allows for – it is not expected to ever be able to meet Access Class 3 standards. Therefore, it is recommended that the corridor be re-designated to Access Class 5. At the corridor's existing posted speed limits of 50 mph and 55 mph, Access Class 5 requires the same signal and full median opening spacings as Access Class 3 (2,640 ft for both) but allows shorter spacing between directional openings (660 ft). Due to the overwhelming majority of median openings being full openings, simply changing the access class will not solve the access management issue. Therefore, it is recommended that changes be made to the median openings; of the existing 52 openings, it is recommended that 13 be closed and a further 19 be modified to directional rather than full openings.

**Table 7** shows the recommended changes to the median openings and **Table 8** shows the resulting opening spacing along the corridor and the spacing requirements for Access Class 5. As can be seen in **Table 8**, the number of links that do not meet spacing requirements is reduced from 50 to 11 and the extent to which the failing spacings deviate from the standard spacing is significantly reduced from existing conditions. The existing and proposed access management are shown in **Figures 6** and **7** respectively.

Table 7: Proposed Access Management Changes

| Proposed Access Management Changes |                 |                                |                              |                              |        |                                       |                             |                             |  |
|------------------------------------|-----------------|--------------------------------|------------------------------|------------------------------|--------|---------------------------------------|-----------------------------|-----------------------------|--|
| Median Opening #                   | Approx. Station | Distance From Previous Opening | Existing Median Opening Type | Proposed Median Opening Type | Signal | East Side Road/Connection             | West Side Road/Connection   | Intersecting Access Type    |  |
| 1                                  | 76+24           | -                              | NB Directional               | NB Directional               |        | Roberts Rd                            | n/a                         | Public Side Street          |  |
| 2                                  | 80+47           | 423                            | NB Directional               | NB Directional               |        | EB SR 404 off ramp                    | n/a                         | SR ramp                     |  |
| 3                                  | 93+94           | 1347                           | NB Directional               | NB Directional               |        | WB SR 404 on ramp                     | n/a                         | SR ramp                     |  |
| 4                                  | 100+32          | 638                            | Full                         | Dual Directional             |        | Otter Creek Ln                        | Freedom Boat Club driveway  | Public Side Street/Business |  |
| 5                                  | 114+42          | 1410                           | Full                         | Full                         |        | Shoff Ln and Unsigned road            | Waterway motel driveway     | Public Side Street/Business |  |
| 6                                  | 122+40          | 798                            | Full                         | Dual Directional             |        | Allen Hill Ave                        | Portofino Lane              | Public Side Street          |  |
| 7                                  | 135+07          | 1267                           | Full                         | NB Directional               |        | Anderson Way                          | Private Driveway            | Public Side Street/Driveway |  |
| 8                                  | 141+46          | 639                            | Full                         | Dual Directional             |        | Pineda Country Store                  | Private Driveway            | Business/Driveway           |  |
| 9                                  | 152+33          | 1087                           | Full                         | Full                         |        | Americana Blvd                        | Still Point Dr              | Public Side Street          |  |
| 10                                 | 159+77          | 744                            | Full                         | Dual Directional             |        | Americana Cir                         | Still Point Dr              | Public Side Street          |  |
| 11                                 | 168+88          | 911                            | Full                         | Closed                       |        | n/a                                   | n/a                         | n/a                         |  |
| 12                                 | 174+32          | 544                            | Full                         | NB Directional               |        | Gannett Plaza Ave                     | Private Driveway            | Public Side Street/Driveway |  |
| 13                                 | 178+57          | 425                            | NB Directional               | NB Directional               |        | Aspinwall Ave                         | Pineda Inn Parking Lot      | Public Side Street/Business |  |
| 14                                 | 183+64          | 507                            | Full-Signal                  | Full-Signal                  | yes    | Suntree Blvd                          | Suntree Blvd                | Public Side Street          |  |
| 15                                 | 188+21          | 457                            | Full                         | Closed                       |        | n/a                                   | n/a                         | n/a                         |  |
| 16                                 | 198+38          | 1017                           | Full                         | NB Directional               |        | Health First Health Plans Parking Lot | n/a                         | Business                    |  |
| 17                                 | 206+22          | 784                            | Full                         | Full                         |        | Friendship Pl                         | n/a                         | Public Side Street          |  |
| 18                                 | 218+36          | 1214                           | Full                         | SB Directional               |        | n/a                                   | Bosun Ct                    | Public Side Street          |  |
| 19                                 | 234+68          | 1632                           | Full                         | Full                         |        | n/a                                   | Helmsman Pl                 | Public Side Street          |  |
| 20                                 | 252+42          | 1774                           | Full                         | Full                         |        | n/a                                   | Compass Dr                  | Public Side Street          |  |
| 21                                 | 270+84          | 1842                           | Full                         | Full                         |        | Florida Memorial Gardens Entrance     | n/a                         | Business                    |  |
| 22                                 | 280+38          | 954                            | Full                         | SB Directional               |        | n/a                                   | Alamo Mexican Kitchen       | Business                    |  |
| 23                                 | 290+63          | 1025                           | Full                         | Dual Directional             |        | n/a                                   | Morgan Financial            | Business                    |  |
| 24                                 | 300+44          | 981                            | Full                         | Closed                       |        | n/a                                   | Unsigned road               | n/a                         |  |
| 25                                 | 310+39          | 995                            | Full-Signal                  | Full-Signal                  | yes    | Viera Blvd                            | River Way                   | Public Side Street          |  |
| 26                                 | 319+89          | 950                            | Full                         | SB Directional               |        | n/a                                   | Barnacle Pl                 | Public Side Street          |  |
| 27                                 | 341+04          | 2115                           | Full                         | Full                         |        | n/a                                   | Rockledge Dr                | Public Side Street          |  |
| 28                                 | 348+65          | 761                            | Full                         | Closed                       |        | n/a                                   | n/a                         | n/a                         |  |
| 29                                 | 356+92          | 827                            | Full                         | Full                         |        | Ansin Rd                              | Goodwill                    | Public Side Street/Business |  |
| 30                                 | 363+22          | 630                            | Full                         | Closed                       |        | n/a                                   | US 1 Golf Center            | Business                    |  |
| 31                                 | 370+47          | 725                            | Full                         | Full                         |        | Carver Rd                             | American Top Team Rockledge | Public Side Street/Business |  |
| 32                                 | 391+54          | 2107                           | Full                         | Dual Directional             |        | n/a                                   | n/a                         | n/a                         |  |
| 33                                 | 411+39          | 1985                           | Full                         | Full                         |        | Barkingham Palace                     | McIver Ln                   | Public Side Street/Business |  |
| 34                                 | 422+05          | 1066                           | Full                         | SB Directional               |        | n/a                                   | n/a                         | n/a                         |  |
| 35                                 | 434+44          | 1239                           | Full-Signal                  | Full-Signal                  | yes    | Barnes Blvd                           | Coquina Rd                  | Public Side Streets         |  |
| 36                                 | 445+49          | 1105                           | Full                         | SB Directional               |        | Abandoned Lot                         | Harvey's                    | Business                    |  |

