CONCEPT DEVELOPMENT AND EVALUATION TECHNICAL MEMO

Florida Department of Transportation
District 5
FM#: 435627-1-12-01

FDOT

April 2019

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Executive Summary

Project Background and Purpose

This project was requested by the City of Titusville to coordinate the development of a future vision for the US Route 1 (US 1) corridor that will establish a multimodal approach to addressing future transportation needs. The Florida Department of Transportation (FDOT) completed a Corridor Planning Study (CPS) for US 1 (including both Washington Avenue and Hopkins Avenue) from Laurel Place to Indian River Avenue in September 2016. The purpose of the CPS was to establish a long-term plan to guide evolution of the corridor that appropriately correlates the balance between land use and transportation planning, in coordination with local and regional agency partners. The process combined planning and engineering efforts to develop a range of potential improvement strategies to more forward to the Concept Development and Evaluation study phase. This study was conducted in parallel with the SR 406 Concept Development and Evaluation Study.

In July 2017, the project process continued with the start of the Concept Development and Evaluation Study. This study phase continued what was started in the CPS by further evaluating the alternatives identified, creating concept plans, and identifying and evaluating potential impacts. The study also continued engagement with the public and local agency partners.

Concept Development and Evaluation Process

As part of the Concept Development and Evaluation study, the Existing Conditions Report and Future Conditions Technical Memorandum were updated to include any changes that may have occurred since the completion of the CPS. This included a comprehensive on-site field review to document actual existing conditions along the corridor.

Once the existing and future conditions update was complete, the Issues and Opportunities, Purpose and Need, and Goals and Objectives developed during the CPS were reviewed and confirmed to be still appropriate for the study corridor. The following is the Purpose and Need for the US 1 project:

Purpose: *To provide additional safe multimodal mobility options to support economic development goals, enhance the historic downtown corridor, and encourage a community atmosphere.*

Need: *Additional mobility options and enhancement of the safety of existing pedestrian facilities is needed based on the existing volume of pedestrians, the desire for more transit and bicycle use, and to support the downtown community by creating a bicycle and pedestrian friendly neighborhood as supported by the following observations:*

- *The corridor has been designed by the City as part of the community redevelopment area (CRA) district*
- *High volume of pedestrian activity*
- *High volume of pedestrian activity*
- *High volume of mid-block crossing*
- *Large transit dependent community*
- *Lack of ADA accommodations*
- *Lack of bicycle facilities*

Once the data refresh and review of the Purpose and Need for the US 1 corridor was completed, the following CPS recommended improvement strategies were further evaluated:

- Elongated roundabout at the SR 406 and US 1 (one-way pairs) intersections
- Roundabout at Grace Street

Concept plans for the alternatives were detailed and refined, including a comprehensive review and field verification process. The roundabouts were run through the FDOT Roundabout evaluation, a three-step process established to determine if a roundabout is the appropriate control measure for a proposed intersection improvement, as described in the FDOT Intersection Design Guide. The screening evaluation revealed that the elongated roundabout at SR 406 and US 1 (one-way pairs) intersections is appropriate, however the roundabout at Grace Street would be too impactful and costly as compared to the anticipated benefit.

Public Involvement

Throughout the Concept Development and Evaluation Study, the project team engaged public and local agencies to bring diverse viewpoints and values between all interested people, groups, government organizations into the decision-making process regarding the development of the project. These public involvement activities included the following:

- Two Project Visioning Team (PVT) Meetings were held at key points during the study process (November 8, 2017 and June 27, 2018) to discuss progress of the concepts
- Small group meeting with the City of Titusville staff to review study findings and garner support from the city representatives (March 30, 2018)
- Public meeting to present the final recommendations and allow interested parties an opportunity to provide feedback and comments about the project (September 20, 2018)
- Presentation of study results to the City of Titusville Council and the Space Coast Transportation Planning Organization's Board and subcommittees in October 2018

Final Recommendations

The final recommendation for the US 1 Concept Development and Evaluation Study is construction of an elongated roundabout at the intersections of SR 406 and US 1 (one-way pairs). The proposed roundabout maintains two northbound lanes and two southbound lanes along US 1 but reduces the eastbound and westbound lanes to one lane in each direction. This recommendation would need to be implemented concurrently with the lane modifications found with the SR 406 Concept Development and Evaluation Study (FM# 436187-1).

The purpose of this improvement recommendation is to reduce the number of severe crashes at the intersections and serve as a gateway feature into the City of Titusville's historic downtown district. The roundabout is also projected to improve intersection delay from 22.8 seconds to 6.9 seconds in the 2040 AM Peak Hour and from 26.8 seconds to 10.2 seconds in the 2040 PM Peak Hour.

Impacts anticipated with the recommendation are up to .394 acres, including one business relocation of the KFC north of the existing intersections. The total project cost including right-of-way, construction and design is estimated to be $16.3 million. This project will require an environmental document that would address the impacts to the business relocation in order to move forward.

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1 Introduction

1.1 Purpose of Technical Memorandum

The purpose of this Concept Development Technical Memorandum is to develop a proposed concept for the US Route 1 (US 1) corridor from Laurel Place to Indian River Avenue based on projected future needs through 2040. This technical memorandum will include existing conditions of the corridor as well as a forecast of future traffic conditions. The latest available development and growth projections have been compiled to create an accurate picture of future traffic demand. Future traffic projections are used by this study to influence, improve and validate potential improvement strategies identified through the rigorous study and public engagement during the Corridor Planning Study. These traffic projections have been used to analyze the concept described in this report. Finally, the memorandum will describe the concepts for the proposed alternatives.

1.2 Project Background and Purpose

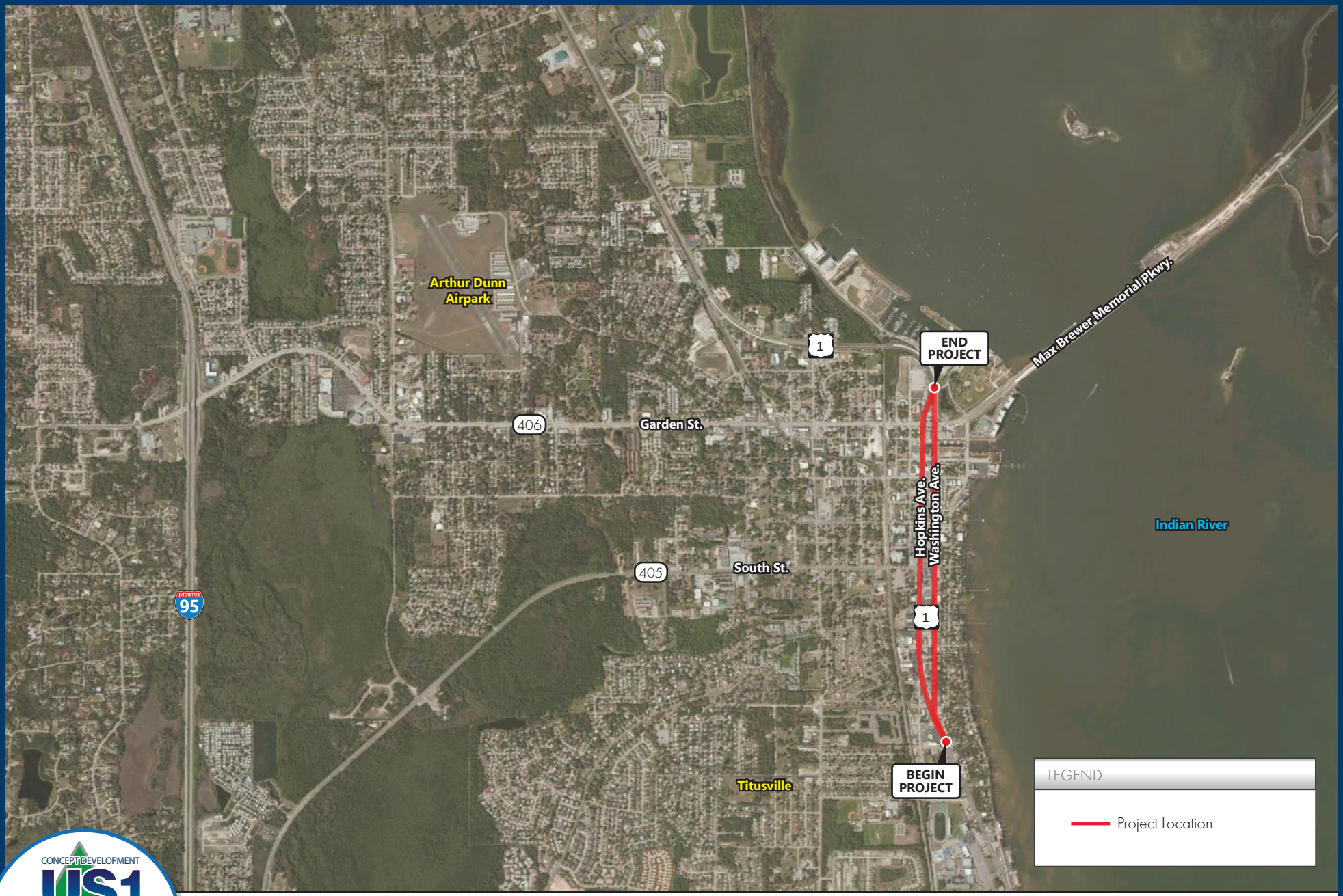
In January 2015, the Florida Department of Transportation (FDOT) began a Corridor Planning Study on US 1 (including both Washington Avenue and Hopkins Avenue as one-way pairs) from Laurel Place to Indian River Avenue in Titusville, Florida. Figure 1 illustrates the study area. A Corridor Planning Study is an evaluation of safety, environmental and geometric concerns along a transportation corridor where needs, possible improvement options and planning level cost estimates are identified. This project was requested by the City of Titusville to coordinate the development of a future vision for the US 1 corridor that will establish a multimodal approach to addressing future transportation needs. Multimodal corridor projects are essential to network efficiency, safety, and livability within the context of future transportation needs.

The Corridor Planning Study involved a community-based evaluation to determine how best to meet the needs of current and future users. It then established a long-term plan to guide the evolution of the corridor that appropriately balances land use and transportation planning initiatives. This project was coordinated with local and regional agency partners, such as the Space Coast Transportation Planning Organization (SCTPO), Brevard County, the City of Titusville, Space Coast Area Transit (SCAT), Titusville Community Redevelopment Area (CRA) and Florida East Coast (FEC) Railway to develop a context-sensitive approach. US 1 has been the subject of various previous planning studies and improvement efforts. Several development and planning goals have been identified and

implemented to create a more walkable urban environment for the downtown Titusville business district. As part of the analysis, previous studies, improvement plans, as well as an inventory of existing traffic, pedestrian and bicycle, and transit conditions and facilities were evaluated. This process combined planning and engineering efforts to develop a range of potential improvement strategies. The Corridor Planning Study concluded in September 2016. Full documentation for this study can be found at CFLRoads.com

In July 2017, the project process continued with the start of the Concept Development and Evaluation Study. This study continues what was started in the Corridor Planning Study by further evaluating the alternatives identified, creating concept plans, as well as identifying and evaluating impacts. This study continued the public and agency involvement effort that was previously established by continuing to engage the Project Visioning team throughout the process as well as holding a public meeting to receive local input.

The proposed alternative produced by the study is a roundabout at the intersection of SR 406 (Garden Street) and the one-way pairs of US 1 (Hopkins Avenue and Washington Avenue). Details of this proposed alternative are provided in Section 5 of this report. This Concept Development and Evaluation Study was conducted in parallel with the State Road 406 (Garden Street) Concept Development and Evaluation Study.



US 1 Concept Development & Evaluation

LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 1
Study Area Location Map

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Existing Conditions

2.1 Roadway and Intersection Characteristics

The US 1 study area consists of approximately 1.25-mile, one-way pair section (Hopkins Avenue and Washington Avenue) of US 1 within the City of Titusville in Brevard County, Florida. The study area begins at Laurel Place and extends north to Indian River Avenue, which encompasses the entire one-way pair section through downtown Titusville. The study area corridor can be characterized as an urbanized two-lane roadway, in an area of predominantly retail and service land uses. Based on the FDOT Context Classification Guidance, this corridor is classified as a C-4 Urban General. This context classification designation is further discussed in Section 2.4.2.

US 1 from Laurel Place to Indian River Avenue is classified as an "urban principal arterial other". There are two predominate typical sections of the corridor; a four-lane bidirectional segment from Laurel Place to Grace Street; and a two-lane, one-way pair segment from Grace Street to Indian River Avenue. The posted speed limit varies along US 1; from south of the study area to north of Laurel Place the posted speed limit is 45 miles per hour (MPH), immediately north of Laurel Place to south of SR 405 it transitions to 40 MPH, from south of SR 405 to north of SR 406 the posted speed is 30 MPH, and transitions to 35 MPH south of Indian River Avenue.

2.2 Summary of Transportation Plans

The following transportation plans were reviewed in order to identify planned improvements within the Study Area:

- Space Coast Transportation Planning Organization's (TPO) 2040 Long Range Transportation Plan;
- Space Coast TPO's Transportation Improvement Plan;
- Space Coast TPO Intelligent Transportation Systems (ITS) Master Plan
- FDOT Five Year Work Program;
- City of Titusville Comprehensive Plan Policies
- Space Coast TPO's Bicycle & Pedestrian Mobility Plan; and
- Space Coast Area Transit's Transit Development Plan.

Space Coast TPO 2040 Long Range Transportation Plan (LRTP)

The SCTPO 2040 LRTP identifies a multimodal range of improvements for Brevard County through 2040. The LRTP identifies a section of SR 406 (Garden Street) from Park Avenue to US 1 SB (Hopkins Avenue) in which to add sharrows and 'Bike May Use Full Lane' (BMUFL) signage with an estimated cost of $109,000. A sharrow and BMUFL sign was identified from north of SR 406 (Garden Street) to SR 405 (South Street) along US 1 for the cost of $98,000. ITS Improvements of installing fiber were identified along US 1 from SR 406 (Garden Street) to SR 405 (South Street) with an estimated cost of $1.3 Million. These improvements can also be found in the Space Coast TPO ITS Master Plan. An off road shared use path along US 1 was identified between Dairy Road and SR 406 (Garden Street).

Space Coast TPO Transportation Improvement Plan (TIP) FY 2019-FY2023

The TIP is a priority list of federal and state funded projects that have been scheduled for implementation by the Space Coast TPO. The TIP includes financially feasible multimodal projects that were previously adopted by state and local officials, and transportation agencies. This plan was updated in July of 2017. A resurfacing is funded for construction in FY 2019 for SR 406 (Garden Street) from East of Petty Circle (West of Forrell Avenue North) to US 1 NB (Washington Avenue).

Space Coast TPO Intelligent Transportation System (ITS) Master Plan

The SCTPO ITS Master Plan, published in 2015, provides the framework for determining the region's future ITS needs. As part of this effort, the ITS Master Plan documents the existing ITS infrastructure as well as expected future needs. Figure 14 indicates there is currently no fiber provided along US 1 within the study area. As shown in Figure 15, the US 1 study area includes one (1) closed-circuit television camera at the SR 406 intersection. Figure 18 indicates there is one (1) arterial dynamic message sign (ADMS) north of the South Street intersection.

Based on the identification of future ITS infrastructure needs, the ITS Master Plan proposed fiber be deployed along US 1 from NASA Causeway north to SR 406. Similarly, a CCTV camera and Bluetooth device deployment are proposed at the Laurel Place Intersection.

FDOT Five-Year Work Program FY 2019-FY 2023

Each year, FDOT develops the Five-Year Work Program in accordance with Section 339.135, Florida Statutes. The plan reviewed was updated in November 2018. The Five-Year Work Program is an ongoing process that is used to forecast the funds needed for upcoming transportation system improvements scheduled for the next five years. The development of this Work Program involves extensive coordination with local governments, including Metropolitan Planning Organizations and other city and county officials. After review of the programmed improvements, there were no projects identified along US 1 in the Study Area.

City of Titusville Comprehensive Plan Policies

The City of Titusville Comprehensive Plan, adopted in 1988 and last revised in April of 2014, has adopted multiple Comprehensive Plan Objectives and Policies that focus on multi-modal transportation options. Some of these include complete streets, street beautification and creating a system-wide multi-modal transportation network master plan. Objective 1.13 of the Future Land Use Element identifies policies and strategies concerning land uses along the US 1 corridor.

The 2006 US 1 Corridor Master Plan included the southern portion of the current study corridor, from Grace Street to Laurel Place, and seeks to encourage the recommended master plan by developing a Neighborhood Plan. This involves designating land uses that protect the interior established single-family areas of the neighborhood by preserving and revitalizing the commercial uses along US 1 and preventing these uses from encroaching into the established single-family

neighborhoods. The City of Titusville has also adopted policies that the 2006 Master Plan recommended regarding strengthening and encouraging a pedestrian-friendly, mixed-use district along US 1, that can include, but is not limited to high density residential, retail, and public areas, and that is intended to contain urban elements of increased density, intensity and height.

US 1 is also identified in the City of Titusville Vision Plan 2017 as a "Gateway" corridor, which is defined as important to create a positive first impression for people visiting Titusville.

Space Coast TPO Bicycle & Pedestrian Mobility Plan

The Space Coast TPO Bicycle & Pedestrian Mobility Plan, published in 2013, documents future improvements to the bicycle/pedestrian network within Brevard County. It is a synthesis of prior plans, regional projects and local plans which identifies short- and long-term improvements that address gaps or deficiencies in the bicycle/pedestrian network. The following improvement projects were identified:

- Installation of sharrows along US 1 from St Johns Street to Grace Street. There is no existing funding for this project.
- Installation of sharrows and BMUFL signs along US 1 from SR 405 (South Street) to 1,200 feet north of SR 406 (Garden Street). It does not have any existing funding.
- A designated bike lane from north of SR 406 (Garden Street) to SR 405 (South Street) along US 1. There is no existing funding for this project.
- A designated bike lane from St. Johns Street to Grace Street along US 1. There is no existing funding for this project.
- An off road shared use path along US 1 was identified between Dairy Road and SR 406 (Garden Street).

Space Coast Area Transit 2013-2022 Transit Development Plan

The Space Coast Area Transit (SCAT) 2013-2022 Transit Development Plan (TDP) documents future transit improvements throughout Brevard County for a ten-year window. Transit improvements can include new routes, expanded hours of operation, or increased frequencies. The following improvements are noted as unfunded and are summarized by implementation year:

Year 2019

- Increase weekday frequency to 30 minutes on Routes 1 and 2
- Increase Saturday frequency to 30 minutes on Routes 1 and 2
- Extend service on weekdays to 9 PM on Route 1
- Extend service on Saturday to 9 PM on Route 1
- Start Sunday service on Route 2

Year 2020

- Increase weekday frequency to 30 minutes on Route 5
- Start Saturday service on Route 5
- Extend service on weekdays to 9 PM on Routes 2 and 5
- Extend service on Saturday to 9 PM on Route 2
- Start Sunday service on Route 5

Year 2021

- Create a new route that provides north-south connectivity in Brevard County (documented in the TDP as Alternative 18: BCC Connector). The route would run north/south along US 1 for the length of the Study Area.

Year 2022

- Create a new route that connects Downtown Titusville to Canaveral National Seashore. This is documented in the TDP as Alternative 21: Canaveral National Seashore. The route would begin at SR 405 (South Street) and move north/south along the US 1 corridor before connecting east to Canaveral National Seashore along SR 406 (Garden Street).

Local Small Area Plans and Community Redevelopment Areas

The Community Redevelopment Agency (CRA) program was created in Florida in 1969 to help communities revitalize downtown areas. The Florida Legislature established criteria to allow and encourage CRA redevelopment and revitalization activities when certain conditions exist, including but not limited to the presence of substandard or inadequate structures, higher crime rates than surrounding areas, inadequate infrastructure, insufficient roadways, deterioration of sites or other improvements, and inadequate parking.

The US 1 Study Area is located fully within The Downtown Titusville CRA. The CRA encompasses land from Buffalo Road in the north, to Grace Street in the south, and lands from the Indian River Lagoon in the east to the FEC railroad in the west. The CRA projects implemented within the Study Area include a US 1 Streetscape Plan, with the goal to adjust the horizontal alignment, calm traffic, provide greater pedestrian activity, shaded areas, on-street parking, includes entryway signage, wider sidewalks, landscaping and historic lighting along the corridor. Designed and engineered by the firm Wilson Miller, this plan was constructed beginning in 2009.