Table 7: Proposed Access Management Changes Continued

| Median Opening # | Approx. Station | Distance From Previous Opening | Existing Median Opening Type | Proposed Median Opening Type | Signal | East Side Road/Connection           | West Side Road/Connection | Intersecting Access Type    |
|------------------|-----------------|--------------------------------|------------------------------|------------------------------|--------|-------------------------------------|---------------------------|-----------------------------|
| 37               | 454+59          | 910                            | Full                         | Closed                       |        | n/a                                 | n/a                       | n/a                         |
| 38               | 462+84          | 825                            | Full                         | Dual Directional             |        | n/a                                 | Blinds of All Kinds       | Business                    |
| 39               | 471+92          | 908                            | Full                         | Closed                       |        | n/a                                 | Unmarked Driveway         | Private Driveway            |
| 40               | 477+16          | 524                            | Full                         | Full                         |        | Gus Hipp Blvd                       | Indian River Furniture    | Public Side Street/Business |
| 41               | 483+85          | 669                            | Full                         | Closed                       |        | n/a                                 | n/a                       | n/a                         |
| 42               | 490+01          | 616                            | Full                         | Closed                       |        | n/a                                 | n/a                       | n/a                         |
| 43               | 495+90          | 589                            | Full                         | Closed                       |        | n/a                                 | n/a                       | n/a                         |
| 44               | 501+88          | 598                            | Full                         | Dual Directional             |        | n/a                                 | Grimaldi Candies          | Business                    |
| 45               | 507+74          | 586                            | Full                         | Closed                       |        | Abandoned Lot                       | Floridelpia Ave           | Public Side Street          |
| 46               | 512+14          | 440                            | Full                         | Full                         |        | Closed Packing Plant                | Magruder Ave              | Public Side Street          |
| 47               | 518+25          | 611                            | Full                         | Closed                       |        | Rockledge Gardens                   | n/a                       | Business                    |
| 48               | 523+39          | 514                            | Full                         | NB Directional               |        | Boaters Exchange                    | n/a                       | Business                    |
| 49               | 527+47          | 408                            | Full                         | Dual Directional             |        | Harbor Auto Restoration             | Focus Salon Suites        | Business                    |
| 50               | 534+62          | 715                            | Full                         | Closed                       |        | Curb Pro                            | n/a                       | Business                    |
| 51               | 540+22          | 560                            | Full                         | Dual Directional             |        | AA Snowbird Auto Sales and Services | Dr. Vinay K Kumar         | Business                    |
| 52               | 546+40          | 618                            | Full                         | Full                         |        | n/a                                 | Park Ave                  | Public Side Street          |

xxx Unchanged Openings  
 xxx Modified Openings  
 xxx Openings to be Closed

Table 8: Proposed Access Management

| Median Opening # | Approx. Station | Distance From Previous Opening | Median Opening Type | Signal                                | East Side Road/Connection   | West Side Road/Connection   | Intersecting Access Type    | Directional Openings           |                          | Full Openings                  |                          | Traffic Signal | Proposed Access Class | Posted Speed |
|------------------|-----------------|--------------------------------|---------------------|---------------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|----------------|-----------------------|--------------|
|                  |                 |                                |                     |                                       |                             |                             |                             | Distance from Previous Opening | Meets Std or % Deviation | Distance from Previous Opening | Meets Std or % Deviation |                |                       |              |
| 1                | 76+24           | -                              | NB Directional      |                                       | Roberts Rd                  | n/a                         | Public Side Street          |                                |                          |                                |                          |                |                       |              |
| 2                | 80+47           | 423                            | NB Directional      | EB SR 404 off ramp                    | n/a                         | SR ramp                     | SR ramp                     | 423                            | 35.91%                   |                                |                          |                |                       |              |
| 3                | 93+94           | 1347                           | NB Directional      | WB SR 404 on ramp                     | n/a                         | SR ramp                     | SR ramp                     | 1,347                          | Meets                    |                                |                          |                |                       |              |
| 4                | 100+07          | 613                            | Dual Directional    | Other Creek Ln                        | Freedom Boat Club driveway  | Public Side Street/Business | Public Side Street/Business | 613                            | 7.12%                    |                                |                          |                |                       | 50           |
| 5                | 114+42          | 1435                           | Full                | Preferred Materials Asphalt Plant     | Waterway motel driveway     | Public Side Street/Business | Public Side Street/Business | 1,435                          | Meets                    | 2048                           | 22.42%                   |                |                       |              |
| 6                | 122+60          | 818                            | Dual Directional    | Allen Hill Ave                        | Portofino Lane              | Public Side Street          | Public Side Street          | 818                            | Meets                    |                                |                          |                |                       |              |
| 7                | 134+30          | 1170                           | NB Directional      | Anderson Way                          | Private Driveway            | Public Side Street/Driveway | Public Side Street/Driveway | 1,170                          | Meets                    |                                |                          |                |                       |              |
| 8                | 142+22          | 792                            | Dual Directional    | Pineda Country Store                  | Suzie Lane                  | Business/Driveway           | Business/Driveway           | 792                            | Meets                    |                                |                          |                |                       |              |
| 9                | 152+33          | 1011                           | Full                | Americana Blvd                        | Still Point Dr              | Public Side Street          | Public Side Street          | 1,011                          | Meets                    | 3791                           | Meets                    |                |                       |              |
| 10               | 159+77          | 744                            | Dual Directional    | Americana Cir                         | Still Point Dr              | Public Side Street          | Public Side Street          | 744                            | Meets                    |                                |                          |                |                       |              |
| 12               | 174+32          | 1455                           | NB Directional      | Garnett Plaza Ave                     | Private Driveway            | Public Side Street/Driveway | Public Side Street/Driveway | 1,455                          | Meets                    |                                |                          |                |                       |              |
| 13               | 178+57          | 425                            | NB Directional      | Aspinwall Ave                         | Pineda Inn Parking Lot      | Public Side Street/Business | Public Side Street/Business | 425                            | 35.61%                   |                                |                          |                |                       |              |
| 14               | 183+64          | 507                            | Full-Signal         | Suntree Blvd                          | Suntree Blvd                | Public Side Street          | Public Side Street          |                                |                          | 3131                           | Meets                    |                |                       |              |
| 16               | 197+85          | 1421                           | NB Directional      | Health First Health Plans Parking Lot | n/a                         | Business                    | Business                    | 1,421                          | Meets                    |                                |                          |                |                       |              |
| 17               | 206+22          | 837                            | Full                | Friendship Pl                         | n/a                         | Public Side Street          | Public Side Street          | 837                            | Meets                    | 2258                           | 14.47%                   |                |                       | 5            |
| 18               | 218+82          | 1260                           | SB Directional      | n/a                                   | Bosun Ct                    | Public Side Street          | Public Side Street          | 1,260                          | Meets                    |                                |                          |                |                       |              |
| 19               | 234+68          | 1586                           | Full                | n/a                                   | Helmman Pl                  | Public Side Street          | Public Side Street          | 1,586                          | Meets                    | 2846                           | Meets                    |                |                       |              |
| 20               | 252+42          | 1774                           | Full                | n/a                                   | Compass Dr                  | Public Side Street          | Public Side Street          |                                |                          | 1774                           | 32.80%                   |                |                       |              |
| 21               | 270+84          | 1842                           | Full                | Florida Memorial Gardens Entrance     | n/a                         | Business                    | Business                    |                                |                          | 1842                           | 30.23%                   |                |                       |              |
| 22               | 279+15          | 831                            | SB Directional      | n/a                                   | Alamo Mexican Kitchen       | Business                    | Business                    | 831                            | Meets                    |                                |                          |                |                       |              |
| 23               | 290+63          | 1148                           | Dual Directional    | n/a                                   | Morgan Financial            | Business                    | Business                    | 1,148                          | Meets                    |                                |                          |                |                       |              |
| 25               | 310+39          | 1976                           | Full-Signal         | Viera Blvd                            | River Way                   | Public Side Street          | Public Side Street          | 1,976                          | Meets                    | 3955                           | Meets                    | 12675          | Meets                 |              |
| 26               | 320+25          | 986                            | SB Directional      | n/a                                   | Barnacle Pl                 | Public Side Street          | Public Side Street          | 986                            | Meets                    |                                |                          |                |                       |              |
| 27               | 341+04          | 2079                           | Full                | n/a                                   | Rockledge Dr                | Public Side Street          | Public Side Street          | 2,079                          | Meets                    | 3065                           | Meets                    |                |                       |              |
| 29               | 356+92          | 1588                           | Full                | Ansin Rd                              | Goodwill                    | Public Side Street/Business | Public Side Street/Business |                                |                          | 1588                           | 39.85%                   |                |                       |              |
| 31               | 370+47          | 1355                           | Full                | Carver Rd                             | American Top Team Rockledge | Public Side Street/Business | Public Side Street/Business |                                |                          | 1355                           | 48.67%                   |                |                       |              |
| 32               | 394+92          | 2445                           | Dual Directional    | n/a                                   | n/a                         | n/a                         | n/a                         | 2,445                          | Meets                    |                                |                          |                |                       |              |
| 33               | 411+39          | 1647                           | Full                | Barkingham Palace                     | Mclver Ln                   | Public Side Street/Business | Public Side Street/Business |                                |                          | 4092                           | Meets                    |                |                       |              |
| 34               | 422+05          | 1066                           | SB Directional      | n/a                                   | Private Driveway            | Driveway                    | Driveway                    | 1,066                          | Meets                    |                                |                          |                |                       |              |
| 35               | 434+44          | 1239                           | Full-Signal         | Barnes Blvd                           | Coquina Rd                  | Public Side Streets         | Public Side Streets         | 1,239                          | Meets                    | 2305                           | 12.69%                   | 12405          | Meets                 |              |