The 2006 Downtown Master Plan lead to a Downtown Mixed Use Smart Code for the CRA, which was adopted in 2010. These standards were intended to encourage mixed-use buildings for infill development and new public facilities, while maintaining the historic character of the community. These codes were revised in 2013.

In 2014, a Community Redevelopment Plan update was created to "develop a plan for coordinated growth in the Downtown CRA" and to create a downtown area with a vibrant mixed-use town center environment. The FY 2018/2022 5-Year Capital Improvement Plan, published in the 2017 CRA Adopted Budget, identifies $50,000 annually towards concrete street repairs on US 1 side streets. This is relevant to the identified parallel pedestrian and bicycle route on Indian River Avenue.

A Main Street Streetscape design project, funded by the CRA program, includes a new sidewalk and pavement milling and resurface. The project was planned to not change the existing typical section of the roadway, which included bike lanes and on-street parking. This project later included the addition of the cycle track for the Downtown Titusville Trail that is part of the Coast-to Coast network.

Developments of Regional Impact

Information on Developments of Regional Impact (DRIs) was collected from the Florida Department of Economic Opportunity (DEO), East Central Florida Regional Planning Council, Brevard County and FDOT. There are no DRIs located within one mile of the Study Area.

Related Traffic Studies

A safety study was performed at the intersection of State Road 406 and US 1 one-way pair intersections in February 2017 to evaluate the operations and safety of the intersections. Due to the high angle crash history, many short and mid-term improvements were recommended. A potential long-term improvement identified for further evaluation is to combine both intersections into an elongated roundabout. This would involve significant right of way (R/W) impacts to adjacent properties on both sides of SR 406 (Garden Street).

In addition to that study, a Traffic Signal Warrant Study was also conducted at the intersection of US 1 NB (Washington Avenue) and Julia Street in July 2014. This study recommended that a traffic signal not be installed, however it was recommended to install Rectangular Rapid Flashing Beacons, or RRFB's, providing an enhanced crosswalk to improve pedestrian safety at the intersection. This RRFB's was installed in late 2015.

2.3 Land Use

Land use data was compiled from the Brevard County Property Appraiser parcel data and FDOT District 5 Generalized Land Use Data generated in 2015. This data was used to identify existing land uses around the study corridor.

Existing Land Use

Residential and retail/office uses are the predominant existing land uses for the lands abutting and around the study corridor. These categories each account for approximately 19 percent of the land within a ¼ mile of the study corridor. The next highest percentage of land use is public/semi-public, with approximately 11.7 percent of the existing land use. Over 6.5 percent of the land within a ¼ mile of the study corridor is currently vacant. Figure 2 depicts the existing land uses.

Future Land Use

The Future Land Uses (FLUs) assigned to the Study Area, Figure 3, are generally consistent with the existing land uses along, and adjacent to the corridor.

The entirety of the land adjacent to the study corridor is designated as Downtown Mixed-Use. The City of Titusville specifies that the Downtown Mixed-Use FLU is permitted to have a maximum density of 20 dwelling units per acre and a maximum Floor Area Ratio (FAR) of 5.0. The FAR is the ratio of a buildings total floor area (Gross Floor Area) to the size of the parcel that it is built on, and is generated by dividing the building area by the parcel area. The Downtown Mixed-Use FLU was established by the City of Titusville to "pursue the renewal of Downtown Titusville as the center of professional, governmental, financial and unique retail and redevelop blighted areas." The Downtown Mixed-Use FLU is intended to enhance the visual attractiveness of downtown, utilize the waterfront, encourage and promote pedestrian spaces, and emphasize development and redevelopment east of US 1 that uses the waterfront as an amenity.

Along the study corridor, the Downtown Mixed-Use district extends to Indian River Avenue east of US 1 NB (Washington Avenue). Further east, between Indian River Avenue and the Indian River, the majority of the land is designated as Residential Medium. Medium density residential lands are permitted for a maximum density of 10 dwelling units per acre and are intended to consider existing and proposed land uses during development to ensure compatibility with surrounding uses.

Source: Brevard County Property Appraiser (2017) and University of Florida GeoPlan Center "Florida Parcel Data Statewide-2017"

Existing Land Use

- AGRICULTURAL
- COMMERCIAL
- INDUSTRIAL
- INSTITUTIONAL
- MIXED USE
- OTHER
- RECREATIONAL
- RESIDENTIAL
- UTILITIES, GAS, SEWAGE, R/W

WEST ST
KENNEDY WY
SOUTH ST.
PALMETTO ST
ON ST
ENGLISH ST
JONES ST
GARDEN ST.
FOURTH AV
THIRD AV
SECOND AV
FIRST AV
MAXWELL ST
BRIDGE ST
UNION ST
OLIVE AV
405
406
CRA BOUNDARY
PALM AV S
1
5
JOHNS ST
INDIAN RIVER AV
BEGIN PROJECT
END PROJECT
Indian River

LEGEND
Project Location

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LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 2
Existing Land Use Map

Source: City of Titusville (2015)

Future Land Use

- Commercial - High Intensity
- Conservation
- Downtown Mixed-Use
- Industrial
- Public/Semi-Public
- Residential - High Density
- Residential - Medium Density
- Residential - Low Density
- Urban Mixed-Use

WEST ST
KENNEDY WY
METTO ST
SOUTH ST
PINE ST
NST
ENGLISH ST
JONES ST
DE LEON AV N
MAIN ST
ORANGE ST
GARDEN ST
LA GRANGE AV
BRYAN AV
FLAGLER ST
FOURTH AV
THIRD AV
SECOND AV
FIRST AV
MAXWELL ST
BRIDGE ST
UNION ST
WAGER AV
OLIVE AV
CANAVERAL AV
DUMMITT AV
405
406
JULIA ST
LEMON AV N
PALM AV N
PALM AV S
PALM AV S
1
5
1
5
JOHNS ST
WASHINGTON AV S
INDIAN RIVER AV
BROAD ST
BEGIN PROJECT
END PROJECT

LEGEND

Project Location

CONCEPT DEVELOPMENT US1

US 1 Concept Development & Evaluation

LAUREL PLACE TO INDIAN RIVER AVENUE

FDOT

FIGURE 3
Future Land Use Map

2.4 Existing Physical Features

The existing physical features were collected through field inspection and design/construction plans obtained from FDOT and the affected jurisdictions. The features evaluated include existing R/W, speed limit, typical sections, access management, utilities, on-street parking, lighting, bicycle, and pedestrian facility locations.

2.4.1 Roadway Classification, Jurisdiction, and Posted Speed

US 1 from Indian River Avenue to Laurel Place is classified as an "urban principal arterial other" and is owned and maintained by the Florida Department of Transportation. The roadway ID of US 1 from Laurel Place to Grace Street is 70030000. This segment begins at MP 2.925, the roadway then splits into northbound and southbound one-way pairs at MP 3.078. The roadway ID for US 1 NB (Washington Avenue) is also 70030000 and extends from MP 3.078 until the project end at MP 4.2, for a total of 1.275 miles. US 1 SB (Hopkins Avenue begins at the split to one-way as MP 1.397 and extends to MP 0.285 for a total of 1.112 miles. The roadway ID for the southbound portion of US 1 is 7030101.

The posted speed limit varies along US 1; from south of the Study Area to north of Laurel Place the posted speed limit is 45 MPH, immediately to the north of Laurel Place to south of SR 405 (South Street) it transitions to 40 MPH, from south of SR 405 (South Street) to north of SR 406 (Garden Street) the posted speed is 30 MPH, and transitions to 35 MPH south of Indian River Avenue.

2.4.2 Context Classification

The context classification of a roadway is a standard adopted by FDOT that provides information about who the users are along the roadway, the regional and local travel demand of the roadway, and the challenges and opportunities of each roadway user. The context classification and transportation characteristics of a roadway determine key design criteria for all non-limited access state roadways.

US 1 from Indian River Avenue to Laurel Place is classified C4, which is defined as roadways with a mix of uses set within small blocks with a well-connected roadway network. The primary and secondary measures as defined in the FDOT Context Classification guidebook were considered for each segment and showed that the segment from SR 405 (South Street) to Broad Street is more densely developed that the adjacent segments to the north and south. After reviewing the US 1 segment from Laurel Place to Indian River Avenue, FDOT determined that the whole segment merits the C4 context classification. The memorandum showing the primary and secondary measures, and the results of the context classification evaluation can be found in **Appendix A**.

2.4.3 Right of Way

The roadway R/W has been inventoried for the roadway corridors within the Study Area using FDOT R/W maps obtained from the FDOT District 5 Survey and Mapping Unit.
Table 1 shows the available R/W by roadway segment.

Table 1: Right of Way Summary

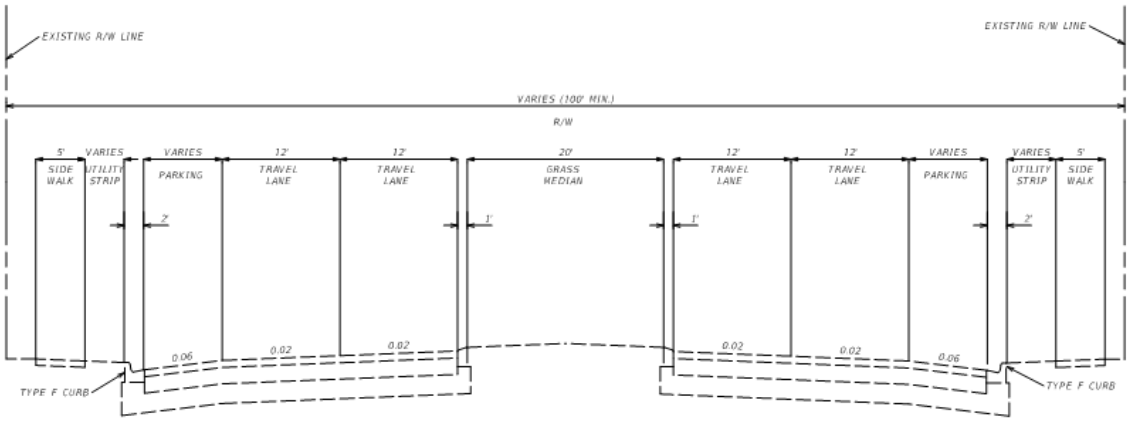
Roadway	Roadway ID	From	To	R/W Width (Feet)
US 1	70030000	Laurel Place	Grace Street	Varies (Min. 100)
US 1 NB (Washington Avenue)	70030000	Grace Street	Brevard Street	55-60
		Brevard Street	SR 406 (Garden Street)	59-61
US 1 SB (Hopkins Avenue)	70030101	Grace Street	St. Johns Street	53-60
		St. Johns Street	Union Street	50-58
		Union Street	SR 405 (South Street)	60-69
		SR 405 (South Street)	SR 406 (Garden Street)	49-51
US 1	70030000	SR 406 (Garden Street)	Indian River Road	Varies (Min. 200)

Source: FDOT R/W Maps

2.4.4 Typical Sections

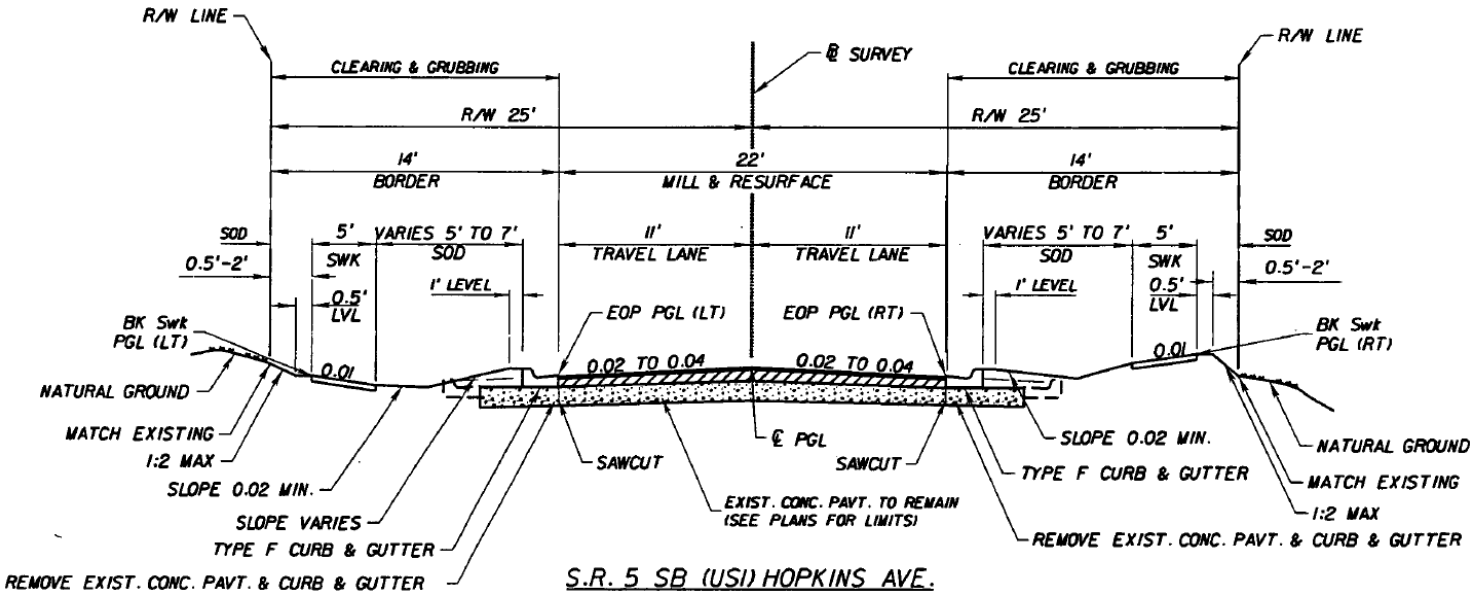
There are two predominate typical sections of US 1 within the Study Area. The four-lane bidirectional segment from Laurel Place to Grace Street is illustrated in Figure 4. The other section of the one-way pair is illustrated in Figure 5. Figure 4 is based of R/W maps and existing field review.

Figure 4: Existing US 1 Typical Section – Laurel Place to Grace Street



The two-lane, one-way pair segment from Grace Street to Indian River Avenue is illustrated in Figure 5. The exception to this typical section is sporadic eight foot on-street parking facilities that are located throughout the segment. The on-street parking on US 1 NB (Washington Avenue) is located on both sides of the travel lanes while on US 1 SB (Hopkins Avenue) on-street parking is located on the west side. An approximately four-foot wide paved shoulder is provided between Main Street and Indian River Avenue on both US 1 Northbound and Southbound. Figure 5 is taken from a 2011 Contract Plan provided by FDOT for the resurfacing of US 1 from SR 406 (Garden Street) to Grace Street (Financial Project ID is 418647-1-52-01).

Figure 5: Existing US 1 Typical Section – One-Way Pair Grace Street to SR 406 (Garden Street)



2.4.5 Access Management

The FDOT classifies access on state roadways using a seven-tier access management system, established in Rule 14-97 of the Florida Administrative Code (FAC). The classification system ranges from Access Class 1, reserved for limited access freeways, to Access Class 7, assigned to lower priority state highways in areas that are already highly urbanized. This classification system assigns standards for driveway connections, spacing, median opening spacing, and signal spacing.

Table 2 shows the approximate limits for Access Class categories for the Study Area and corresponding posted speed limits (MPH). The spacing standards for each Access Class as per FDOT are shown in Table 3.

Table 2: FDOT Access Management Classifications and Posted Speeds

Roadway	Limits	Access Class	Posted Speed
US 1	Laurel Place to Grace Street	5	40
US 1 NB (Washington Avenue)	Grace Street to SR 406 (Garden Street)	7	30/40
US 1 NB (Washington Avenue)	SR 406 (Garden Street) to Indian River Avenue	3	30/35
US 1 SB (Hopkins Avenue)	Indian River Avenue to Grace Street	7	30/35/ 40

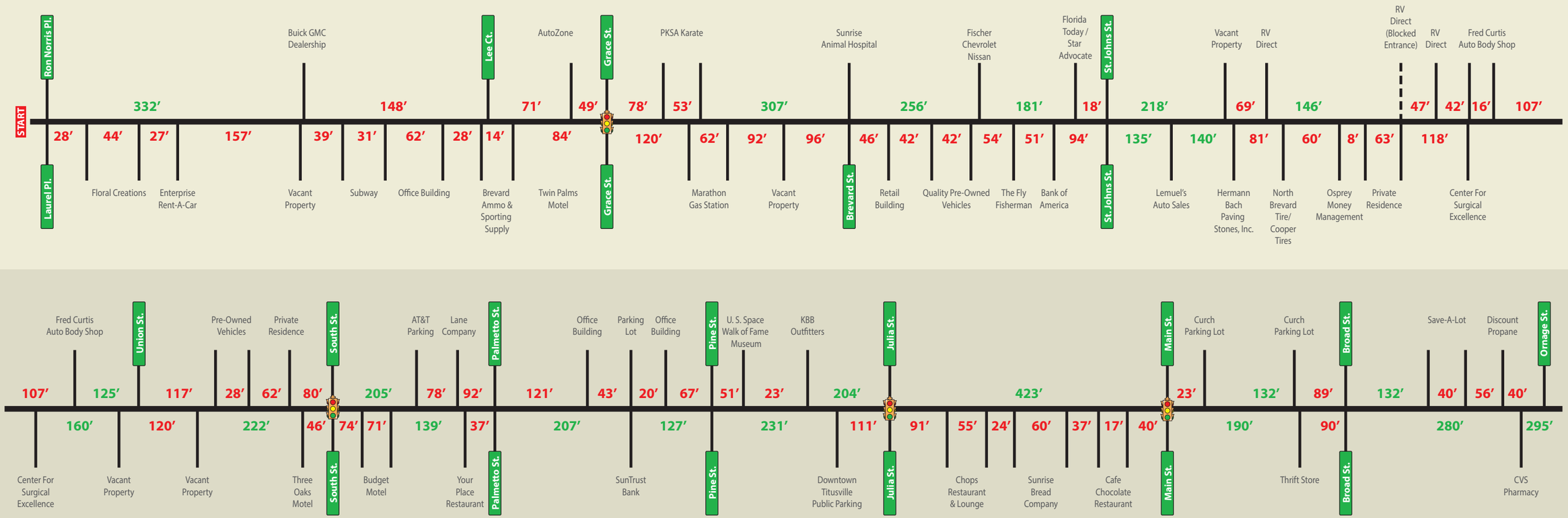
Source: FDOT Straight Line Diagram, FDOT Roadway Characteristic Inventory (RCI) Data

Table 3: Access Class Spacing Standards

FDOT Access Management Class	Minimum Connection Spacing (feet)	Minimum Median Opening Spacing (feet)		Minimum Signal Spacing (feet)
		Directional	Full	
Class 3	660/440[1]	1,320	2,640	2,640
Class 5	440/245[1]	660	2,640/1,320[1]	2,640/1,320[1]
Class 7	125	330	660	1,320

Source: Section 14-97.003, Florida Administrative Code
[1] Greater than 45 MPH / Less than or equal to 45 MPH

Figure 6 through Figure 10 illustrate the existing access management and whether or not the median, connection, and signal spacing's are currently satisfying access management standards.



LEGEND

000 - Meets Access Management Standards

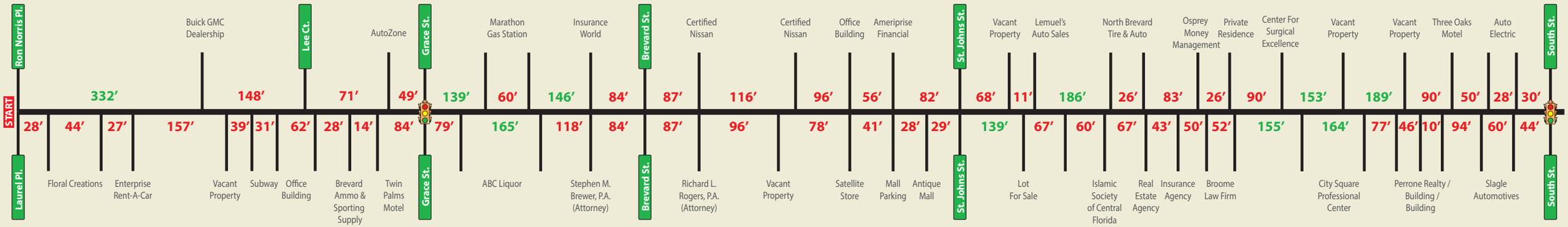
000 - Does Not Meet Access Management Standards

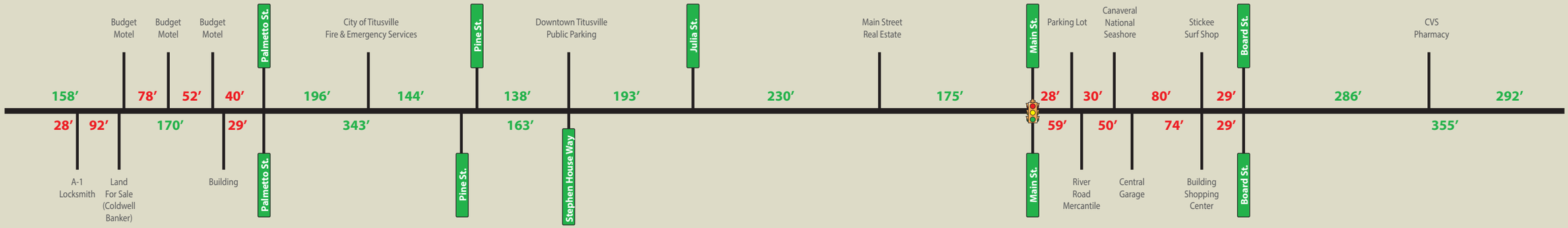
US 1 Concept Development & Evaluation

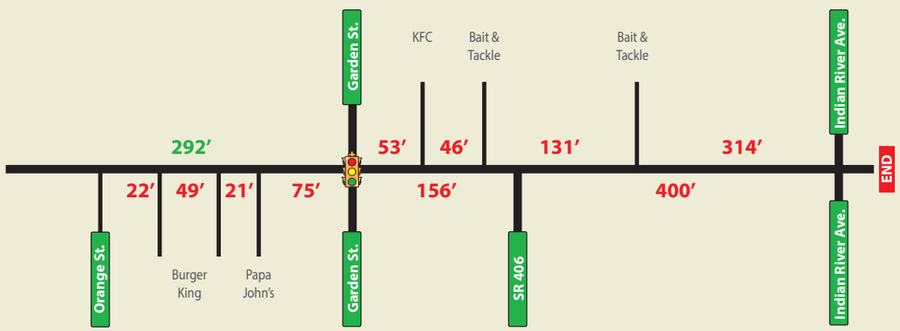
HOPKINS AVENUE | LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 6

Access Management - Driveway Spacing







LEGEND

000 - Meets Access Management Standards

000 - Does Not Meet Access Management Standards

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WASHINGTON AVENUE | LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 7
Access Management - Driveway Spacing

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LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 8
Access Management - Signalized Intersection Spacing

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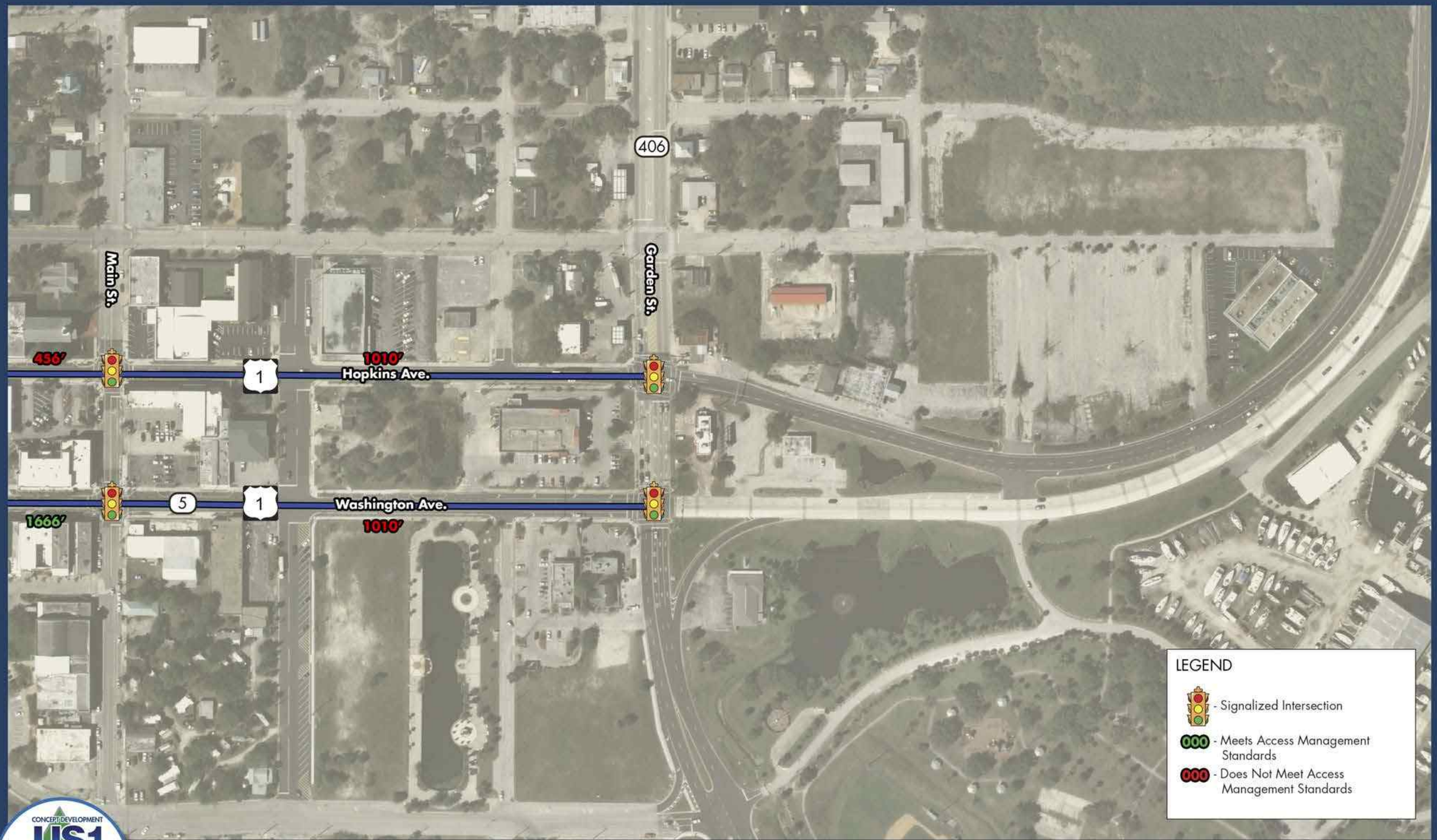
LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 9
Access Management - Signalized Intersection Spacing



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LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 10
Access Management - Signalized Intersection Spacing

2.4.6 Existing Intersection Geometry

Figure 11: Existing Intersection Geometry, Parking, and Lighting Facilities provides the year 2017 intersection geometry for the following Study Area intersections:

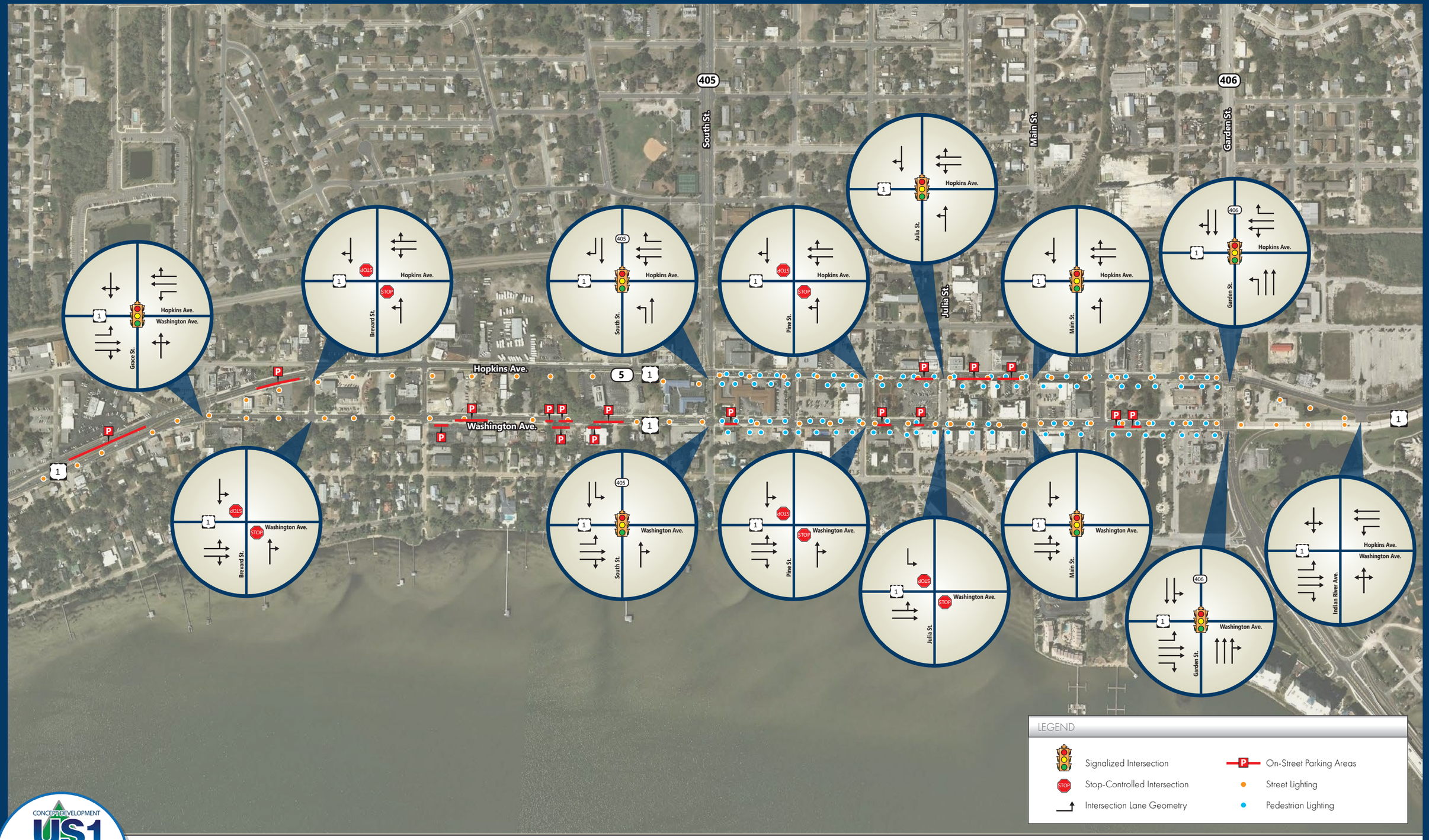
- US 1/Grace Street (Signalized)
- US 1 NB (Washington Avenue)/Brevard Street (Un-signalized)
- US 1 SB (Hopkins Avenue)/Brevard Street (Un-signalized)
- US 1 NB (Washington Avenue)/SR 405 (South Street) (Signalized)
- US 1 SB (Hopkins Avenue)/ SR 405 (South Street) (Signalized)
- US 1 NB (Washington Avenue)/Pine Street (Un-signalized)
- US 1 SB (Hopkins Avenue)/Pine Street (Un-signalized)
- US 1 NB (Washington Avenue)/Julia Street (Un-signalized)
- US 1 SB (Hopkins Avenue)/Julia Street (Signalized)
- US 1 NB (Washington Avenue)/Main Street (Signalized)
- US 1 SB (Hopkins Avenue)/Main Street (Signalized)
- US 1 NB (Washington Avenue)/SR 406 (Garden Street) (Signalized)
- US 1 SB (Hopkins Avenue)/SR 406 (Garden Street) (Signalized)
- US 1/Indian River Avenue (Un-signalized)

2.4.7 Parking

Existing public parking facilities within the Study Area consist of on-site parking lots, public parking lots, and on-street parking in various locations. US 1 NB (Washington Avenue) provides 39 on-street parking spots while US 1 SB (Hopkins Avenue) provides 25 on-street parking spots within the one-way pair. Between Laurel Place and Grace Street 375 linear feet of on-street parking is available on the northbound side. Parking is not allowed in this section but appears to be utilized by business along the roadway. On the southbound side, there 475 linear feet of paved shoulder wide enough for parking. This side has no signage prohibiting parking. Figure 11: Existing Intersection Geometry, Parking, and Lighting Facilities illustrates the location of existing on-street parking.

2.4.8 Lighting

Street lighting is provided along US 1 for the entire length of the Study Area. Traversing from the southern study limits to the northern limits, street lighting commences with two-way lamps installed in the median of US 1. As US 1 splits into one-way pairs, overhead lighting is provided for both directional roadways. Additional pedestrian lighting is present from SR 405 (South Street) to SR 406 (Garden Street) for both roadways in the downtown area. As the one-way pairs converge at the northern study limits lighting is located on poles in the median serving both travel directions of US 1. Specific lighting locations are illustrated on Figure 11: Existing Intersection Geometry, Parking, and Lighting Facilities
.



US 1 Concept Development & Evaluation

LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 11
Existing Intersection Geometry, Parking, and Lighting Facilities

2.4.9 Utilities

A Sunshine One-call ticket was processed in August 2017 to identify a listing of potential utilities provided within the Study Area. Utilities located within one quarter mile of the roadway center line were inventoried along within the Study Area and documented in this section. Table 4 below lists the various utility companies/agencies that have facilities located within the Study Area.

Table 4: Utility Agency Contacts

Utility Company	Notes
Florida City Gas *Bock Kreinhagen* *(321) 638-3424*	2-inch polyethylene pipe starts at SR 406 (Garden Street) heading south along the east side of Indian River Avenue splitting at Main Street with one segment heading further south ending at SR 405 (South Street) and the other crossing over Washington Avenue on the south side ending just before Hopkins Avenue. 2-inch polyethylene pipe also crosses Washington Avenue on the south side of Palmetto Street where it turns to 1.25 inch polyethylene before crossing over Hopkins Avenue on the south side as 1.25 inch steel piping. This piping then runs south on Palm Avenue along the west side and ends after Union Street.
CenturyLink *George McElvain* *(303) 992-9931*	No information provided.
Florida Power & Light *Joel Bray* *(954) 581-3088*	Utilities run from south of Study Area along the west side of Hopkins Avenue until SR 405 (South Street) where it switches to the east side ending just north of SR 406 (Garden Street). There are also utilities that parallel US 1 along the west side of Indian River Avenue ending east of the study area on SR 406 (Garden Street). Utilities can also be found from Riverside Drive to SR 405 (South Street) on the east side of Washington Avenue and crossing over both Washington Avenue and Hopkins Avenue on the south side of SR 405 (South Street) and north side of Riverside Drive, Main Street, Broad Street, SR 406 (Garden Street), and Indian River Avenue.
Level 3 Communications LLC *Michael Nunez* *(877) 366-8344* *Ext: 2*	Underground utilities run throughout the entire Study Area parallel to US 1 in the railroad R/W. Aerial utilities can be found along the west side of Palm Avenue from SR 405 (South Street) to Main Street.
Advanced Cabling Solutions INC *Joseph Muniz* *(407) 883-8881*	No information provided.
MCI (Verizon) *Dean Boyers* *(469) 886-4238*	Verizon Business buried cable runs along the railroad tracks parallel to US 1 throughout the entire study area before splitting at SR 406 (Garden Street) with one segment continuing north along the railroad tracks and the other segment heading east along SR 406 (Garden Street) crossing over both Hopkins Avenue and Washington Avenue ending just east of the Study Area.
City of Titusville *Jimmy Gager* *(321) 567-3883*	No information provided.
AT&T Distribution *Bryan Coughlin* *(954) 249-0558*	Aerial cable runs from SR 405 (South Street) to SR 406 (Garden Street) along the east side of Hopkins Avenue. It can also be found crossing both Hopkins Avenue and Washington Avenue on the north side of SR 406 (Garden Street), Broad Street, Main Street, Riverside Drive, and south side of SR 405 (South Street). There is also aerial

	cable along the east side of Washington Avenue from south of Brevard Street to North of SR 405 (South Street). Buried cable can be found crossing Washington Avenue and Hopkins Avenue on the south side of Julia Street, Pine Street, and Brevard Street and the south side of SR 405 (South Street) and St. John's Street. It is also located along the west side of Hopkins Avenue south of SR 405 (South Street) switching to the east side before ending at St. John's Street. A segment can also be found north of SR 406 (Garden Street) ending at Indian River Avenue on the east side of both Washington Avenue and Hopkins Avenue. Underground duct banks can be found along the west side of Hopkins Avenue from Grace Street to Julia Street.
Transcore *Tushar Patel* *(386) 943-5315*	Utilities can be found along the entire Study Area on the east side of Hopkins Avenue.
Sprint Nextel *Mark Caldwell* *(407) 422-6670*	Utility company representative specified that Sprint is only in the FEC railroad R/W. No other information was provided.
Spectrum *Paul Rymer* *(321) 757-6451*	Overhead fiber optic utilities can be found along the west side of Hopkins Avenue from south of the study area to SR 405 (South Street) where it goes west of the study area. It also runs along the east side of Washington Avenue from Brevard Street to south of SR 405 (South Street). There are also overhead fiber optic utilities on the east side of Hopkins Avenue from Julia Street to Main Street. They cross over Washington Avenue on the north side of Main Street and St. Johns Street; and the south side of SR 405 (South Street). It also crosses over Hopkins Avenue on the north side of Main Street and St. Johns Street and just south of Brevard Street. Underground fiber optic utilities are located crossing Washington Avenue on the north side of Brevard Street and between St. Johns Street and SR 405 (South Street).
Brevard County Water Resources *Roy Hawthorne* *(321) 633-2089*	No utilities located in Study Area.

Source: Sunshine State One. Data was aggregated to reflect Study Area section limits

Listed utilities in the Sunshine ticket does not indicate definite presence within the corridor. These utility companies will be contacted to verify the location and content of the utilities during the study.

2.4.10 Soils

Soil conditions were inventoried within the Study Area using data provided by the National Resources Conservation Service. Six soil types occur within the study corridor and are represented on Figure 12. Given the level of urbanization, most of the soils have been disturbed and reworked during development.

Source: Florida SSURGO (Soil Survey Geographic Database) (2010) via Florida Geographic Data Library (FGDL) (2017)

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LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 12
Soils Map

2.4.11 Drainage

The general stormwater conveyance system that serves the US 1 corridor is curb and gutter along the roadway with storm pipes that direct runoff to either a stormwater management facility or directly to an outfall. US 1 is generally depicted as flat terrain along the corridor. The United States Geological Survey (USGS) maps indicate a high point north of St. John's Street. The roadway elevation is approximately 14 National Geodetic Vertical Datum (NGVD) at this point and tapers to 10 NGVD at the southern limit of the Study Area and 2 NGVD at the northern limit. There are other local low points to facilitate drainage within the closed system. Ultimately, stormwater runoff from the US 1 corridor flows to the Indian River, east of the road.

Floodplain

As shown in Figure 13, according to the Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) for Brevard County (community panel 12009C0210G dated May 2016), US 1 has a small portion of the roadway within the Zone X. This zone has areas of 0.2% annual chance of flood; areas of 1% chance of flood with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance of flood. The area in the Zone X is located at SR 406 (Garden Street) in the northern limit of the Study Area. This area is also adjacent to a Floodplain Zone AE, where the base flood elevations have been determined (1.7 North American Vertical Datum (NAVD)). Any fill placed in this area between the Seasonal Highwater Level (SHWL) and the floodplain elevation will require floodplain compensation. No net encroachment into the floodplain is allowed between the SHWL and the floodplain elevation.

Existing Drainage Conditions and Considerations

Stormwater runoff from the US 1 corridor is conveyed to a curb and gutter system that provides drainage for the US 1 corridor. Along the corridor, curb inlets and catch basins connected to storm sewer systems that direct runoff to either a stormwater management facility or directly to the Indian River, east of the road. Construction as-builts provided by FDOT show six known discharge locations in the corridor. The locations are listed below.