Table 8: Proposed Access Management Continued

| Median Opening # | Approx. Station | Distance From Previous Opening | Median Opening Type | Signal | East Side Road/Connection           | West Side Road/Connection | Intersecting Access Type    | Directional Openings           |                          | Full Openings                  |                          | Traffic Signal                 |                          | Proposed Access Class | Posted Speed |
|------------------|-----------------|--------------------------------|---------------------|--------|-------------------------------------|---------------------------|-----------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|--------------------------------|--------------------------|-----------------------|--------------|
|                  |                 |                                |                     |        |                                     |                           |                             | Distance from Previous Opening | Meets Std or % Deviation | Distance from Previous Opening | Meets Std or % Deviation | Distance from Previous Opening | Meets Std or % Deviation |                       |              |
| 36               | 445+49          | 1105                           | SB Directional      |        | Abandoned Lot                       | Harvey's                  | Business                    | 1,105                          | Meets                    |                                |                          |                                |                          |                       |              |
| 38               | 462+04          | 1655                           | Dual Directional    |        | n/a                                 | Blinds of All Kinds       | Business                    | 1,655                          | Meets                    |                                |                          |                                |                          |                       |              |
| 40               | 477+16          | 1512                           | Full                |        | Gus Hipp Blvd                       | Indian River Furniture    | Public Side Street/Business | 1,512                          | Meets                    | 4272                           | Meets                    |                                |                          |                       |              |
| 44               | 501+88          | 2472                           | Dual Directional    |        | n/a                                 | Grimaldi Candies          | Business                    | 2,472                          | Meets                    |                                |                          |                                |                          |                       |              |
| 46               | 512+14          | 1026                           | Full                |        | Closed Packing Plant                | Magruder Ave              | Public Side Street          |                                |                          | 3498                           | Meets                    |                                |                          |                       |              |
| 48               | 523+69          | 1155                           | NB Directional      |        | Boaters Exchange                    | n/a                       | Business                    | 1,155                          | Meets                    |                                |                          |                                |                          |                       |              |
| 49               | 529+08          | 539                            | Dual Directional    |        | Harbor Auto Restoration             | Focus Salon Suites        | Business                    | 539                            | 18.33%                   |                                |                          |                                |                          |                       |              |
| 51               | 539+32          | 1024                           | Dual Directional    |        | AA Snowbird Auto Sales and Services | Dr. Vinay K Kumar         | Business                    | 1,024                          | Meets                    |                                |                          |                                |                          | 5                     | 55           |
| 52               | 546+40          | 708                            | Full                |        | n/a                                 | Park Ave                  | Public Side Street          | 708                            | Meets                    | 3426                           | Meets                    |                                |                          |                       |              |

Xxx Percent Deviation

| Rule 14-97   |             |        |       |             |            |
|--------------|-------------|--------|-------|-------------|------------|
| Access Class | Speed Limit | Signal | Full  | Directional | Connection |
| 5            | ≤45mph      | 1,320  | 1,320 | 660         | 245        |
|              | >45mph      | 2,640  | 2,640 | 660         | 440        |





## 5.6.4 Drainage Considerations

### 5.6.4.1 Introduction

As part of the study, a desktop analysis and field review were performed to identify any potential stormwater management issues which may arise from the four-lane and spot improvements alternatives. This effort centered on gathering data regarding the existing hydrologic and hydraulic features, documenting the occurrence and extent of Federal Emergency Management Agency (FEMA) floodplains, a review of all permits within the study corridor, as well as identifying permitting requirements in regards to treatment, attenuation, special basin criteria, Outstanding Florida Waters (OFW) and nutrient impairments.