1. Grace Street
2. Brevard Street
3. St. Johns Street
4. South Street
5. Main Street
6. Orange Street

If improvement options are chosen, the roadway runoff will need to be directed to new inlets. New stormsewer pipes would be required to connect to the existing stormsewer system. Previous drainage inlets would be converted to drainage manholes. The roadway spread for the proposed system would also need to be calculated. In the event of intersection improvements such as roundabouts, the existing stormsewer pipes will have enough capacity in the proposed condition because the roadway runoff will be reduced by reducing the amount of directly connected impervious area.

The detailed existing drainage conditions are described below. These were obtained from field observation, aerial review, general topography review and available adjacent permits and as-builts. The roadway itself does not have a permit with the St. Johns River Water Management District (SJRWMD). The overall drainage pattern is shown in Figure 14. Permit research and field notes are provided in **Appendix D**.

Intersection of Grace Street, Edison Avenue and South Washington Avenue

As shown in Drainage Map & Field Notes US 1 & Grace St in **Appendix D**. All the drainage in the vicinity of this intersection consists of a curb and gutter section draining to curb inlets. From SJRWMD permit 63864-4 for Ron Norris Honda – Buick GMC, the storm sewer system north of the Ron Norris car dealership flows north, before ultimately outfalling to the Indian River. The storm sewer south of Ron Norris, flows south, and then ultimately towards the Indian River. Additional supporting information is provided in the Field Notes US 1 & Grace Street figure in **Appendix D**.

Intersection of SR 406 (Garden Street) and US 1

As shown in Drainage Map & Field Notes SR 406 & US 1 in **Appendix D**. All the drainage in the vicinity of this intersection consists of a curb and gutter section draining to curb inlets. From SJRWMD permits 34976-1 (CVS Pharmacy) and 56330-3 (Titusville Downtown Stormwater Park), the conveyance of stormwater runoff in this area is as follows:

The storm sewer system on SR 406 (Garden Street) flows east along SR 406 (Garden Street) and then south along South Washington Avenue. It discharges to the Space Park pond, a wet detention pond on Orange Street. In the past, this pond has been an alum injection treatment system, before outfalling east in a 60-inch concrete storm sewer pipe along Orange Avenue to the Indian River. It is unclear if this pond is still an alum treatment system. The existing pond is shown in the Drainage Map & Field Notes SR 406 & US 1 figure in **Appendix D**.

The intersection of SR 406 and US 1 is adjacent to the floodplain. Any fill placed in this area between the Seasonal Highwater Level (SHWL) and the floodplain elevation, will require floodplain compensation. No net encroachment into the floodplain is allowed between the SHWL and the floodplain elevation.

SJRWMD Criteria

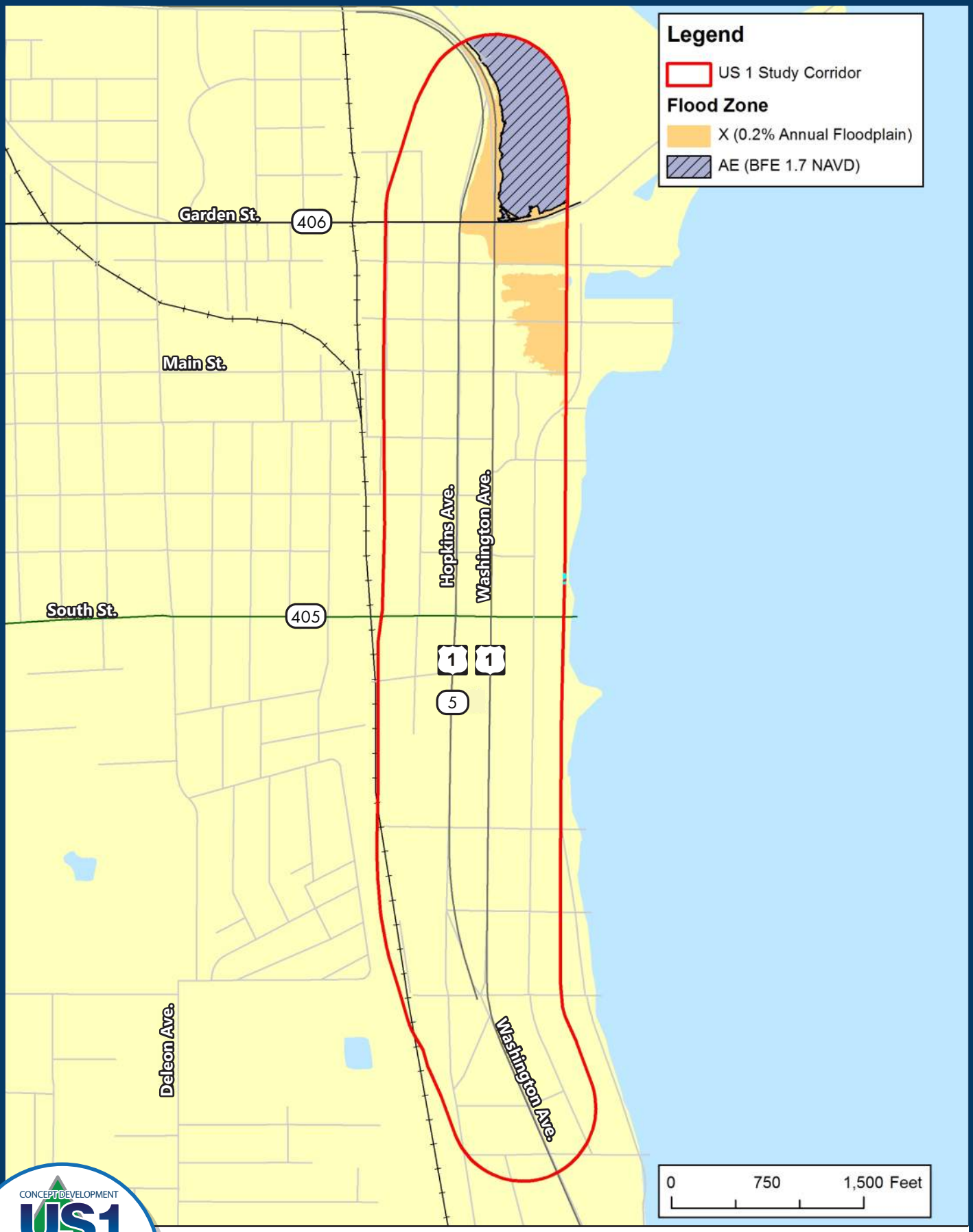
Proposed improvements to US 1 will be subject to the St. John's River Water Management District (SJRWMD) criteria that are current at the time of the improvement. In addition, the FDOT Drainage Manual requires that roadway projects' stormwater management facilities comply with Chapter 14-86 of the Florida Administrative Code regarding water quality, rate and volume.

The site is in the North Indian River Lagoon Basin, which is a hydraulically open basin that is impaired for nutrients. Stormwater may need to be treated prior to its discharge to the respective water bodies and adequate erosion and turbidity barriers will be used during the proposed construction activities.

If treatment volumes are required, and wet detention systems are used, the project will need to provide storage for the water quality volume equal to 1-inch of runoff detention over the drainage area, or 2.5-inches times the percentage of impervious (excluding water bodies), whichever is

greater. Additional water quality treatment volume and permanent pool volume are required because the North Indian River is a Class III. Water quality classifications are arranged in order of the degree of protection required, with Class I water having generally the most stringent water quality criteria and Class V the least. Class III designation necessitates that the waterbody remained viable for fish consumption; as well as recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife.

Source: Flood Hazard Zones of the Digital Flood Insurance Rate Map (DFIRM) in the State of Florida – May 2016 (FEMA)



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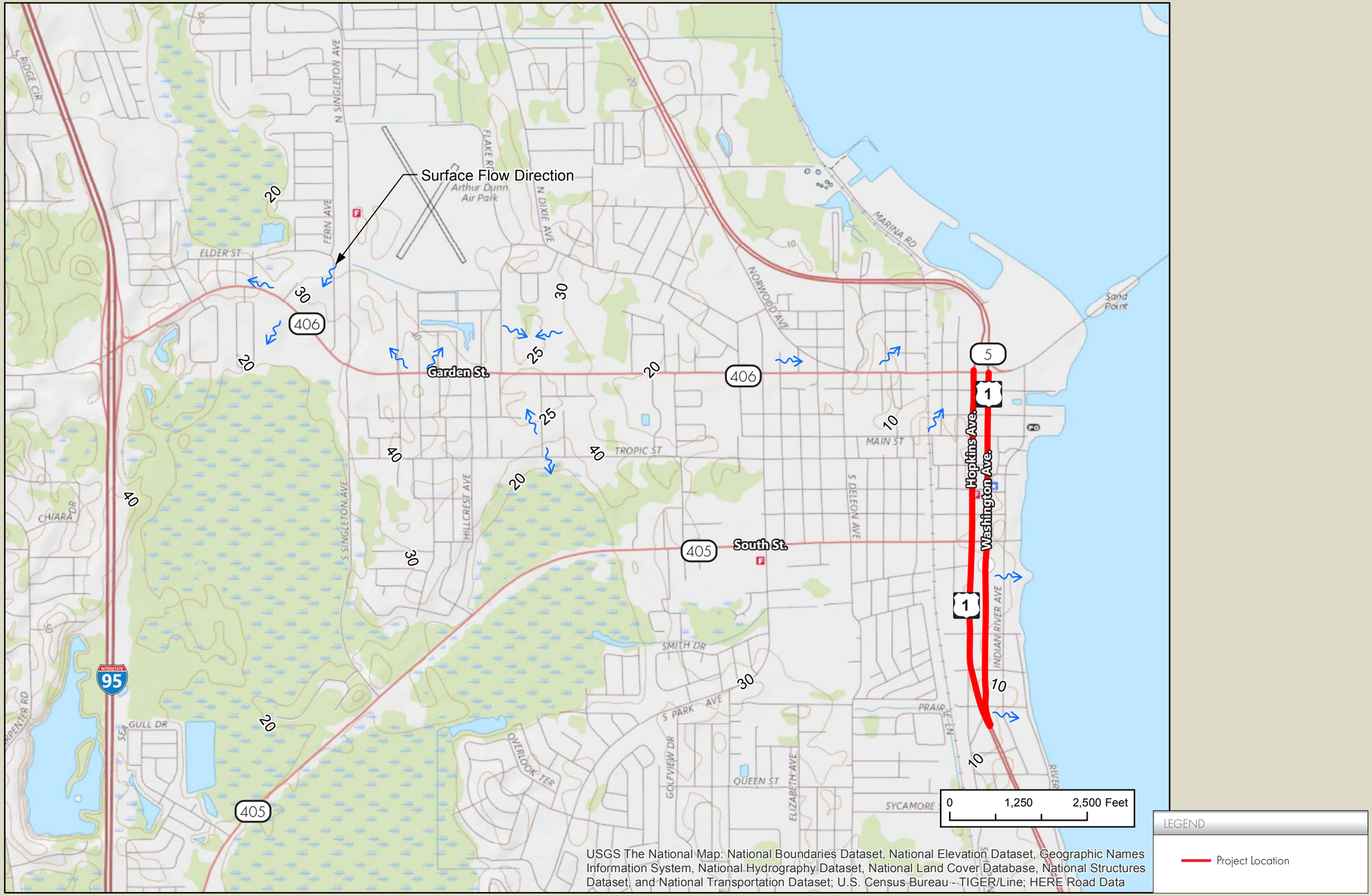
LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 13
Floodplains Map



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LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 14
USGS Drainage Map

2.4.12 Bicycle and Pedestrian Infrastructure

Bicycle and pedestrian connectivity plays an important role within the Study Area given the number of destinations along the corridor. This section details the existing bicycle and pedestrian network in the Study Area.

Bicycle Facilities

Undesignated bike lanes were identified along both sides of US 1 from Main Street north to Indian River Avenue as well as on the east side of US 1 NB (Washington Avenue) from Laurel Place to Grace Street. Figure 15 illustrates the location of existing bicycle facilities within the Study Area.

Pedestrian Facilities and Curb Cuts

US 1 has sidewalks present on both sides of the road, with the exception of the following locations:

- Sporadic sidewalk coverage on the east side of US 1 from Laurel Place to Grace Street
- No sidewalks on both sides of US 1 SB (Hopkins Avenue) between SR 406 (Garden Street) and Indian River Avenue
- No sidewalks along the west side of US 1 NB (Washington Avenue) between SR 406 (Garden Street) and Indian River Avenue

In general, curb ramps are provided at all intersections, except at the following location:

- Southwest corner of the US 1 Southbound/Brevard Street intersection

Existing pedestrian facilities locations are highlighted in Figure 15.

Crosswalks

Signalized crosswalks located at:

- US 1 and Grace Street
- US 1 and SR 405 (South Street)
- Hopkins Avenue and Julia Street
- US 1 and Main Street
- US 1 and SR 406 (Garden Street)

Non-Signalized crosswalks located at:

- Hopkins Avenue and SR 405 (South Street)

Mid-Block crosswalks located:

- On Washington Avenue between Palmetto Street and Pine Street (2)
- On Washington Avenue between Pine Street and Julia Street

Marked crosswalks at Study Area intersections are presented in Figure 15.

Trails

In addition to sidewalks and bike lanes, existing and planned regional trails within the Study Area were inventoried. Trails are multi-use paths that are used by runners, bicyclists, rollerbladers, and other non-motorized recreational users.

The Downtown Titusville Trail, illustrated in Figure 15, crosses both US 1 NB (Washington Avenue) and US 1 SB (Hopkins Avenue) at the Main Street intersections across the southern leg. This facility was recently (2017) implemented to provide a connection between the East Central Florida Regional Rail Trail to the northwest and the Future Space Coast Trail to the east. These trails are all part of the Coast-to-Coast trail network connecting St. Petersburg to the Space Coast.

Parallel Bicycle and Pedestrian Routes

The following parallel bicycle and pedestrian routes are highlighted in Figure 15: Existing and Proposed Trails, Existing Bicycle & Pedestrian Facilities
15:

Indian River Avenue – Located one block east of US 1 NB (Washington Avenue), Indian River Avenue runs parallel to US 1 from Laurel Place to SR 406 (Garden Street), a distance of about 1.2 miles. Sidewalk coverage is sporadic and there are no designated bike lanes, however this route has been identified as a pareallel route for bicycles due to its slower traffic speeds and lower traffic volume as compared with US 1. Signing is provided along Indian River Avenue indicate 'Bike Sharing Roadway.'

Palm Avenue – Located one block west of US 1 SB (Hopkins Avenue), Palm Avenue runs from SR 405 (South Street) to SR 406 (Garden Street), a distance of about half a mile. Sidewalks are provided along both sides of the road. There are no designated bike lanes, however this route offers slower traffic speeds and lower volume than the parallel US 1.

South

LEGEND

- Paved Shoulder
- Trail
- Sidewalk Gap
- Parallel Bike and Pedestrian Facility
- Signalized Crosswalk
- Non-Signalized Crosswalk
- Mid-Block Crosswalk

Laurel Pl.
Hopkins Ave.
Washington Ave.
South St.
Paved Shoulder
Sidewalk Gap
Sidewalk Gap

North

South St.
Pine St.
Julia St.
Downtown Titusville Trail
Garden St.
Hopkins Ave.
Washington Ave.
Indian River Ave.
Main St.
Paved Shoulder
Paved Shoulder
Sidewalk Gap

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LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 15
Existing and Proposed Trails,
Existing Bicycle & Pedestrain Facilities

School Bus Routes

There are no public schools located within the Study Area. However, Brevard Public Schools (BPS) operates a school bus route on US 1 throughout the Study Area, with potential bus stops on US 1 or the parallel facilities.

2.4.13 Transit Service and Infrastructure

Existing transit services in the Study Area are operated by Space Coast Area Transit (SCAT).

Overview of SCAT

SCAT provides transit service within Brevard County, featuring 19 local fixed bus routes. SCAT also provides paratransit service and commuter assistance vanpools. The existing SCAT transit service types found within the Study Area are described below in more detail.

Fixed-route – Regular local bus service providing frequent stops typically spaced every two blocks. Several routes within the SCAT system operate using "flag stops". Flag stops enable passengers to board a bus anywhere along the route simply by waving to the bus driver.

Paratransit Service - The paratransit program provides service for eligible individuals who are not able to use the regular fixed-route bus service because of a disability or other limitations. Paratransit service is subsidized depending on the type of trip through one of the following: the Americans with Disabilities Act (ADA) program, the Transportation Disadvantaged (TD) program, or a negotiated agency contract.

Commuter Assistance Vanpools - The vanpool program provides vehicles that are purchased by the Brevard County Commission with support from federal capital grants. These vehicles are then provided to a third party, vRide, who then lease these vehicles to commuters. The leasing rate includes all maintenance, insurance, and administration costs.

The paratransit service and the commuter assistance vanpools are available on a case-by-case basis by request.

SCAT Transit Service

SCAT fixed-routes located along or intersecting with the US 1 Study Area include:

- *Route 1 (Melbourne/Titusville – North Loop)* – The North Loop of Route 1 connects Titusville with Cocoa. It provides service along US 1 from the southern terminus of the Study Area (Laurel Place) to SR 405 (South Street). This route only serves the Study Area during morning and evening hours (all-day service is provided along a shorter segment of the route).
- *Route 2 (Titusville)* – This route serves as a local circulator for Titusville, operating in a counter-clockwise loop around the city. Within the Study Area, Route 2 provides service along US 1 NB (Washington Avenue) from Grace Street to Stephen House Way and on US 1 SB (Hopkins Avenue) from SR 406 (Garden Street) to SR 405 (South Street). Limited

service is provided along US 1 (both directions) north of SR 406 (Garden Street) past the northern terminus of the Study Area (Indian River Avenue).

- *Route 5 (Titusville/Mims)* – This route connects Titusville with Mims. This route provides service along the entire length of the US 1 Study Area.

There are no transit centers located within the Study Area. Figure 16 shows the existing SCAT bus routes serving the Study Area.

SCAT service in the Study Area is provided on weekdays and Saturdays with service not provided on select major holidays. Table 5 presents the span of service, frequency, and annual ridership for each Study Area transit route.

Table 5: SCAT Study Area Route Summary

Route	Route Description	Span of Service	Service Frequency	Flag Stop Route	October 2016 – August 2017 Total Ridership
1	Melbourne/Titusville (North Loop)	5:40 AM to 7:15 AM* 5:00 PM to 8:00 PM* Monday – Friday* One run at 7:45 AM* One run at 4:55 PM and 5:55 PM* Saturday*	60/30 Min* N/A*	Yes	225,217
2	Titusville	6:55 AM to 7:55 PM Monday – Friday 9:00 AM to 5:55 PM Saturday	60 Min 60 Min	No	82,807
5	Mims/Titusville	8:00 AM to 4:55 PM Monday – Friday 8:00 AM to 4:55 PM Saturday	60 Min	Yes	44,089

*Note: Route 1 offers all-day service, however it only provides limited service to the Study Area. The span of service and frequency data represents service provided to the US 1 Study Area.
*Note: Limited Service for Route 2 extends north on US 1 for the first and last 3 runs of the day for weekday service and at 1 PM and 5 PM on Saturday
Source: SCAT Posted Timetables (Effective 08/01/2017), SCAT 2013 Transit Development Plan, FY 2017 ridership provided by SCAT

Source: Space Coast Area Transit (2017)

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LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 16
Transit Routes & Facilities

2.4.14 Field Reviews

Two field reviews were conducted for the US 1 corridor study. Field review #1 was conducted on September 27, 2017, its purpose was to verify the existing conditions data collection and note additional findings. The team drove both corridors of US 1, walked the US 1 and Grace Street intersection, and the US 1 and SR 406 intersection. The team also stopped at US 1 and Pine Street and reviewed both northbound and southbound between Julia Street and Palmetto Street. Observations recorded include utilities, cross section measurements, drainage infrastructure, and potential design and MOT requirements for the proposed improvements.

Field Review #2 was conducted on May 18, 2018. The purpose of this field review was to understand the corridor in perspective of the proposed concept to understand potential design hurdles. The team drove both corridors of US 1, walked the US 1 and Grace Street intersection, and the US 1 and SR 406 intersection. Observations recorded include utilities, cross section measurements, drainage infrastructure, and potential design and MOT requirements for the proposed improvements. A summary of the field review observations and actions items from both Field Review #1 and Field Review #2 can be found in **Appendix D**.

2.5 Safety and Crash Analysis

Crash Data was obtained from Signal Four Analytics for the previous five years (January 01, 2011 to December 31, 2015) along US 1 from south of Grace Street to north of SR 406 (Garden Street).

2.5.1 Total Crashes

A total of 418 crashes, 114 of those resulting in injuries, were reported over the five-year period along US 1 within the Study Area, as illustrated by Table 6 and Figure 17.

Table 6: Crash Data Summary by Year

Year	Total Number of Crashes	Number of Injury Crashes	Total Number of Injuries	Number of Fatal Crashes	Total Number Fatalities	Number of Night Crashes	Number of Wet Crashes
Roadway: US 1 NB (Washington Avenue) Roadway ID: 70030000 Milepost: 2.925 to 4.290							
2011	25	9	11	0	0	5	0
2012	38	10	16	0	0	7	4
2013	48	12	22	0	0	9	4
2014	56	16	24	0	0	7	8
2015	38	4	7	0	0	5	2
2011-2015	205	51	80	0	0	33	18
Average	***41.0***	***10.2***	***16.0***	***0.0***	***0.0***	***6.6***	***3.6***
Percent	***-***	***24.9%***	***-***	***0.0%***	***-***	***16.1%***	***8.8%***
Roadway: US 1 SB (Hopkins Avenue) Roadway ID: 70030101 Milepost: 0.000 to 1.397							
2011	26	9	12	0	0	3	2
2012	43	13	17	0	0	6	3
2013	51	17	26	0	0	5	2
2014	54	17	25	0	0	4	3
2015	39	7	14	0	0	6	4
2011-2015	213	63	94	0	0	24	14
Average	***42.6***	***12.6***	***18.8***	***0.0***	***0.0***	***4.8***	***2.8***
Percent	***-***	***29.6%***	***-***	***0.0%***	***-***	***11.3%***	***6.6%***
Grand Total	***418***	***114***	***174***	***0***	***0***	***57***	***32***
Grand Percent	***-***	***27.3%***	***-***	***0.0%***	***-***	***13.6%***	***7.7%***

It was concluded from the analysis of both directions that the predominant crash types were angle crashes (25.8%) and sideswipe crashes (15.9%).

Table 7, summarizes the number of crashes by harmful event along the US 1 corridor.

Table 7: Crash Data Summary by Harmful Event

Crash Type	2011	2012	2013	2014	2015	2011-2015	Average Per Year	Percent
Roadway: US 1 NB (Washington Avenue)								
Roadway ID: 70030000 Milepost: 2.925 to 4.290								
Angle	5	9	10	13	6	43	**8.6**	**21.0%**
Sideswipe	4	9	3	10	8	34	**6.8**	**16.6%**
Rear End	3	4	9	8	8	32	**6.4**	**15.6%**
Left Turn	0	4	4	3	3	14	**2.8**	**6.8%**
Off Road	0	1	6	4	2	13	**2.6**	**6.3%**
Bicycle	2	0	0	2	0	4	**0.8**	**2.0%**
Right Turn	0	0	0	0	2	2	**0.4**	**1.0%**
Head On	0	0	0	0	1	1	**0.2**	**0.5%**
Pedestrian	0	0	0	1	0	1	**0.2**	**0.5%**
Rollover	0	1	0	0	0	1	**0.2**	**0.5%**
Other	11	10	16	15	8	60	**12.0**	**29.3%**
Total	***25***	***38***	***48***	***56***	***38***	***205***	-	***100.0%***
Roadway: US 1 SB (Hopkins Avenue)								
Roadway ID: 70030001 Milepost: 0.000 to 1.397								
Angle	12	9	19	15	10	65	**13.0**	**30.5%**
Sideswipe	4	7	6	10	8	35	**7.0**	**16.4%**
Rear End	3	4	8	5	4	24	**4.8**	**11.3%**
Left Turn	1	1	0	4	1	7	**1.4**	**3.3%**
Off Road	0	0	2	0	2	4	**0.8**	**1.9%**
Head On	1	0	2	0	0	3	**0.6**	**1.4%**
Right Turn	0	0	1	0	2	3	**0.6**	**1.4%**
Pedestrian	1	1	0	0	0	2	**0.4**	**0.9%**
Bicycle	1	0	0	1	0	2	**0.4**	**0.9%**
Rollover	0	0	0	0	1	1	**0.2**	**0.5%**
Other	3	21	13	19	11	67	**13.4**	**31.5%**
Total	***26***	***43***	***51***	***54***	***39***	***213***	-	***100.0%***
Grand Total	***51***	***81***	***99***	***110***	***77***	***418***	-	-

Segment crash rates in crashes per million vehicle-miles traveled were calculated for the US 1 corridor in order to compare the actual crash rate of the corridor to the statewide average crash

rate for similar facilities during the study period. Each transition in crash rate category or Annual Average Daily Traffic (AADT) requires a break in the segment crash rate calculation, resulting in three distinct segments on US 1 NB (Washington Avenue), three distinct segments on Hopkins Avenue and one for Laurel Place to Grace Street for which an individual crash rate was calculated and compared to the statewide average for the corresponding crash rate category. The Statewide Average Crash Rate was extracted from the FDOT CAR system.

As seen in Table 8 both roadway segment of US 1 from SR 406 (Garden Street) to SR 405 (South Street) as well as from Laurel Place to Grace Street experienced an average crash rate higher than the average crash rate for similar facilities according to FDOT's State wide average. The length of the Laurel Place to Grace Street segment, 0.153 miles, implies a higher per-mile concentration of crashes compared to the statewide average crash rate. These segments are noted as high crash segments and will be considered during the planning process. The high crash rate from SR 406 (Garden Street) to SR 405 (South Street) for both northbound and southbound segments of US 1 can be primarily attributed to a high rate of crashes at the intersections of US 1 and SR 406 (Garden Street). Safety at these intersections will be a major consideration moving forward.

Table 8: Summary of Crash Rates (number of crashes per million vehicle miles)

From/To	Number [1] of Crashes[4]	Length (miles)	AADT	ACR[2]	Crash Rate Category	AVG[3]	High Crash Segment?
Roadway: US 1 Roadway ID: 70030000 Milepost: 2.925 to 3.078							
Laurel Place to Grace Street	13	0.153	3,000	3.43	Urban 4-5 Ln 2Way Divided Road	12	Yes
Roadway: US 1 NB (Washington Avenue) Roadway ID: 70030000 Milepost: 3.078 to 4.290							
Grace Street to SR 405 (South Street)	38	0.497	12,000	3.49	Urban One Way	40	No
SR 405 (South Street) to SR 406 (Garden Street)	130	0.509	12,000	11.66	Urban One Way	40	Yes
SR 406 (Garden Street) to Indian River Avenue	15	0.206	8,200	4.87	Urban One Way	40	No
Roadway: US 1 SB (Hopkins Avenue) Roadway ID: 70030101 Milepost: 0.000 to 1.397							
Grace Street to SR 405 (South Street)	79	0.497	11,000	7.92	Urban One Way	9.40	No
SR 405 (South Street) to SR 406 (Garden Street)	132	0.509	12,000	11.84	Urban One Way	9.40	Yes
SR 406 (Garden Street) to Indian River Avenue	2	0.206	8,900	0.60	Urban One Way	9.40	No

1- Number of crashes from January 1, 2011 to December 31, 2015.
2- Average Crash Rate (ACR) = (N*1,000,000)/(365*Y*AADT*L), where N = number of crashes, Y = number of years, AADT = Annual Average Daily Traffic, and L = Length of the segment in miles.

3- AVG = Statewide Average Crash Rate for Corresponding Category.
4- Segments are defined as not including the 'from' intersection, but including the 'to' intersection

2.5.2 Bicycle and Pedestrian Crashes

Nine (9) crashes including a pedestrian and a cyclist occurred on US 1 within the Study Area from 2011 to 2015. Of those, four (4) cyclist and one (1) pedestrian incident occurred northbound, while southbound there were two of each. Northbound, one incident with a bicyclist occurred during the night in dry conditions while the other four happened during dry daytime conditions, including the single pedestrian collision. Southbound, three of the four incidents occurred during dry daytime conditions while the other happened during dry night time conditions.

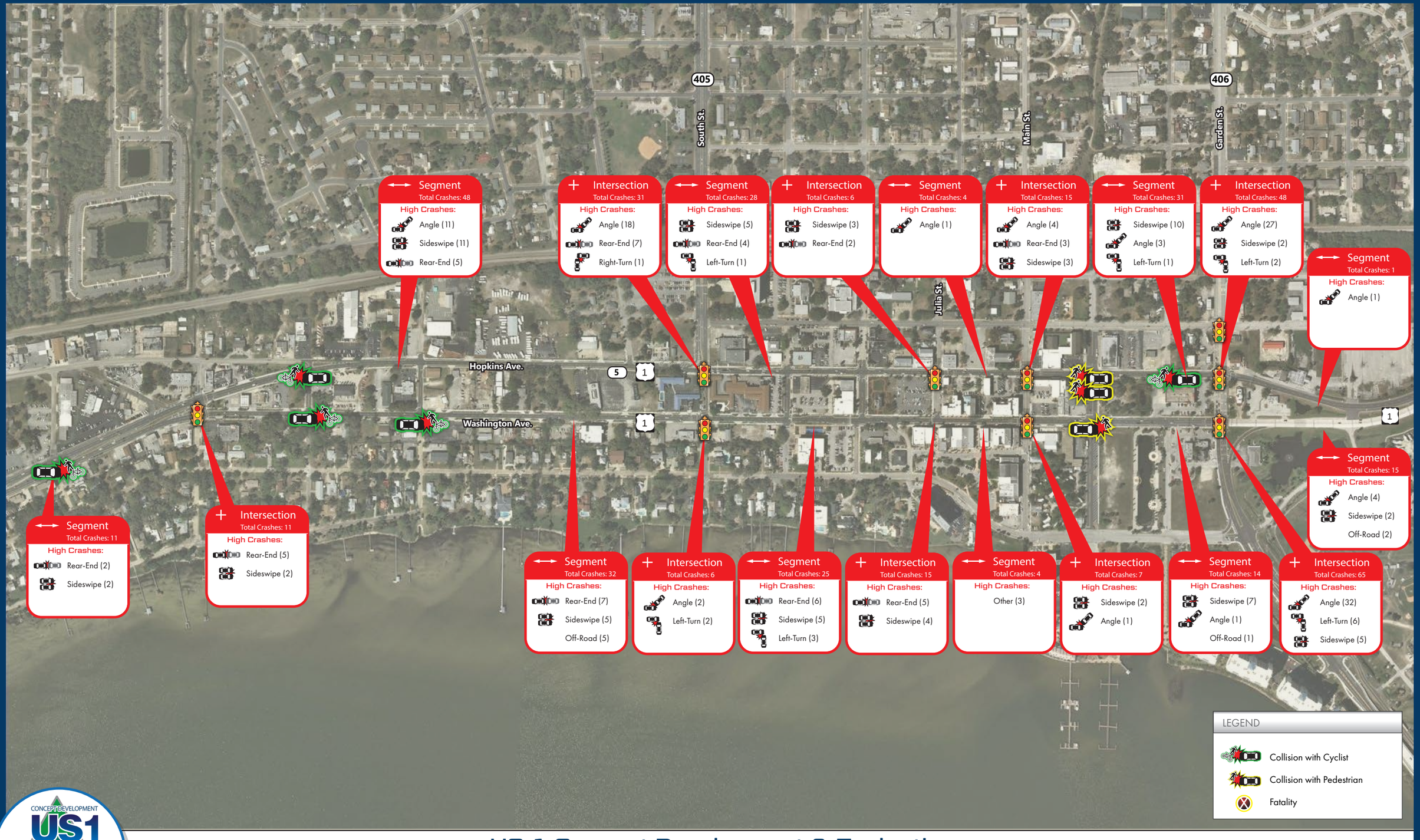

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FIGURE 17
Crash Location Map

2.6 Existing Traffic Conditions

2.6.1 Existing Traffic Volumes

Traffic counts were collected in August 2017 at the following Study Area locations:

24-hr Tube Count Locations

- **US 1 NB (Washington Avenue)**
  - South of Grace Street
  - North of Grace Street
  - South of SR 406 (Garden Street)
  - North of SR 406 (Garden Street)
- **US 1 SB (Hopkins Avenue)**
  - South of Grace Street
  - North of Grace Street
  - South of SR 406 (Garden Street)
  - North of SR 406 (Garden Street)
- **Grace Street**
  - West of US 1 SB
  - East of US 1 NB

Existing roadway 24-hour bi-directional volume counts were collected at the above mentioned locations. Weekday turning movement counts were collected at the Study Area intersections for the AM (7:00 – 9:00 AM) and PM (4:00 – 6:00 PM) peak hours.

Intersections

- US 1 at Grace Street
- US 1 NB (Washington Avenue) at SR 406 (Garden Street)
- US 1 SB (Hopkins Avenue) at SR 406 (Garden Street)

All traffic count data collected was adjusted utilizing the latest (2016) FDOT axle and seasonal adjustment factors for Brevard County to provide 2017 annual average conditions. All collected traffic counts and seasonal factors are provided in **Appendix E**. Existing 2017 volumes are illustrated in Figure 18 and Figure 19.

2.6.2 Spot Speed Study

Four spot speed studies were conducted along US 1 corridor in March of 2015 as part of the Corridor Planning Study. The posted speed limit within the Study Area on US 1 NB (Washington Avenue) from Grace Street to SR 405 (South Street) is 40 MPH, from SR 405 (South Street) to north of SR 406 (Garden Street) is 30 MPH, and increases to 35 MPH between SR 406 (Garden Street) and Indian River Avenue. The posted speed limit for US 1 SB (Hopkins Avenue) from Indian River Avenue to north of SR 406 (Garden Street) is 35 MPH, from north of SR 406 (Garden Street) to SR 405 (South Street) is 30 MPH and from SR 405 (South Street) to Grace Street is 40 MPH.

Factors used in interpreting spot speeds are defined below:

a) 85th Percentile Speed – The speed that 85% of the free-flowing vehicles do not exceed.

b) 50th Percentile Speed – The speed that 50% of the free-flowing vehicles do not exceed.
c) Pace – A 10-MPH range that includes the highest number of vehicles observed.

Table 9: Vehicle Spot Speed Summary

Locations #1 and #2 North of St. Johns Street		
Direction	**SB**	**NB**
Posted Speed	40	40
85th Percentile	42.0	42.0
50th Percentile	38.0	37.0
10 MPH Pace	33-42	33-42
Locations #3 and #4 North of Palmetto Street		
Posted Speed	30	30
85th Percentile	34.0	35.0
50th Percentile	29.0	30.0
10 MPH Pace	24-33	25-34

The speed data reveals that vehicles traveling southbound and northbound through stations 3 and 4 move at 34.0 MPH and 35.0 MPH, consecutively. The 30 MPH posted speed is above the 50th Percentile Speed for the southbound direction and at the 50th Percentile Speed for the northbound direction. The 30 MPH posted speed is within the 10 MPH Pace at these locations.

Based on the spot speed studies data analyses and engineering judgment, we conclude that the operating speed along the study segment of US 1 is above the posted speed of 30 MPH for the segment from SR 405 (South Street) to SR 406 (Garden Street), while the operating speed appeared to be lower than the posted speed of 40 MPH for the segment from Grace Street to SR 405 (South Street).

2.7 Existing Operational Analysis

Existing 2017 operational analysis was conducted to determine the Level of Service (LOS) for the roadway segments and the study area intersections. Peak hour peak direction volumes along the different segments were compared against the latest Generalized Peak Hour Directional Service Volumes Tables from the 2012 FDOT Quality/Level of Service Handbook to obtain the arterial LOS. The LOS for the study area intersections were determined using the procedures as outlined in the Transportation Research Board's (TRB) – Highway Capacity Manual (HCM 2010) using Synchro Software (version 9.0).

2.7.1 Roadway Operational Analysis

According to FDOT, the study corridor is classified as an "urban principal arterial other" and has an adopted LOS "D". The generalized peak hour directional service volumes for the LOS letters "A" through "F" were obtained from Table 7 of the 2012 FDOT Quality/Level of Service Handbook and

compared with volumes collected from the 24-Hour bi-directional tube counts. A summary of the LOS analysis for the study roadways is included in Table 10.

Table 10: Existing Roadway Level of Service

Roadway/Segment	Daily		AM Peak (Peak Direction)		PM Peak (Peak Direction)	
	AADT	LOS	Volume	LOS	Volume	LOS
US 1						
Laurel Place to Grace Street	23,000	C	880 (NB)	C	1000 (NB)	C
US 1 SB (Hopkins Avenue)						
Grace Street to SR 405 (South Street)	12,000	C	800	C	920	C
SR 405 (South Street) to SR 406 (Garden Street)	12,000	D	850	C	860	C
SR 406 (Garden Street) to Indian River Avenue	8,900	D	630	C	690	C
US 1 NB (Washington Avenue)						
Grace Street to SR 405 (South Street)	12,000	C	840	C	940	C
SR 405 (South Street) to SR 406 (Garden Street)	12,000	D	840	C	980	D
SR 406 (Garden Street) to Indian River Avenue	8,300	C	580	C	700	C
Grace Street						
West of US 1 SB (Hopkins Avenue)	1,600	C	60 (WB)	C	210 (WB)	C
East of US 1 NB (Washington Avenue)	490	C	20 (WB)	C	35 (WB)	C

2012 FDOT Quality/Level of Service Handbook Tables
*AADT = Data Collected * Seasonal Factor (1.06) * Axle Factor (0.98)*

As shown in Table 10, all the segments within the US 1 corridor currently operates within acceptable LOS standards.

2.7.2 Intersection Operational Analysis

According to the HCM 2010, for signalized intersections, an average control delay per vehicle from 55 seconds up to 80 seconds is considered to be a LOS E condition. Beyond 80 seconds is considered to be a LOS F condition. A summary of the LOS analysis for the study intersections is included in Table 11.

Table 11: 2017 Intersection Level of Service

Intersection	Control	AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
US 1/Grace Street	Signalized	5.2	A	5.5	A
US 1 NB (Washington Avenue)/SR 406 (Garden Street)	Signalized	8.8	A	9.9	A
US 1 SB (Hopkins Avenue)/SR 406 (Garden Street)	Signalized	14.4	B	13.6	B

As seen in Table 11, all study area intersections currently operate under acceptable LOS conditions during the AM and PM peak hours.