### 5.6.4.2 Existing Drainage Conditions

This segment of U.S. 1 is located within the Indian River Lagoon Watershed of the Saint Johns River Water Management District (SJRWMD). It traverses Water Body Identification Number (WBID) 2963C1 – Indian River Below 520 Causeway, for which there is a Nutrient Total Maximum Daily Load (TMDL) dated March 2009. Additionally, the corridor lies within the North Indian River Lagoon Best Management Practices (BMAP) area, which was established in January 2013. Please refer to **Figure 8** for more information.

The terrain is relatively flat, with roadway elevations ranging from 10-feet to 30-feet along the corridor. Within the area, elevations range from 0-feet along the Indian River (east of the project) to 65-feet to the west of the project. In the current condition, stormwater runoff is collected in roadside and median swales. The median swales flow to ditch bottom inlets (DBIs) that discharge to the roadside swales. In general, stormwater collected in the ditches is eventually discharged to the Indian River via wetlands, lateral ditches, or direct outfall from several cross drains. Currently, runoff from U.S. 1 is not treated with the exception of the intersection at Barnes Blvd. This intersection is permitted under ERP 102771-3 which included the construction of “Pond 1,” a 2-acre wet pond that discharges to adjacent wetlands. There are several other existing permits within the study limits that may be impacted by U.S. 1 improvements. A comprehensive review of these permits is recommended in the next phase of project development to determine the extent to which these permits will affect the recommended roadway improvements.

The soils within the study limits are mostly classified as hydrologic soil group (HSG) A, with a few areas of HSG C and D. Group A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. Group C and D soils have a slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. Field observation indicated that soils in the area are erosive and in several locations along the corridor there are exposed utility lines and broken storm sewer structures. Please refer to **Figure 9** for soil information.







## Brevard County Soil Descriptions

- |   |   |
|---|---|
| 2: Anclote sand, frequently ponded, 0 to 1 percent slopes     | 52: Quartzsammits, smoothes                               |
| 3: Anclote sand, frequently flooded                           | 53: Satellite sand, 0 to 2 percent slopes                 |
| 4: Candler fine sand  | 54: St. Johns sand, 0 to 2 percent slopes                 |
| 5: Candler-Urban land complex                                 | 55: St. Johns sand, 0 to 2 percent slopes                 |
| 6: Basinger sand, depressional                                | 56: St. Lucie fine sand, 0 to 5 percent slopes            |
| 7: Basinger sand  | 59: Udorhents, steep                                      |
| 8: Bradenton fine sand, limestone substratum                  | 63: Tavares fine sand, 0 to 5 percent slopes              |
| 9: Canaveral-Anclote complex, gently undulating               | 64: Terra Ceia much, frequently flooded                   |
| 10: Canaveral-Urban land complex                              | 67: Tomoka much, frequently ponded, 0 to 1 percent slopes |
| 15: Cocoa sand  | 69: Urban land, 0 to 2 percent slopes                     |
| 16: Copeland-Bradenton-Wabasso complex, limestone substratum  | 99: Water   |
| 19: Riviera sand, 0 to 2 percent slopes                       |   |
| 23: Floridana sand, 0 to 2 percent slopes, frequently flooded |   |
| 28: Immokalee sand, 0 to 2 percent slopes                     |   |
| 36: Myakka sand, 0 to 2 percent slopes                        |   |
| 38: Myakka sand, depressional                                 |   |
| 41: Orsino fine sand, 0 to 5 percent slopes                   |   |
| 43: Paola fine sand, 0 to 8 percent slopes                    |   |
| 44: Paola fine sand, 5 to 12 percent slopes                   |   |
| 45: Paola-Urban land complex, 0 to 8 percent slopes           |   |
| 49: Pomello sand, 0 to 5 percent slopes                       |   |
| 51: Pompano sand, 0 to 2 percent slopes                       |   |

**Legend**

Project Limits

**SOIL RATING**

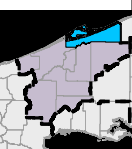
- A
- B/D
- C
- C/D
- D
- Urban
- Water

**END PROJECT**

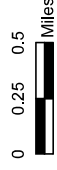
**BEGIN PROJECT**



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN,



**US 1 Corridor Planning Study**  
 from Pineeda Causeway (SR 404)  
 to Park Avenue  
 Brevard County, Florida  
 Financial Project ID: 433604-1-12-01  
 Federal Project No: n/a