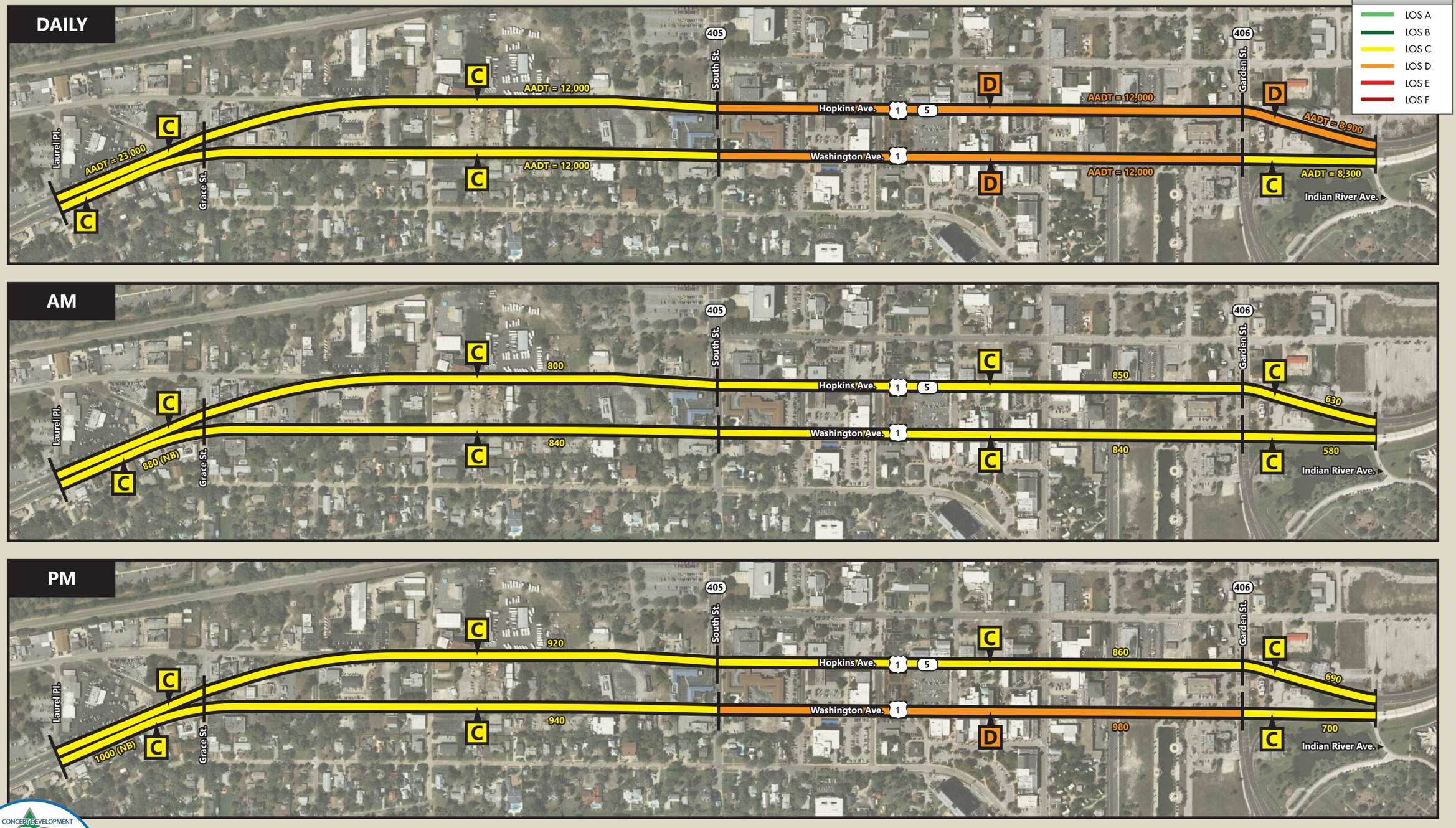

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FIGURE 18
Existing 2017 Roadway Operations

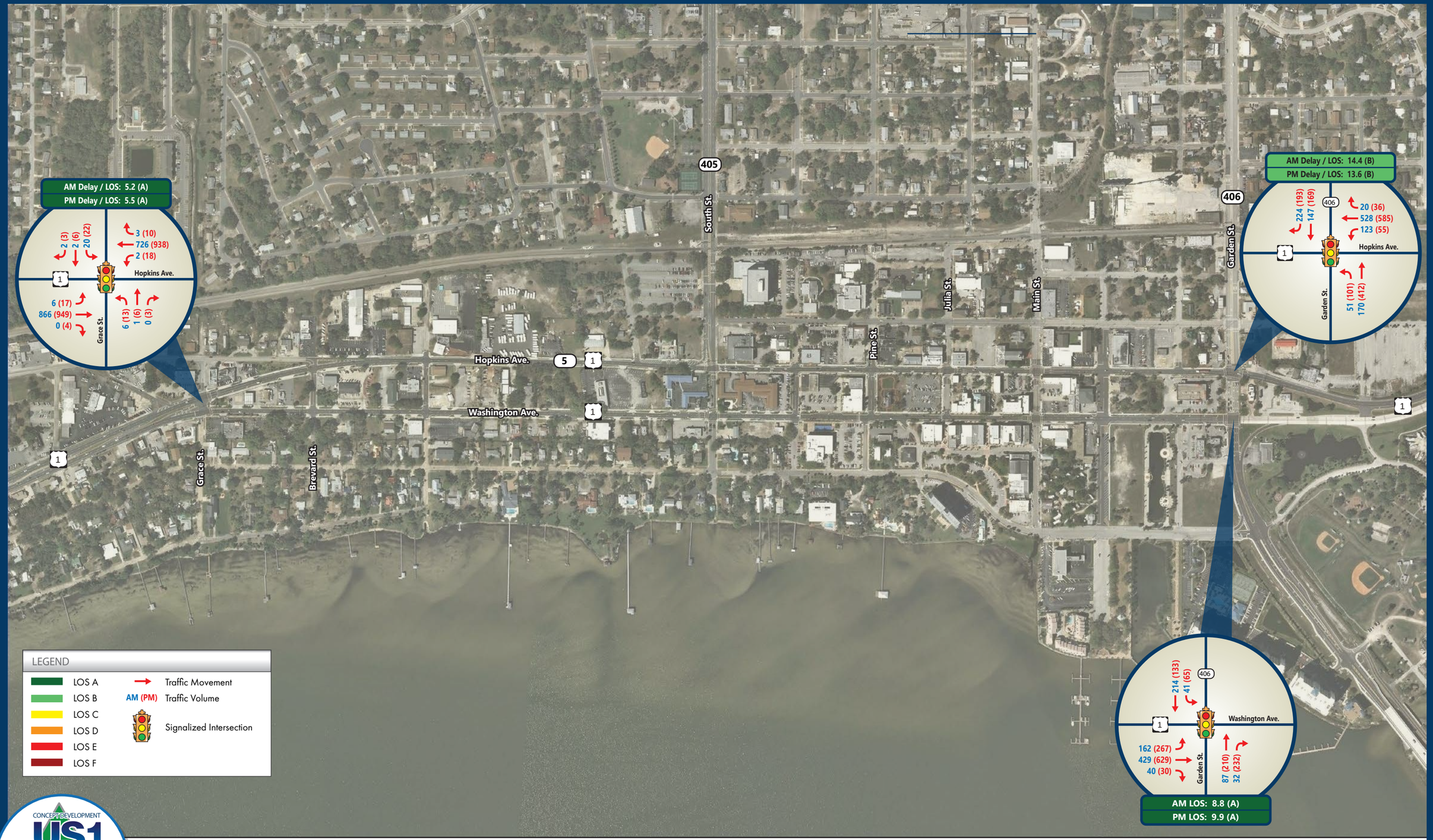

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FIGURE 19
Existing 2017 Intersection Operations

2.8 Environmental Character

The existing environmental conditions were extracted from Geographical Information System (GIS) datasets maintained by the Florida Geographic Data Library (FGDL). For purposes of this environmental analysis, a buffer of 500 feet was used for the study area.

The following were examined as part of this review:

- Cultural Resources
- Social Resources
- Population Characteristics
- Socioeconomic Characteristics
- Major Employers and Activity Centers
- Threatened and Endangered Species
- Wetlands
- Floodplains
- Contamination

2.8.1 Cultural Resources

Cultural resources are defined by the National Historic Preservation Act (NHPA) of 1966 and governed by federal and state regulations. Section 106 of the NHPA provides a general process for cultural resource assessments and requires that historic and archaeological resources be considered in project planning for federally funded or permitted projects. Cultural resources or "historic properties" include any "prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the *National Register of Historic Places (NRHP)."*

Archaeological sites or historic resources that are listed, determined eligible, or considered potentially eligible by the State Historic Preservation Office (SHPO) for listing in the NRHP are listed in Table 12. These sites along with other state recorded sites and survey locations are graphically depicted in Figure 20.

Table 12: Summary of Cultural Resources

Cultural Resources	Within Study Area
SHPO Structures	166
SHPO Bridges	0
SHPO Resource Groups	4
National Register (Site, District, Building)	6
Archaeological/Historic Sites	1
SHPO Surveys	5

Source: FGDL, ETDM

The SHPO Resource Groups include 2 linear resources, Florida East Coast Railroad and US Highway 1/Cocal Boulevard, and 2 Historic Districts which include the Titusville Downtown Residential and Commercial Districts. According to the Florida Master Site File (FMSF), six sites or structures are listed on the NHRP within the Study Area, with others shown as eligible for listing. These sites include:

- St. Gabriel's Episcopal Church (Listed)
- Judge George Robbins House (Listed)
- Pritchard House (Listed)
- Titusville Commercial District (Listed)
- Wager House (Listed)
- Spell House (Listed)
- Florida East Coast Railroad (Eligible
- Brevard County Courthouse (Eligible)
- 423 Palm Avenue (Eligible)

Source: Florida State Historic Preservation Office (SHPO) Survey (2016)

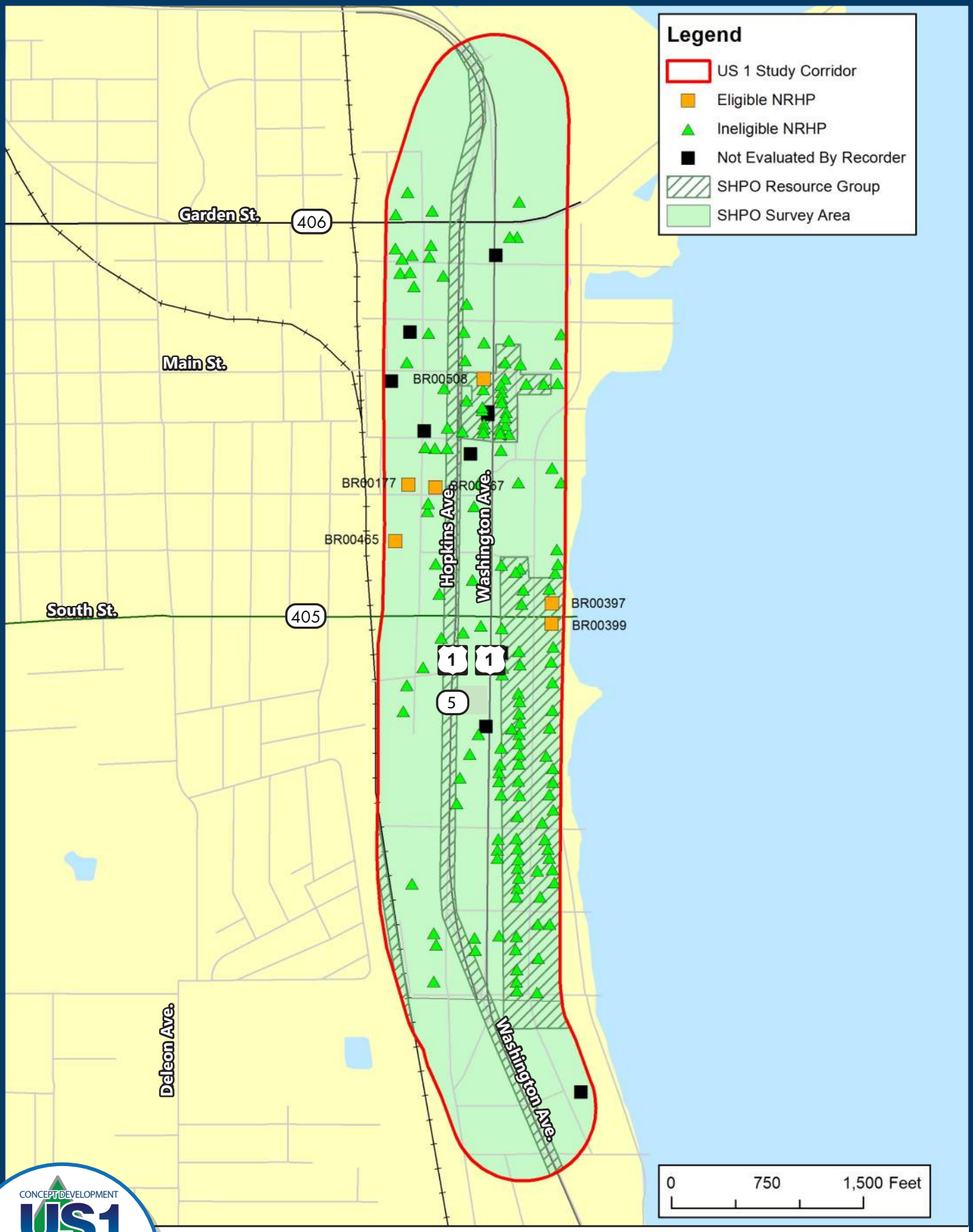

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FIGURE 20
Cultural Resources Map

2.8.2 Social Resources

Any public or private social resources that were considered relevant to the Study Area were tabulated. Table 13 below summarizes the public facilities within the Study Area. Figure 21 graphically displays the results of the social resource evaluation. Several of the government buildings are clustered into government complexes, thus only 3 are presented graphically.

Table 13: Summary of Public Facilities

Social Resources	Within Study Area
FDEM* Places of Worship	2
Florida Marine Facilities	1
Cemeteries	0
Community Centers	1
Cultural Centers	1
Fire Stations	1
Government Buildings	6
Health Care Facilities	4
Homeowner and Condominium Associations	2
Parks	2
Religious Centers	8
Schools	0
Social Service Facilities	2

Source: University of Florida GeoPlan Center, FGDL, ETDM
*FDEM – Florida Department of Emergency Management

The Study Area is adjacent to Sand Point Park and Space View Park. These parks are protected under the Department of Transportation Act (DOT Act) of 1966-section 4(f). The project area is also part of the Indian River Lagoon National Scenic Byway. The Indian River Lagoon National Scenic Byway received its recognition in 2000 for its outstanding scenic, historic, cultural, natural, recreational and archeological qualities.

Source: University of Florida GeoPlan Center (Accessed via FGDL, July 2017), Florida Department of Business & Professional Regulation (2010), and Brevard County GIS (2013).

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FIGURE 21
Public Facilities Map

2.8.3 Population Characteristics

An overview of the corridor population and demographics data collected for the US Census 2010 and the American Community Survey are provided in Table 14. The data presented reflects an analysis based on abutting Census Tracts. Population density is approximately 4.46 persons per acre and housing density is 1.21 households per acre. Average household size in the abutting area is 2.42 persons per household and the median age is 38 years old.

Table 14: Population Characteristics

Characteristic	Study Area
Total Population	1,429
Population Density (Persons per Acre)	4.46
Total Households	652
Average Household Size	2.42
Household Density (Households per Acre)	1.21
Median Age	38
Population Over 65	21.8%
Male	50.0%
Female	50.0%

2.8.4 Socioeconomic Data

Table 15 provides an overview of the socioeconomic characteristics. In the US 1 Study Area, the median household income is $34,063, and 29.6 percent of the households are below the poverty line. Of the 950 total housing units, 26.6 percent are owner-occupied, and 42.0 percent are renter-occupied. The remaining 31.4 percent of housing units in the Study Area are vacant. Approximately Twenty-seven percent of the households have no vehicle available and 36.4 percent have only one vehicle available. The majority of the population, 61.7 percent, in the Study Area identifies as white only, and 33.3 percent identify themselves as black or African American. Given the percentage of households below the poverty level and the population that identifies as black or African American, environmental justice should be considered with future project planning. Figure 22 and Figure 23 illustrate median household income and households with no vehicles, respectively.

Table 15: Socioeconomic Characteristics

Population	Study Area
Median Household Income	$34,063
Households Below Poverty Level	29.6%
Total Housing Units	950
Owner-Occupied	26.6%
Renter-Occupied	42.0%
Vacant	31.4%
Households with No Vehicles	27.4%
Households with 1 Vehicle	36.4%
Total Population	1,429
White	61.7%
Hispanic or Latino	4.6%
Not Hispanic or Latino	57.1%
Black of African American	33.3%
Asian	0.6%
Other	4.4%

2.8.5 Major Employers and Activity Centers

The City of Titusville is the largest employer along the study corridor. The Titusville Sewer and Water Department, which is just one of the City departments along the corridor employs 500 persons. Other major employers along the US 1 corridor include Brevard County and the Florida Department of Education.

Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey.

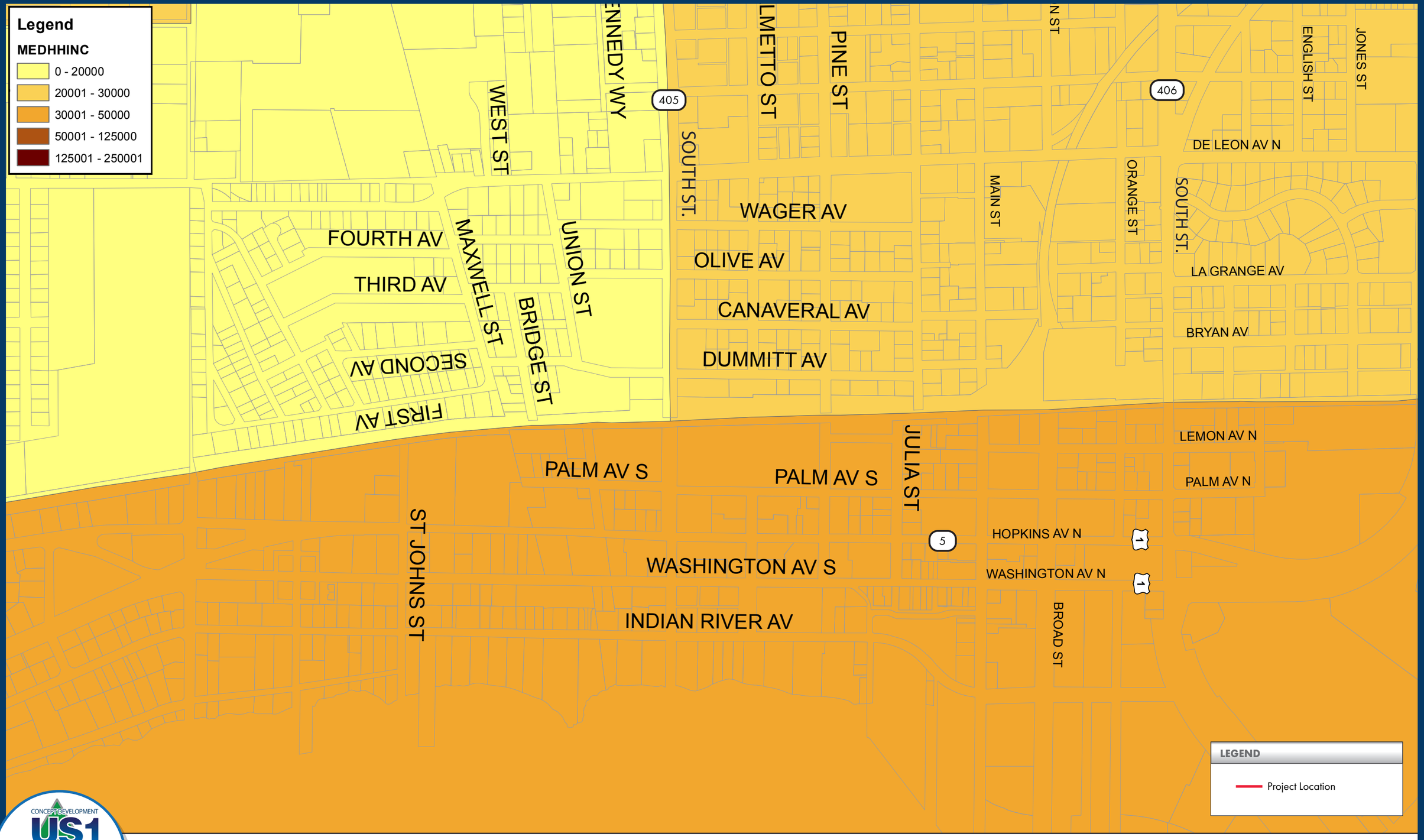

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FIGURE 22
Median Household Income Map

Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey.