## NRCS SOILS MAP

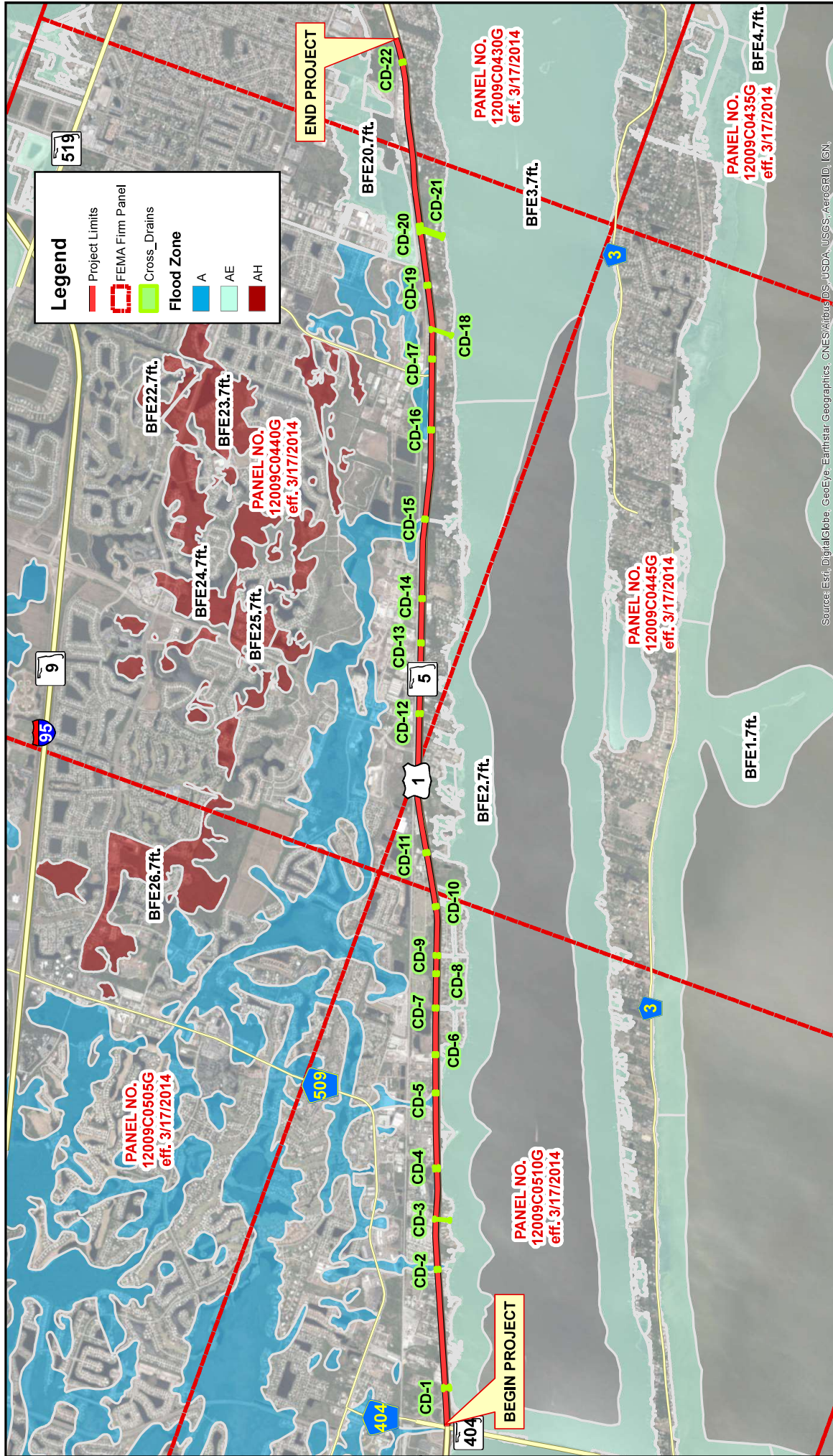
Figure 9

Cross drain information was obtained through the FDOT straight line diagram, permitted plans, and field observation and is summarized in **Table 9**. There are 22 cross drains beneath U.S. 1. CD-1, CD-18, and CD-20 discharge directly to the Indian River Lagoon. CD-20 is also the outfall for a large unnamed ditch that runs parallel to U.S. 1, along the west side near Gus Hipp Blvd. Correspondence (which can be found in **Appendix B**) with the City of Rockledge and field observation indicated that this ditch serves as the stormwater outfall for two-thirds of the City of Rockledge and the pipes are currently undergoing reconstruction.

There are FEMA Zone A and Zone AE floodplains present along the corridor with floodplain elevations ranging from 3-feet on the east side of U.S. 1 to 21-feet on the west side. Future phases of project development should evaluate whether these floodplains are tidally influenced and determine the need for floodplain compensation.

Please refer to **Figure 10** for floodplain and cross drain information.





**Legend**

- Project Limits
- FEMA Firm Panel
- Cross\_Drains
- Flood Zone**
- A
- AE
- AH

**US 1 Corridor Planning Study**  
 from Pineeda Causeway (SR 404)  
 to Park Avenue  
 Brevard County, Florida  
 Financial Project ID: 433604-1-12-01  
 Federal Project No: n/a

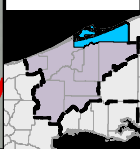
**FEMA MAP**

Figure  
**10**

NORTH

0 0.25 0.5 Miles

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN.



**Table 9: Summary of Cross Drains**

| <b>Cross Drain</b> | <b>Description</b>                                |
|--------------------|---|
| CD-1               | 2 – 6' x 5' CBC                                   |
| CD-2               | 1 – 5' x 3' CBC                                   |
| CD-3               | 1 – 24" RCP                                       |
| CD-4               | 1 – 42" RCP and 1 – 4' x 3' CBC (shared headwall) |
| CD-5               | 1 – 8' x 5' CBC                                   |
| CD-6               | 1 – 4' x 2' CBC                                   |
| CD-7               | 1 – 8' x 3' CBC                                   |
| CD-8               | 1 – 30" RCP                                       |
| CD-9               | 1 – 24" RCP                                       |
| CD-10              | 1 – 30" RCP                                       |
| CD-11              | 1 – 30" RCP                                       |
| CD-12              | 1 – 42" RCP                                       |
| CD-13              | 1 – 36" RCP                                       |
| CD-14              | 1 – 42" RCP                                       |
| CD-15              | 1 – 6' x 4' CBC                                   |
| CD-16              | 1 – 24" RCP                                       |
| CD-17              | 1 – 30" RCP                                       |
| CD-18              | 1 – 5' x 5' CBC                                   |
| CD-19              | 1 – 30" RCP                                       |
| CD-20              | 3 – 60" RCP                                       |
| CD-21              | 1 – 2' x 2' CBC                                   |
| CD-22              | 1 – 30" RCP                                       |

### **5.6.4.3 Methodology and Results**

Data gathered during the desktop analysis was used to determine potential impacts to surrounding hydrologic and hydraulic features, floodplains, and existing permits.

#### **5.6.4.3.1 Floodplains and Cross Drains**

Floodplain impacts were calculated based on total area of impact rather than volumetric impacts. It is estimated that there will be minimal impacts to Zone AE and Zone A Floodplains for the four-lanes improvements and for the spot improvements. Floodplain impact compensation sites should be sized based on volumetric impacts (cup-for-cup) and be adjacent to and hydraulically connected to the impact area. A modeling approach to determining the effects of floodplain impacts on flood elevations is another alternative that can be further explored.

Cross drain extensions or replacements will need to be investigated to ensure clear zone requirements and the Design Service Life (DSL) of the culverts are met and are anticipated for both alternatives. Additionally, it is anticipated that approximately 1520-feet of the City of Rockledge outfall ditch may be impacted by U.S. 1 reconstruction, and stakeholder coordination need to take place during the next phase of project development.

#### 5.6.4.3.2 Stormwater Management Facilities

Existing soil information was used to estimate seasonal high-water table levels to determine the need for wet or dry stormwater management facilities. It is anticipated that any stormwater management facilities located within HSG D soils will be wet ponds, while the stormwater management facilities located within HSG A soils will be dry ponds. It is expected that the majority of stormwater management facilities along this corridor will be dry ponds due to high occurrence of HSG A soils.

Stormwater management facilities may be required in areas where full reconstruction is proposed. For spot improvements including intersection alternatives and the addition of a sidewalk, we anticipate a permit exemption. Treatment and attenuation requirements are based on the rules and regulations set forth by SJRWMD and FDOT.