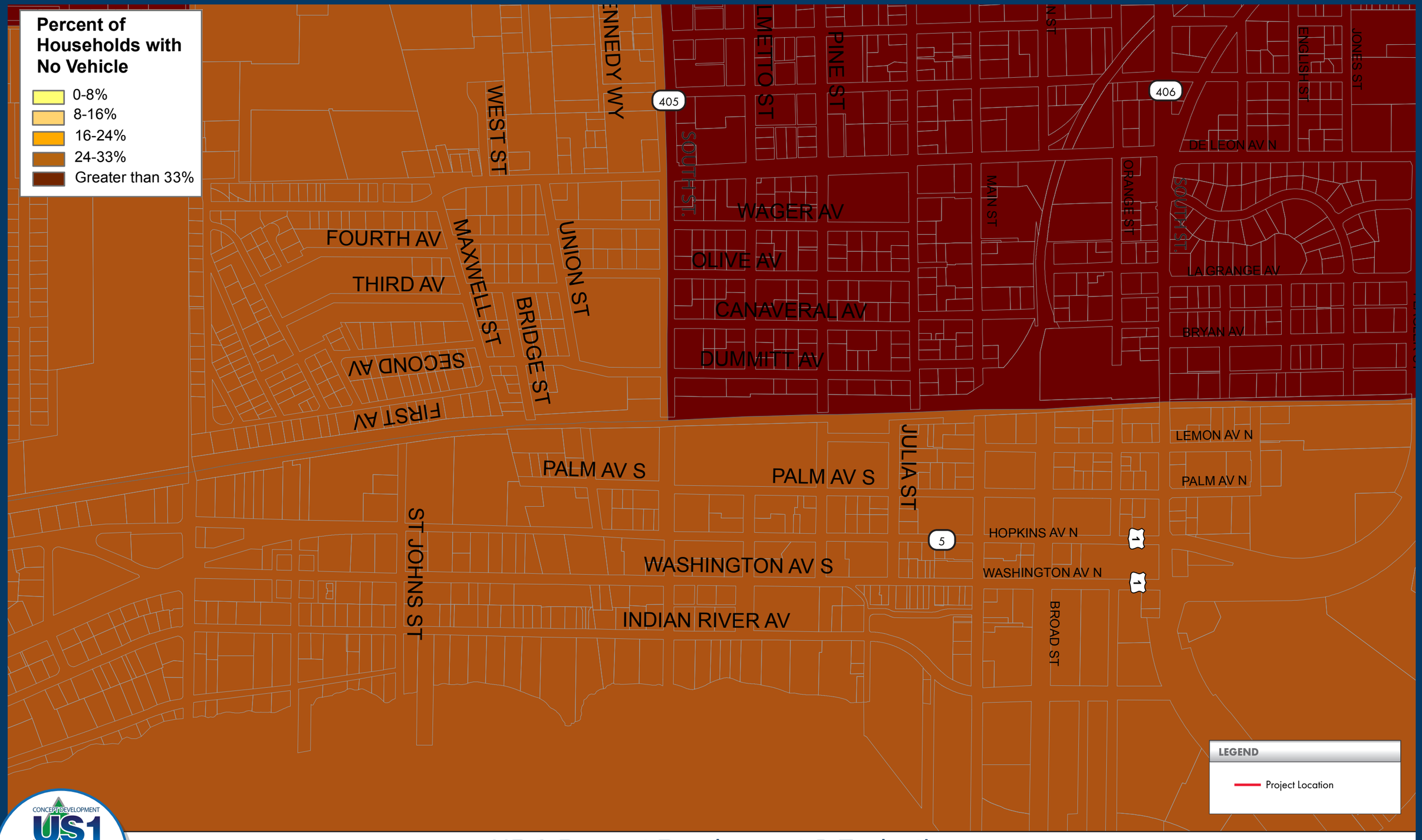

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FIGURE 23
Percentage of Households with No Vehicles Map

2.8.6 Threatened and Endangered Species

Reviews of the Florida Natural Areas Inventory (FNAI) and GIS data from the US Fish and Wildlife Service (USFWS) and Florida Fish and Wildlife Conservation Commission (FWC) identified critical habitat and/or consultation areas for threatened or endangered species. Consultation areas, identified by USFWS, encompass all areas where populations are known to exist. These threatened and endangered species consultation areas and/or critical habitats are summarized in Table 16 and shown in Figure 24. It must be noted that the entire Study Area is located within low quality habitat with limited habitat richness due to the developed nature of the area. However, existing stormwater ponds and swales may provide intermittent foraging habitat for protected wading and colonial bird species.

Table 16: Summary of Wildlife and Habitat

Wildlife and Habitat	Abutting Buffer	Study Area	Habitat within Study Area
Wood Stork Core Foraging Areas	Yes	Yes	Yes
Red-cockaded Woodpecker Consultation Areas	No	No	No
Crested Caracara Consultation Area	Yes	Yes	No
Florida Scrub Jay Consultation Area	Yes	Yes	No
Atlantic Salt Marsh Snake Consultation Area	Yes	Yes	No
Snail Kite Consultation Area	Yes	Yes	No
Piping Plover Consultation Area	Yes	Yes	No

Source: US Fish and Wildlife Service (USFWS), 2011; Florida Natural Areas Inventory (FNAI), 2009.

Source: U.S. Fish and Wildlife Service (USFWS), 2011; Florida Natural Areas Inventory (FNAI), 2009.

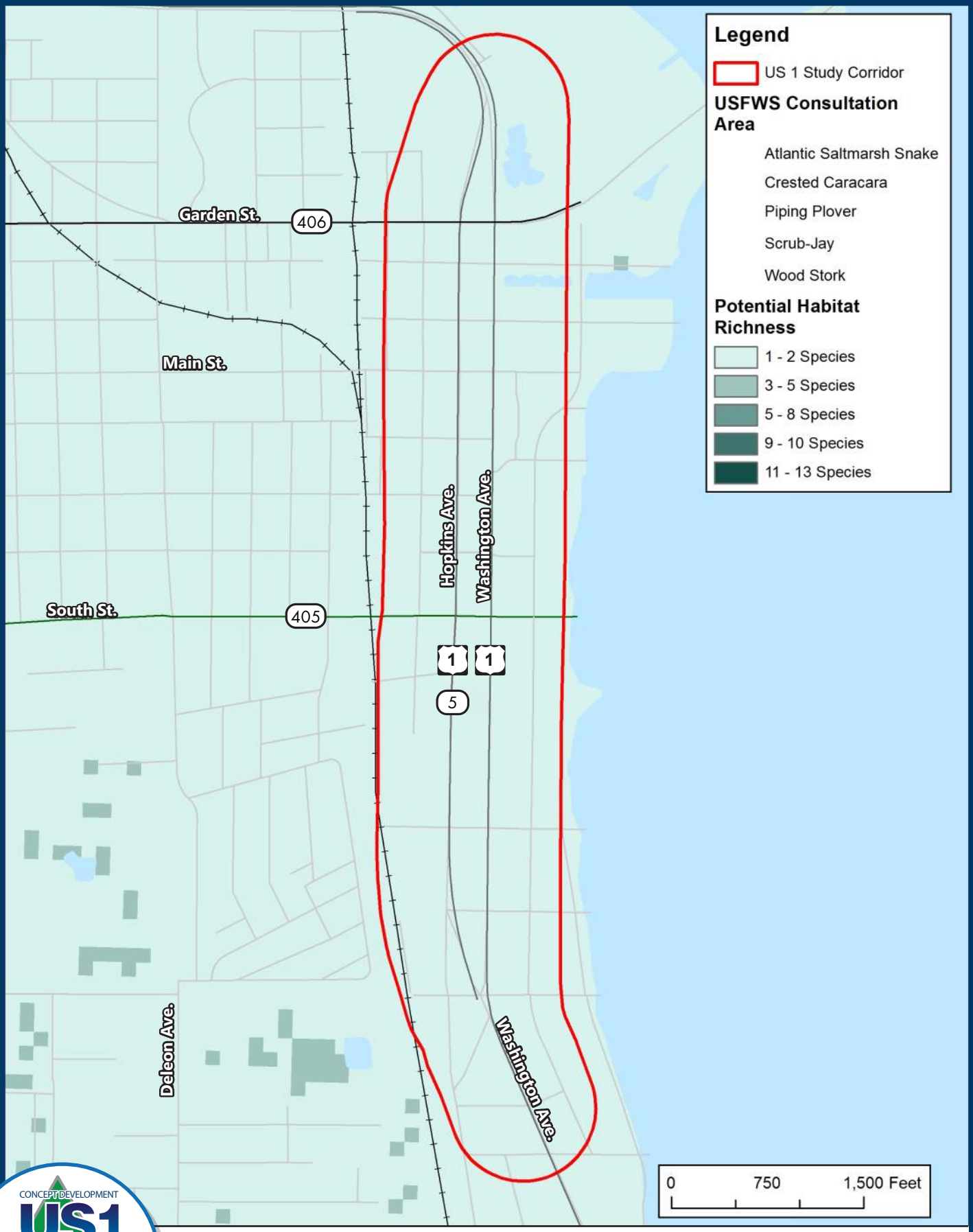

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FIGURE 24
Wildlife & Habitat Map

2.8.7 Wetlands

The wetlands analysis used GIS data made available from the St John's River Water Management District (SJRWMD) dated 2009. The data shows that no wetlands are located within the Study Corridor. "Other surface waters", which include ponds and drainage swales/ditches are present within the area. Figure 25 illustrates the surface water systems as presented in the data, however, drainage swales and ditches are not depicted.

2.8.8 Contamination

Contaminated sites within the Study Area were identified using data made available by the Florida Department of Health (FDOH) and the Florida Department of Environmental Protection (FDEP). Table 17 summarizes the areas that have the potential for contamination and Figure 26 illustrates the location of these sites. It must be noted that the facilities shown are regulated facilities which have the potential for contamination or environmental concern, but are not necessarily contaminated.

Table 17: Summary of Contamination Analysis

Analysis Type	Within Study Area
Biomedical Waste	14
Hazardous Waste Facilities	15
Petroleum Contamination Monitoring Sites	14
Storage Tank Contamination Monitoring (STCM)	24
US EPA Resource Conservation and Recovery Act (RCA) Regulated Facilities	19
Toxic Release Inventory	0
Waste Cleanup Sites	0

Source: FDOH, FDEP, FGDL, ETDM

As shown in Figure 26, the Study Area contains "potential" hazards and risk sites. Seven facilities are being monitored for petroleum contamination with clean-up work underway, four facilities have been closed and are no longer monitored, and three facilities do not require cleanup as no released contaminants have been found. No offsite contamination notices have been issued by FDEP within the Study Area. No other known hazardous contamination sites were found. Furthermore, while not listed in the existing data, railway data shows that contaminants may also be associated with rail lines and spurs. Work in these areas may warrant further investigation.

Source: SJRWMD SDE database (March, 2012)

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FIGURE 25
Wetlands Map

Source: Florida Department of Environmental Protection (FDEP) and Florida Department of Health (FDOH) – (Accessed via FGDL, July 2017)

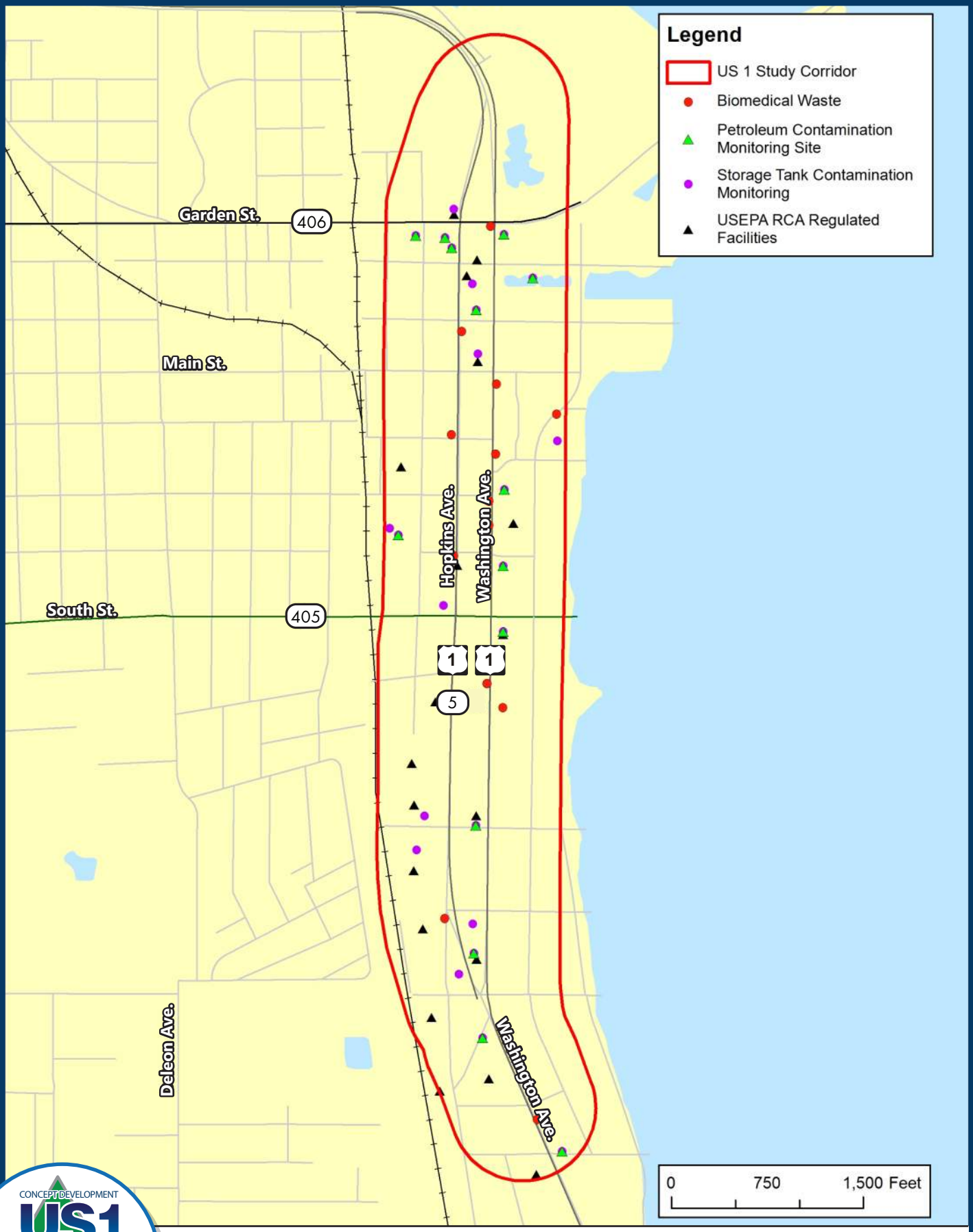

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FIGURE 26
Contamination Map

3

Future Traffic Development

3.1 Model Validation

The Central Florida Regional Planning Model (CFRPM) 6.1 year 2016 subarea model validation was performed to most accurately reflect 2016 traffic conditions inside the study area. This validation helped to create a better forecast of future traffic. The model refinement was performed by fine-tuning the network using the guidelines identified in "FSUTMS-Cube Framework Phase II Model Calibration and Validation Standards – Final Report, October 2, 2008". Validation methods used include volume-over-count ratio and percent error by facility type and by volume group for the study area.

Table 18 shows the percent deviation error by facility type. The percent deviation is defined as (year 2016 model assignment in AADT – year 2016 ground count in AADT) / (year 2016 ground count in AADT).

Table 18: Volume-Over-Count Ratio and Percent Error by Facility Type

	FDOT Standards			
	Acceptable	**Preferable**	**Before**	**After**
Freeway (FT1X,FT8X,FT9X)	+/- 7%	+/- 6%	-37.79%	9.81%
Divided Arterial (FT2X)	+/- 15%	+/- 10%	-27.58%	-10.06%
Undivided Arterial (FT3X)	+/- 15%	+/- 10%	-44.80%	3.93%
Collector (FT 4X)	+/- 25%	+/- 20%	-40.54%	-4.04%
OneWay (FT 6X)	+/- 25%	+/- 20%	-20.67%	-5.75%
Ramp (FT 7X)			30.58%	11.54%

*text in red indicates out of acceptable range

1- Table 3-9, TMIP Travel Model Validation and Reasonableness Checking Manual

In addition, the percent deviation error by volume group performed for the study area is shown in Table 19. The results of this validation method show the model is in preferable range of standards.

Table 19: Volume-Over-Count Ratio and Percent Error by Volume Group

	FDOT Standards			
Statistic	**Acceptable**	**Preferable**	**Before**	**After**
LT 10,000 Volume	50%	25%	-21.71%	-1.46%
10,000-30,000	30%	20%	-27.62%	-8.34%
30,000-50,000	25%	15%	37.79%	9.81%
50,000-65,000	20%	10%	N/A	N/A
65,000-75,000	15%	10%	N/A	N/A
GT 75,000	10%	5%	N/A	N/A

*text in red indicates out of acceptable range

The percent Root Mean Square Error (RMSE) for the study area is another aggregate measure to validate the model against the ground counts gathered within the study area. The RMSE for the study area comprising of 25 roadway links is 3.32% and usually can be ± 35% to 45%. This validates that the adjusted network accurately represents the ground counts within the study area. Table 20 provides on overview of the RMSE output within the study area.

Table 20: RSME Model Validation

Volume Group	% RMSE	Acceptable % RMSE	Preferable % RMSE
1-5,000:	8.82%	100%	45%
5,000-10,000:	3.03%	45%	35%
10,000-15,000:	5.07%	35%	27%
15,000- 20,000:	N/A	30%	25%
20,000- 30,000:	12.29%	27%	15%
30,000- 50,000:	9.09%	25%	15%
50,000- 60,000:	N/A	20%	10%
60,000+:	N/A	*19%*	10%
Areawide	**3.32%**	***45%***	**35%**

Based on the validation efforts performed, the model is considered acceptable for use in estimating future travel demand within the study area. The validation adjustments were carried over to the year 2040 model to achieve optimal results.

Recent coordination with the Project Visioning Team and City of Titusville staff revealed several planned developments within the study area that were not included in the original adopted 2040

model. The developments were included in the updated year 2040 model to account for additional traffic that will be generated within the study area. The following lists those planned developments:

- Housing development with 170 single family homes northwest of I-95 at SR 406 interchange. These were added to TAZ 2925.
- Gas station on the northwest quadrant of US 1 Southbound at SR 406 intersection, added to TAZ 2934.
- A 120,000 SF shopping center was assumed for the area northwest of US 1 Southbound at SR 406 intersection. Although this development information is not certain, a higher traffic demanding land use was assumed for this location to make a conservative analysis of future traffic. This land use was added to TAZ 2934.

3.2 Growth Projections and Assumptions

In order to determine an acceptable growth rate for the US 1 study area, traffic projections from various available sources were considered. This included the latest year Central Florida Regional Planning Model, Version 6.1 (CFRPM 6.1) released in 2016, FDOT historical AADT growth trends, and Brevard County population projections from the Bureau of Economic and Business Research (BEBR) Volume 51, Bulletin 180 (January 2018). The trends analysis sheet and model output files are provided in **Appendix F**. Table 21 below presents the comparison of resulting growth rates.

Table 21: Growth Rate Comparison

Growth Method	Growth Rate
Historic Trends Analysis	-1.17%
Model Growth Analysis	0.65%
BEBR Growth Analysis	
Brevard County Medium	0.90%
Brevard County High	1.69%
Average Growth Rate (used)	0.77%

The historic growth trends were not applied due to the negative value and the R-squared value of the historical counts were not above 75% illustrating volatility in the volumes as illustrated in Table 21. The model growth analysis identified a growth rate of 0.65%. Taking into account future development, planned roadway improvements, as well as historic growth rates, the model is considered to be the most detailed predictor of future traffic growth. Specifically, the model applied for this analysis included aggressive development estimates to reflect development anticipated in the near future. For a conservative analysis of growth, this rate was averaged with BEBR's medium projected growth rate. The average of these two models is 0.77%, which is the rate used for analysis of future traffic growth along the corridor.

3.3 2040 No-Build Operational Analysis

Future 2040 operational analysis was conducted to determine the LOS for the roadway segments and the study area intersections in a no-build scenario. Future traffic volumes were projected by using the preferred growth rate and growing the existing traffic to the future year. Similar to the existing conditions analysis, future LOS was determined by using the 2012 FDOT Quality/Level of Service tables and HCM 2010 guidelines for roadway and intersection operations, respectively.