#### 5.6.4.3.3 SJRWMD Criteria

Water Quality:

- **Wet Detention Ponds:** Treatment will be provided for the greater of one inch (1") of runoff over the drainage area or two and a half inches of runoff from the impervious area (excluding water bodies).
  - An orifice should be set at the Average Wet Seasonal Water Elevation (AWSWE) and sized to drawdown one-half of the required treatment volume within 24 to 30 hours, but no more than one-half of this volume will be discharged within the first 24 hours.
- **Retention Ponds:**
  - Off-line Systems: retention will be provided for the greater of one-half inch (0.5") of runoff over the drainage area or one and a quarter inches (1.25") of runoff from the impervious area (excluding waterbodies).
  - On-line Systems: retention of an additional one-half inch (0.5") of runoff from the drainage area over the volume specified for off-line systems.
  - On-line Systems which serve an area less than 40% impervious surfaces and that contain only Hydrologic Group "A" soils: retention of the greater of one inch (1") of rainfall or one and a quarter inches (1.25") of runoff from the impervious areas.
  - The entire treatment volume is to be infiltrated within 72 hours after a storm event.

Water Quantity: Critical Duration as defined by Chapter 14-86 F.A.C.

- **Open Basins:** Ponds shall be sized such that the post-development peak discharges shall be at or below pre-development peak discharges for the 25-year/24-hour and mean annual storms. Offsite discharges and peak stages for the existing and proposed conditions shall be computed using the SJRWMD 25-year/24-hour rainfall depth and the Natural Resources Conservation Service (NRCS) Type II Florida Modified 24-hour rainfall distribution with an AMC II.



#### 5.6.4.3.4 FDOT Criteria

Water Quality: That which is specified by SJRWMD.

Water Quantity: Critical Duration as defined by Chapter 14-86 F.A.C.

- **Open Basins:** Ponds shall be sized such that the post development discharge rate (or volume) does not exceed the pre-development discharge rate (or volume) for the critical duration (one-hour through three-day) storm and up to the 100-year storm. This applies only to basins subject to historical flooding.

It is anticipated that there will be 13 drainage basins within the study limits. Drainage basin limits were determined based on available elevation data and existing drainage patterns, with additional consideration given to a number of large cross drains that would be difficult to cross with a storm sewer system. These large cross drains created the need for several small drainage basins; therefore, it is recommended that a compensating treatment approach is evaluated in the next phase of project development in order to reduce the number of drainage basins and stormwater ponds needed. Additionally, Environmental Look Arouns (ELAs) will provide the opportunity to team up with regional stakeholders to explore watershed wide stormwater needs and alternative permitting approaches for roadway improvement projects. Areas of potential cooperation should be explored and documented during the PD&E study phase for future follow up as a design moves forward.

Nutrient loading analysis will be required for any roadway improvements within WBID 2963C1 – Indian River Below 520 Causeway to ensure that the post development nutrient loadings do not exceed that of the existing condition and that all requirements of the Nutrient TMDL and the North Indian River Lagoon BMAP are met.

### 5.6.5 Environmental Impacts

#### 5.6.5.1 Data Collection

The study corridor was evaluated to identify potential impacts to wetlands and protected species and their habitat for both the spot improvements and the four lane improvements. The most currently available data was reviewed to determine the location and extent of habitats and land uses within the project vicinity and whether protected species occur or have the potential to occur in these habitats and land uses. This information included land use maps provided by the SJRWMD. Other information reviewed included:

- Brevard County Scrub-jay Occurrence and Habitat Maps
- Florida Fish and Wildlife Conservation Commission (FWC)
  - Bald Eagle Nesting Territory Maps
  - Florida Black Bear Range and Telemetry Data
  - Scrub-jay and Red-Cockaded Woodpecker Observation Maps
  - Species Action Plans
- National Marine Fisheries Service (NMFS) Essential Fish Habitat (EFH) Maps
- U.S. Fish and Wildlife Service (USFWS)
  - Consultation Area and Critical Habitat Maps
  - Wood Stork Nesting Colonies and Core Foraging Areas (CFA) Maps
  - National Wetlands Inventory (NWI) Maps

### 5.6.5.2 Protected Species and Designated Critical Habitat

The study corridor is within the USFWS Consultation Area for the Audubon's crested caracara (*Polyborus plancus audubonii*), Florida scrub-jay (*Aphelocoma coerulescens*), red-cockaded woodpecker (*Leuconotopicus borealis*), piping plover (*Charadrius melodus*), and West Indian manatee (*Trichechus manatus*). The NMFS has designated the Indian River as EFH for shrimp, snapper/grouper complex, and spiny lobster. In addition, the Indian River is designated as critical habitat for the West Indian manatee and Habitat Areas of Particular Concern (HAPC) for shrimp and snapper/grouper. The study corridor is within the CFA for five wood stork (*Mycteria americana*) colonies. This project is also within the Central Bear Management Unit range of the Florida black bear (*Ursus americanus floridanus*). Additional protected species considerations include the eastern indigo snake (*Drymarchon couperi*), bald eagle (*Haliaeetus leucocephalus*), burrowing owl (*Athene cunicularia*), gopher tortoise (*Gopherus polyphemus*), and state listed wading birds.

Many of the natural habitats have been replaced by residential and commercial developments, limiting habitat for protected species. The project does not contain suitable habitat for the Audubon's crested caracara, red-cockaded woodpecker, piping plover, or the Florida black bear. According to the FWC's Eagle Nesting Data, the corridor is not located within 660-feet of a bald eagle nest. Impacts to these species are not anticipated.

The remaining uplands within the project corridor, particularly the remnant scrub habitats, provide suitable habitat for some state and federally protected species. Scrub-jays have been documented in habitat immediately adjacent to U.S. 1. Proposed actions within this suitable scrub-jay habitat would require a formal scrub-jay survey and additional coordination with the USFWS. These upland habitats also may also support the eastern indigo snake, burrowing owl and gopher tortoise. Additional surveys using established protocols and coordination with the USFWS and FWC may be required for work in these areas.

The Indian River is designated as EFH and HAPC as well as critical habitat for the West Indian Manatee. No direct impacts to EFH, HAPC, manatees or their critical habitat are anticipated as no in water work is proposed. However, to avoid secondary impacts to these resources, additional stormwater treatment may be required in addition to BMPs to protect the function of surrounding wetlands and surface waters to prevent the degradation of water quality in the Indian River Lagoon.

Wetlands and surface waters, including swales and ditches, provide suitable foraging habitat for the wood stork and state listed wading birds. According to the USFWS's North Florida Ecological Service Office, the habitats within 15-miles of a wood stork breeding colony are considered to be wood stork CFAs. The study corridor is within the CFA for five wood stork colonies: Brevard County Maintenance Shop, SR 524/520, Deseret Ranch, U.S. 192 East, and Kemper Ranch. To offset unavoidable impacts to wetlands and surface waters, mitigation from a USFWS-approved mitigation bank within the appropriate CFA may be required. Depending on the amount of impacts to wetlands and surface waters, the applicant may also need to offset the potential loss of foraging biomass consumed by wood storks. Additional guidance is provided in the Wood Stork Key (USFWS 2010).



Due to the documented occurrence of protected species and suitable habitat within the project corridor, the proposed project has the potential to impact the Florida scrub-jay and wood stork. The preliminary analysis of the potential impacts to protected species associated with the proposed alternatives are provided below:

- Spot Treatments: Minimal/None
- Four-Lane Improvements: Moderate

### **5.6.5.3 Wetlands and Surface Waters**

Wetlands and other surface waters with the potential to be affected by the proposed project were identified utilizing the SJRWMD and USFWS NWI maps. Forested and non-forested wetlands occur throughout the corridor. The surface waters consist of ditches and reservoirs. A formal wetland delineation to determine jurisdictional boundaries was not performed. The preliminary analysis of the potential wetland impacts associated with the proposed alternatives are provided below:

- Spot Improvements (associated with the six-foot-wide sidewalk): 0.71 acres
- Four-Lane Improvements: six acres

In order to provide reasonable assurances that direct, indirect, or cumulative impacts from the proposed alternatives will not contribute to violations of water quality standards or adverse impacts to the functions of wetlands or other surface waters, mitigation will be required to offset unavoidable impacts. The study corridor is within the North Indian River Lagoon Regulatory Basin. Permittee responsible on-or-off site mitigation is also an option pursuant to Section 373.4137, Florida Statutes.

### **5.6.5.4 Anticipated Permits**

The following is a list of anticipated permits needed from the state and federal agencies for the proposed project.

- U.S. Army Corps of Engineers – Federal Dredge and Fill Permit:  
The proposed project will require a Standard Individual Permit for impacts to waters of the United States.
- USFWS - Biological Opinion/Incidental Take Permit:  
When a Federal action “may affect and is likely to adversely affect” a listed endangered or threatened species, the lead Federal agency submits a request to the USFWS for formal consultation. Then the USFWS prepares a biological opinion (BO) on whether the proposed activity will jeopardize the continued existence of a listed species. A BO will be required for impacts to the Florida scrub-jay (including occupied territory) and wood stork as necessary.
- SJRWMD - Environmental Resource Permit (ERP):  
The proposed project is expected to require an Individual ERP for a stormwater management plan and impacts to wetlands and other surface waters.
- U.S. Environmental Protection Agency/Florida Department of Environmental Protection – NPDES Permit:  
This permit is required because the proposed project will disturb more than one acre of land, and the stormwater runoff will discharge to waters of the state.

## **6 Public Involvement**

### **6.1 Summary of Public Involvement**

Public involvement for the U.S. 1 Corridor Planning Study started with the development of a Public Involvement Program (PIP) that identified community demographics, media, and key stakeholders, including federal agencies, state agencies, regional agencies, and elected and appointed officials. Appointed officials from the City of Rockledge, Brevard County, Space Coast Area Transit and the Space Coast TPO comprised the Project Visioning Team (PVT).

The PIP also identified goals and objectives, which are listed below:

- Identify the short- and long-term transportation needs (capacity, safety and multi-modal improvements) within this nine-mile segment of U.S. 1.
- Work with local, regional, and state agencies to address areas of concern and to build consensus for the proposed improvements.
- Obtain and consider public input through small group meetings, PVT meetings, and public meetings.
- Document the findings and recommendations for use in future phases.

A total of two public meetings and three PVT meetings, discussed below, were held throughout the study. Additionally, presentations to the Space Coast TPO Technical and Citizens Advisory Committee and the Space Coast TPO Board took place on February 10 and February 13, 2020, respectively.

### **6.2 Project Visioning Team**

Three PVT meetings took place throughout the study. Summaries of the PVT meetings are described below.

PVT #1, held on July 16, 2019, began with a review of the project planning and programming information. As part of the planning process, the Space Coast TPO submitted an application to the FDOT requesting a corridor planning study be conducted in Fiscal Year 2019. The Space Coast TPO had programmed the Project Development and Environment (PD&E) Study for Fiscal Year 2021 in the amount of approximately \$1.7 million.

Following this discussion, the study team reviewed the purpose and scope of the project; conducted a corridor walk-through using Google Earth; reviewed the context classification; identified features of the natural, social, cultural and physical environments; reviewed land use; and discussed the existing conditions on U.S. 1 including right of way, access management and safety.

PVT #2, held on September 26, 2019, began with a review of the public meeting that was held on September 19, 2019 at the City of Rockledge Council Chambers from 5:30 pm to 7:00 pm. The PVT first discussed public comments (covered below in Section 6.4). Additionally, the meeting reviewed the future traffic conditions and projections, which do not meet the need for a six-lane widening. Other items discussed included the alternatives to be evaluated which include a four-lane, high speed urban section with the addition of bicycle and pedestrian features, plans for Virgin Trains, safety and operational improvements, intersection improvements, and potentially removing the PD&E Study from the FDOT's Five Year Work Program.

PVT #3, held on January 15, 2020, began by recapping the prior two PVT meetings, the first public meeting, the technical analyses conducted to date, and the next steps, including the second public meeting. Following a review of year 2045 traffic conditions, the typical sections, alignments, and other materials were reviewed. It was again reiterated that the six-lane alignment and typical section would be eliminated from further consideration given that U.S. 1 operates within LOS standards in the year 2045. Following the review, a group activity took place to identify potential spot improvements that included adding crosswalks at all signalized intersections, adding a sidewalk on the east side of U.S. 1 between Viera Boulevard to Barnes Boulevard, and access management and safety improvements.

The three PVT meeting summaries are provided in **Appendix C**.

### **6.3 Public Meeting #1**

The first open house was held on Thursday, September 19, 2019 from 5:30 p.m. to 7:00 p.m. at the City of Rockledge Council Chambers located at 1600 Huntington Lane, Rockledge, Florida 32955. The open house was held to introduce the study and to obtain stakeholder input. The meeting was conducted in an open house format. A newsletter and a comment form were provided to all attendees as they signed into the meeting. Attendees had the opportunity to view project information, consult with project staff, and provide feedback.

There were approximately 1,200 invitations sent to property owners, government officials, and other interested parties. The invitations described the project and provided information about the open house, such as the date and time. This included invitation e-mails to elected officials, appointed officials, agency officials and others in the project area. Open house invitation letters were mailed to property owners, tenants and other interested stakeholders.

An advertisement was published in the local newspaper, Florida Today. The advertisement was published in the form of a quarter-page ad on Sunday, September 8, 2019. In addition to the newspaper advertisement, a public meeting notice was posted in the Florida Administrative Register on Wednesday, August 28, 2019 in Volume 45/103. Additionally, a press release was sent the local media by FDOT's Public Information Office (PIO).

Materials on display included the existing typical sections, a project location map, existing traffic boards, a crash locations board, and an environmental features board. Additionally, two base maps were on display allowing attendees to document their concerns directly onto the maps. The meeting summary with copies of the display boards are available in the project file.

A total of 47 people signed in at the open house. A summary of public comment can be found in **Table 10** below. Complete summaries of the public meeting are available under separate cover.

**Table 10: Public Meeting #1 Comments**

| Comment  | Commenter                     |
|--|-------------------------------|
| Please address the water shedding issue from the box culvert located on the northbound side of U.S. 1 north of Carver Rd. Currently there is no control of the roadway storm run-off. Appears there has never been a ditch and water just flows on the adjacent properties. Suggestion is to create a ditch with embankment to property to address water run-off. Alternatively, pipe U.S. 1 to river to address water issue. Any questions please call 321-288-7087.  | Mike and Christine Richardson |
| We need a right turn lane off U.S. 1 onto Magruder Ave. Also, sidewalk down to Rockledge Square would be nice. I live the closest to U.S. 1 on Magruder Ave. Would a wall be built along U.S. 1 to cut down on the traffic noise? There is one further north where the newer developments were built.  | June Hughes                   |
| Our main concern is lack of drainage ditches between Lucky Way (McIver Ln) all the way to the FDOT drainage ditch on east side of U.S. 1. There is a drainage ditch everywhere else and with no drainage ditch, all water flows directly onto those properties along U.S. 1. This needs to be resolved either way. If any type of widening happens this problem will be compounded. Also, any homeowner that lives along this corridor discussed above has issues trying to turn into our own properties. Pull off lanes needed. | Glen and Laura Baxley         |
| I own 2153 Rockledge Dr. Please advise how you plan to involve my property.  | Johnny Walker                 |
| We own BayWash Car Wash on U.S. 1, corner of Park Ave. We propose a stop light at this intersection as there are multiple accidents. When the widening occurs, this will only get worse. Park Ave is the only street to Rockledge Blvd along the river for quite a distance, so it is used primarily as a cut thru for local residents.  | Nancy DeGrosa                 |
| Traffic light needed at Topsail Dr. and U.S. 1.  | Blanche Healy                 |
| <ol style="list-style-type: none"> <li>1. Need stop light at Gus Hipp Blvd.</li> <li>2. Heavy congestion at Suntree Blvd. headed southbound</li> <li>3. Need right turn lane at Viera Blvd. to be longer (southbound)</li> </ol>   | Alix Bernard                  |
| <ol style="list-style-type: none"> <li>1. Congestion at Suntree Blvd., especially northbound</li> <li>2. Flooding or ponding water on northbound side after heavy rain</li> <li>3. Only a few public transit stops, all in grass or dirt on southbound side</li> </ol>   | Name Not Provided             |
| <ol style="list-style-type: none"> <li>1. Suntree Blvd. is extremely congested southbound – rush hour morning and evening</li> <li>2. Traffic signal needed at U.S. 1 and Gus Hipp Blvd.</li> <li>3. Bicyclists use U.S. 1 heavily on weekend in groups from 5-40 riders</li> </ol>  | Pat O'Neil                    |
| Overall traffic on this corridor is not bad. The most difficult section of this area of road is just south of Eyster where the 3 lanes merge to 2 southbound. It is a poorly marked and poorly placed traffic area. Some people use it to drag race from Eyster and others are caught by surprise. This area should be addressed separate from the overall study and/or corridor construction.   | Craig Blood                   |

## 6.4 Public Meeting #2

The second open house was held on Wednesday, February 12, 2020 from 5:30 p.m. to 7:00 p.m. at the City of Rockledge Council Chambers located at 1600 Huntington Lane, Rockledge, Florida 32955. The open house was held to present the results of the study and to obtain stakeholder input. A newsletter and a comment form were provided to all attendees as they signed into the meeting. Attendees had the opportunity to view project information, consult with project staff, and provide feedback.

Consistent with the first public meeting, approximately 1,030 invitations were sent to property owners, government officials, and other interested parties. The invitations described the project and provided information about the open house, such as the date and time. This included invitation e-mails to elected officials, appointed officials, agency officials, and others in the project area. Open house invitation letters were mailed to property owners, tenants, and other interested stakeholders.

An advertisement was published in the local newspaper, Florida Today. The advertisement was published in the form of a quarter-page ad on Sunday, February 2, 2020. In addition to the newspaper advertisement, a public meeting notice was posted in the Florida Administrative Register on Wednesday, January 22, 2020 in Volume 46/14. Additionally, a press release was sent the local media by FDOT's Public Information Office (PIO).

Materials on display included a project location map, an existing typical section board, a proposed four-lane typical section board, a four-lane alignment board, a spot improvement board, future year 2045 traffic boards and other ancillary information. The meeting summary with copies of the display boards can be found in the project file.

A total of 20 people signed in at the open house. A summary of public comment can be found in **Table 11** below. Complete summaries of the public meeting are available under separate cover.

**Table 11: Public Meeting #2 Comments**

| Comment   | Commenter   |
|---|-------------|
| Very impressed with the overall plan. Additional ideas/comments: <ul style="list-style-type: none"> <li>- Extending the sidewalk from Eyster Blvd. south on the west side of U.S. 1 down to at least Rockledge Gardens if not further.</li> <li>- Finishing the sidewalk on Barnes Blvd. from Plantation Point subdivision east to U.S. 1. Many bikers and walkers on Barnes Blvd traveling to Rockledge Dr./River Rd. and traveling to Brevard workforce on Barnes Blvd.</li> </ul> Thank you. | Mike Rogers |

## 7 Next Steps

In conclusion, the FDOT will continue to work with agency partners including Brevard County, the City of Rockledge and the Space Coast TPO to monitor this segment of U.S. 1 as part of the Space Coast TPO's Long Range Transportation Planning (LRTP) update process to assess potential need for capacity improvements.

However, in the short term, the spot improvements listed below will be evaluated in the next phase of project development, which given the nature of these improvements, will be the concept development phase. The concept development phase implements transportation improvements that do not have significant impacts on the natural, social, cultural and physical environments and can therefore be cleared and implemented through a Type 1 Categorical Exclusion or a Non-Major State Action.

- A new traffic signal at the existing northbound U.S. 1 to westbound S.R. 404 left turn lane.
- The addition of crosswalks to complete all the legs of the intersections at the Suntree Boulevard, Viera Boulevard, and Barnes Boulevard intersections.
- The addition of a 6-foot-wide sidewalk on the east side of U.S. 1 from Viera Boulevard to Barnes Boulevard.
- Turn lane improvements at Viera Boulevard (an improvement identified as part of the Viera Boulevard PD&E Study – FM 428238-1). This includes the addition of a dual northbound U.S. 1 to westbound Viera Boulevard left turn lane and the addition of an eastbound Viera Boulevard to southbound U.S. 1 right turn lane.
- The addition of a northbound left turn lane into Rockledge Gardens / Boater's Exchange.
- Corridor wide bicycle lane improvements.
- Corridor wide access management improvements.
- Assessing future design and posted speeds along the corridor.