3.3.1 2040 No-Build Projected Roadway Operations

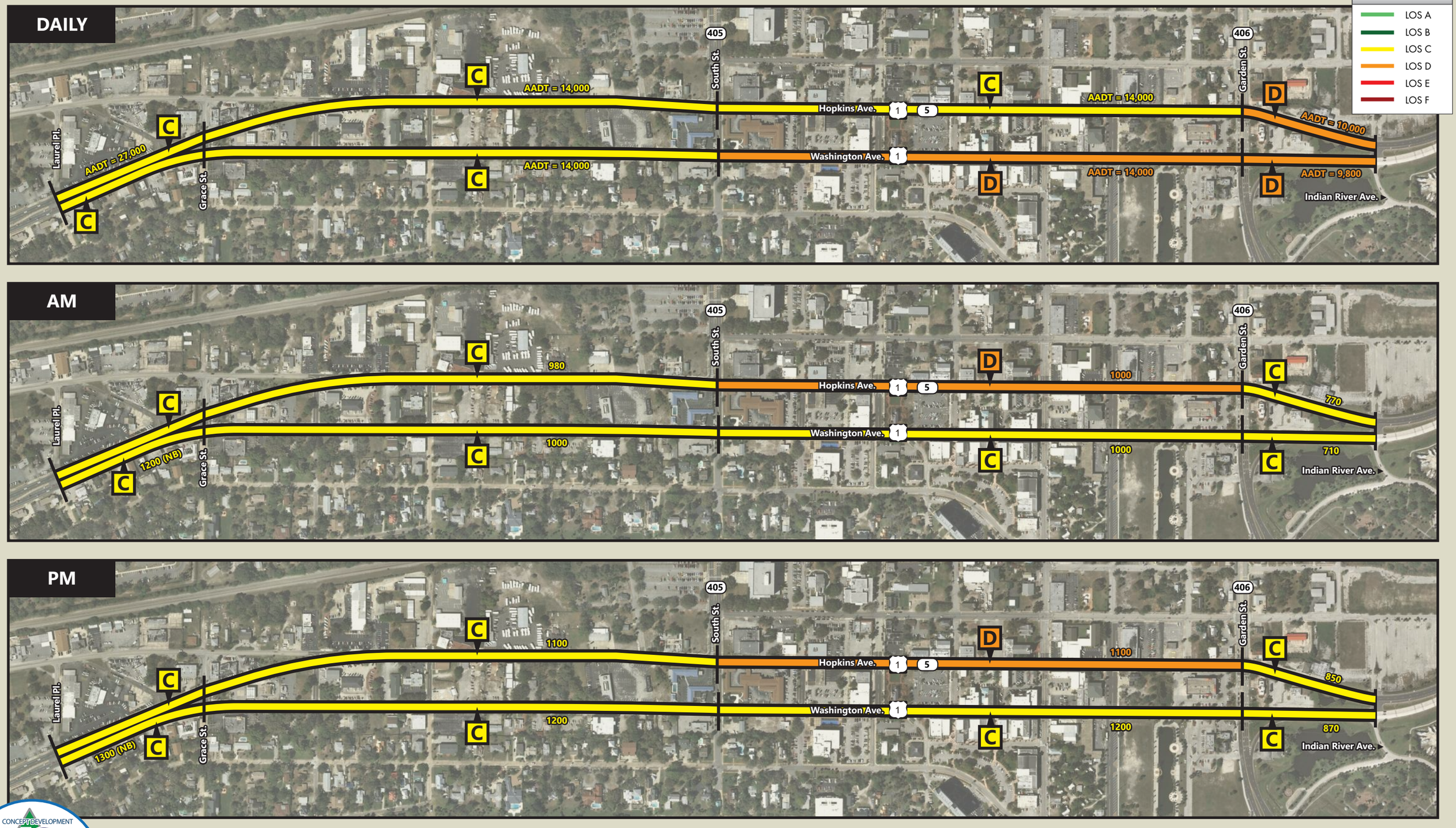
According to FDOT, the study corridor is classified as an "urban principal arterial other" and has an adopted LOS "D". The generalized peak hour directional service volumes for the LOS letters "A" through "F" were obtained from Table 7 of the 2012 FDOT Quality/Level of Service Handbook and compared with projected 2040 volumes calculated using the 2017 existing volumes with the previously-identified 0.77% annual growth factor applied. The 2040 projected roadway operations are provided in Table 22 and Figure 27 for daily, AM peak hour, and PM peak hour. Future volume analysis sheets are located in **Appendix C**.

Table 22: 2040 Projected Roadway Level of Service: No-Build

Roadway/Segment	Daily		AM Peak (Peak Direction)		PM Peak (Peak Direction)	
	AADT	LOS	Volume	LOS	Volume	LOS
US 1						
Laurel Place to Grace Street	27,000	C	1,200 (NB)	C	1,300	C
US 1 SB (Hopkins Avenue)						
Grace Street to SR 405 (South Street)	14,000	C	980	C	1,100	C
SR 405 (South Street) to SR 406 (Garden Street)	14,000	C	1,000	D	1,100	D
SR 406 (Garden Street) to Indian River Avenue	10,000	D	770	C	850	C
US 1 NB (Washington Avenue)						
Grace Street to SR 405 (South Street)	14,000	C	1,000	C	1,200	C
SR 405 (South Street) to SR 406 (Garden Street)	14,000	D	1,000	C	1,200	C
SR 406 (Garden Street) to Indian River Avenue	9,800	D	710	C	870	C

2012 FDOT Quality/Level of Service Handbook Tables
*AADT = Data Collected * Seasonal Factor (1.06) * Axle Factor (0.98) (if need)*

As shown in Table 22, the US 1 corridor is projected to operate within acceptable LOS standards in No-Build condition of YR 2040.



US 1 Concept Development & Evaluation

LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 27
2040 Projected Roadway Volumes and Operations

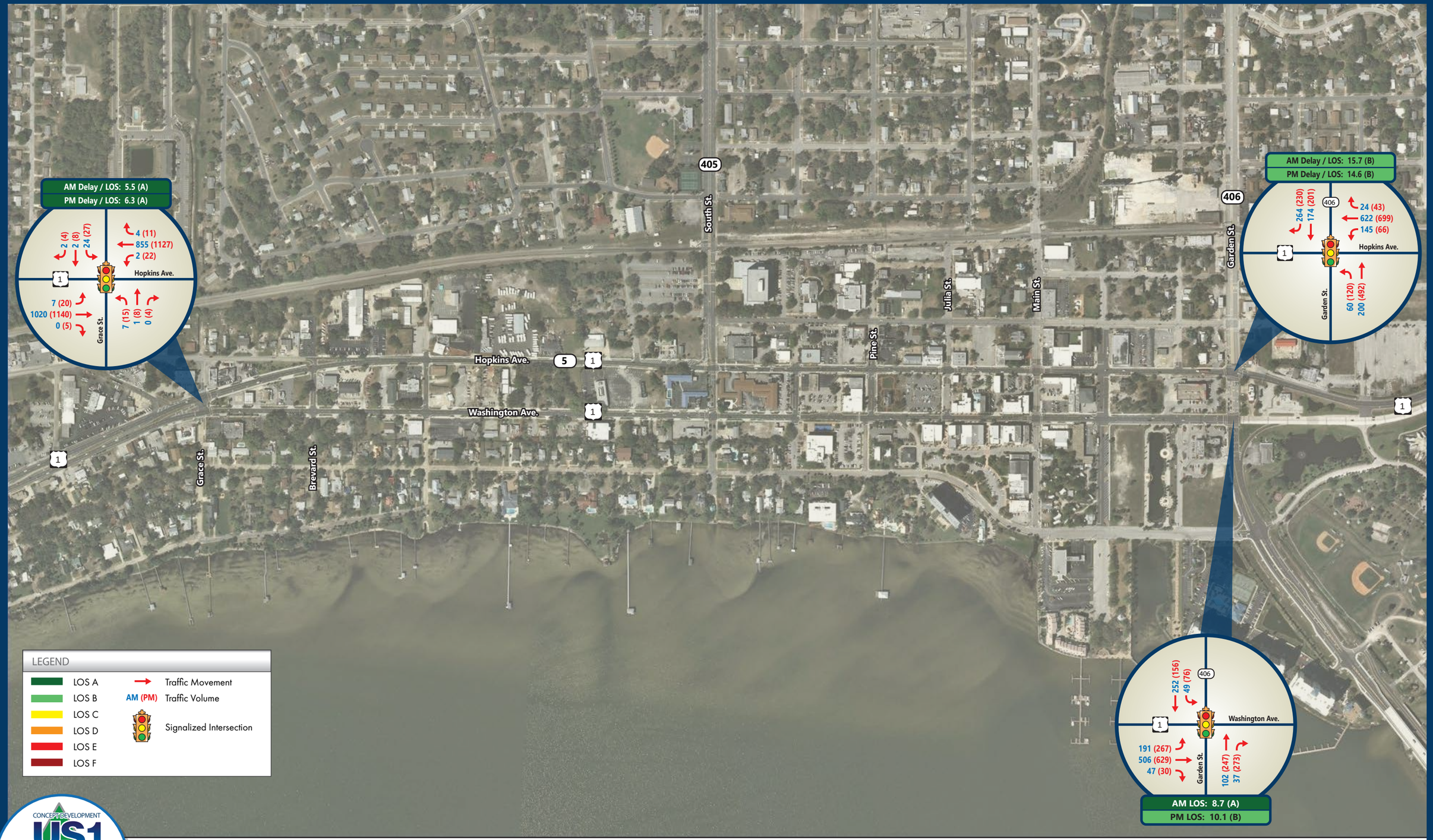
3.3.2 2040 No-Build Projected Intersection Operations

According to the HCM 2010, for signalized intersections, and average control delay per vehicle from 55 seconds up to 80 seconds is considered to be a LOS E condition. Beyond 80 seconds is considered to be a LOS F condition. A summary of the 2040 projected intersection operations for all study area intersections is provided in Table 23 for the AM and PM peak hours. The signal timings were optimized under the assumption that signal timings will be regularly maintained through 2040.

Table 23: 2040 Projected Intersection Level of Service: No-Build

Intersection	Control	AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
US 1/Grace Street	Signalized	5.5	A	6.3	A
US 1 NB (Washington Avenue)/SR 406 (Garden Street)	Signalized	8.7	A	10.1	B
US 1 SB (Hopkins Avenue)/SR 406 (Garden Street)	Signalized	15.7	B	14.6	B

As presented in Table 23 above, all of the study area intersections are anticipated to operate at acceptable LOS in 2040. The 2040 projected intersection operations are presented in Figure 28 for the AM and PM peak hours. Synchro reports are located in **Appendix C**.



US 1 Concept Development & Evaluation

LAUREL PLACE TO INDIAN RIVER AVENUE

FIGURE 28

No Build 2040 Projected Intersection Volumes and Operations

3.4 Understanding the Problem

It is essential to understand the problems facing the roadway prior to determining practical solutions for a corridor. During the Corridor Planning Study, the existing and future conditions discovered for the study corridor were analyzed to define the Issues & Opportunities, Guiding Principles, and Purpose and Need Statement for the project. As part of this Concept Development and Evaluation Study, the existing and future conditions collection and analysis was updated to include any changes that may have occurred since the completion of the previous study. Following the update, the Purpose and Need was reviewed and confirmed to be appropriate for the study corridor.

3.4.1 Issues & Opportunities

This section is intended to summarize the issues and opportunities that were identified and used to develop the potential improvement strategies along the study corridor. During the data collection and existing conditions inventory process, elements within the corridor found to be deficient were noted appropriately. Wherever possible, other aspects of the corridor that represent potential opportunities to support future enhancements were also documents, with note of current local agency transportation plans. The following is an accumulation of the data collection and stakeholder input comprising of the Issues & Opportunities for the US 1 study corridor:

Access Management

The following access management issues have been observed:

- High number of driveways that have direct access to US 1
- Parcels with multiple driveways

Bicycle & Pedestrian Facilities

Based on data collection and stakeholder feedback, the following observations were made:

- Issues with utilization of existing pedestrian crosswalks and drivers' lack of understanding about the requirement to stop for pedestrians crossing US 1
- No designated bike lanes on the corridor south of Main Street
- Undesignated bike lanes are present on US 1 north of Main Street to north of Indian River Avenue
- Many cyclists use Indian River Avenue to the east as an alternate parallel facility (north/south)

Transit

The following observations were made regarding transit through field review and coordination with stakeholders:

- Frequent bus stop spacing with most bus stop locations having ADA accessibility issues such as the absence of wheelchair-accessible boarding and alighting locations
- Minimal bus stop amenities such as benches are provided

Existing Operations

Based on analysis done for both the existing conditions and future traffic projections, the following opportunities were identified:

- Existing and 2040 future volume projects are anticipated to operate at acceptable roadway and intersection LOS conditions during the AM and PM peak hours. This may provide an opportunity for improvements while avoiding major capacity impacts.
- Spot speed study revealed that average speeds range from 24-33 MPH in the 30 MPH posted area; and 33-42 MPH in the 40 MPH posted area. Vehicles do not appear to be traveling at excessive speeds within the study area.
- Pedestrian perception is that vehicles are traveling at excessive speeds.

Safety

Based on crash history analysis the following opportunities were identified:

- From 2011 to 2015, there were 113 crashes at the US 1 and SR 406 (Garden Street) intersections, including 59 angle and 7 left turn crashes. Combined with the lack of capacity issues, this leaves opportunities to directly address safety.

3.4.2 Guiding Principles

Using the Issues & Opportunities identified in the previous section, along with input from local stakeholders, the guiding principles of the study were developed and agreed upon. As part of this exercise, the vision, major users, and desired role of the corridor were identified.

Vision

The vision for the US 1 Corridor is to create a local neighborhood community that encourages residents and tourists to visit, work in, live nearby, and play in.

Major Users

Local residents, commuters, transit users, business patrons, freight, bicyclists and pedestrians, and tourists.

Desire Role

A multimodal corridor that supports economic development while supporting regional traffic.

Guiding Principles

The following guiding principles were developed based on the corridor vision, major users, and desired role:

- Safety
- Pedestrian Mobility
- Economic Development
- Transit

3.4.3 Purpose and Need

Following the identification and definition of the guiding principles of the corridor, the clear statement of purpose and need was developed.

Purpose Statement

To provide additional safe multimodal mobility options to support economic development goals, enhance the historic downtown corridor, and encourage a healthy community atmosphere.

Needs Statement

Additional mobility options and safety enhancements for the existing pedestrian facilities is needed based on the existing pedestrian traffic, and planned investment / economic development activity within Downtown Titusville that will increase pedestrian, bicycle, and transit demands. The City's future vision supports increased use by non-vehicular modes within the downtown core as part of continuing to establish a walkable, pedestrian friendly urban environment. The contributing factors that support the project need include:

- The corridor has been designated by the City of Titusville as part of the Community Redevelopment Agency (CRA) district
- Increasing commerce and pedestrian activity
- Increasing numbers of bicycle users with Coast-to-Coast trail and other regional trails
- High volume of pedestrian mid-block crossings
- Large transit-dependent community
- Lack of ADA accommodations
- Lack of bicycle facilities

4

Public Involvement

Successful public involvement is about building credibility, facilitating understanding and building consensus. This requires a process characterized by technical competence, integrity, and effectively listening to input provided by project stakeholders. The public involvement framework for this study was built around these principles.

The goal of outreach efforts performed during this study was to allow people living and working within the project study area, and other interested parties, to contribute to the decision-making process and to influence the choices made about improving the US 1 corridor. The following sections summarize the public involvement activities held during the US 1 Concept Development and Evaluation. Summaries of the following activities, including details on the feedback received, are provided in **Appendix G**.

4.1 2040 Public Involvement Plan

Public involvement brings diverse viewpoints and values between all interested people, groups, and government organizations into the decision-making process regarding the development of a project. A Public Involvement Program (PIP) was developed at the beginning of the study as a living document to assist FDOT in developing a project that meets the needs of the community in addition to gaining greater acceptance and support of the project. The PIP indicates the general approach to the public involvement process determined for this study and documents the contact persons, media outlets, agency and project stakeholders, and the means used to involve them in the process. The PIP is included in **Appendix G**.

4.2 Project Visioning Team (PVT)

During the Corridor Planning Study, specific agency staff and other interested parties were identified to actively participate as part of a Project Visioning Team (PVT) that assisted and guided the planning process throughout the study in the development of a multi-modal planning approach. The PVT consisted of approximately 20 members, including representatives from the following:

- Florida Department of Transportation
- Space Coast Transportation Planning Organization (SCAT)

- Brevard County
- City of Titusville
- Space Coast Area Transit
- Titusville Community Redevelopment Agency
- Greater Titusville Renaissance

At the beginning of the Concept Development and Evaluation study, the PVT was reassembled. The list of members was updated to reflect any position changes and to the extent that any additional active local residents, businesses, or property owners wished to become engaged as stakeholders in the process. The complete list of PVT members is included in **Appendix G**. The following subsections summarize the two PVT meetings held during the Concept Development and Evaluation study.

4.2.1 PVT Meeting #1

PVT Meeting #1 was held on November 8, 2017 at the City of Titusville City Hall Council Chambers from 9:00 am to 12:00 pm. The meeting was attended by staff representing Brevard County, City of Titusville, Space Coast TPO, Titusville Police Department, Florida East Coast (FEC) Railway, and Greater Titusville Renaissance. The meeting began with a presentation covering the role of the PVT, review of the Corridor Planning Study and key differences between that study and the Concept Development and Evaluation phase, and updates made to the existing and future conditions reports. The PVT then gathered for open discussion around a roll plot of the recommended improvement strategies carried through from the Corridor Planning Study. A meeting summary including details of the open discussion are included in **Appendix G**.

4.2.2 PVT Meeting #2

PVT Meeting #2 was held on June 27, 2018 at the City of Titusville City Hall Council Chambers from 9:00 am to 12:00 pm. The meeting was attended by staff representing the City of Titusville, Brevard County, Space Coast TPO and Space Coast Area Transit (SCAT). The meeting began with a presentation recapping the role of the PVT, project background and progress to date, and the Concept Development and Evaluation process. The study team then provided an update on progress since PVT Meeting #1 and presented the final recommendation for the study corridor. The PVT then gathered for open discussion around a roll plot of the final recommendations developed during the study. The meeting was wrapped up with next steps and project schedule. A summary of the meeting including details of the open discussion are included in **Appendix G**.

4.3 Public Meeting

A public meeting was held on Thursday, September 20, 2018 from 5:30 pm to 7:30 pm at the City of Titusville City Hall Council Chambers. The purpose of the public meeting was to explain the project and study process, present the final recommendations, and allow interested people an opportunity to provide feedback and comments to the study team about the project.

The Public Information Meeting was held in an open house format. A fourteen-minute informational looping presentation was looped for attendees to view. Upon the video's conclusion, participants were directed to display boards with information about the projects. In total there were seven meeting stations: 1. Welcome Station 2. Presentation Video 3. Roundabout 4. Lane Modifications 5. Future Traffic Operations 6. Corridor-Wide Conceptual Roll Plots 7. Comments. Study team staff were available around the room to answer questions and obtain stakeholder feedback. The Public Information Meeting began at 6:00 pm and concluded at 7:30 pm. The video presentation, boards, resource station, and study team staff were available throughout the meeting. Printed copies of the *Existing Conditions Report and Future Conditions Report* for the U.S. 1 and S.R. 406 studies was also available for public review.

While study team members were available to discuss the project, meeting participants were strongly encouraged to also provide their comment or question on the comment forms provided so that their feedback could be accurately recorded. There were 36 members of the public and nine (9) Study Team members in attendance.

A comment form was provided to submit during the meeting or until the comment period end date, September 30, 2018. A summary of the meeting, including notices, materials presented at the meeting, and comments and responses are included in **Appendix G**.

4.4 Small Group Meetings and Coordination

4.4.1 City of Titusville Coordination

Following final development of the future conditions analysis and concept plans, the study team met with the staff from the City of Titusville, on March 30, 2018, to gather feedback and ensure the City was supportive of the final recommendations for the study corridor. City of Titusville representatives in attendance at the meeting included City Manager, Redevelopment Planner, Economic Development Director, and City Planning Manager. The City of Titusville representatives agreed the alternatives for US 1 with the Grace Street roundabout and elongated roundabout at SR 406 and US 1 are appropriate and should be moved forward into concept development to better understand impacts to the surrounding areas. A summary of the meeting is available in **Appendix G**.

After further coordination, a letter of support for the concepts was submitted to the Department on July 2, 2018 and is signed by City Manager Scott Larese. This letter is attached in **Appendix G**. This letter states, "We are supportive of the Department proceeding with a lane reduction along SR 406 (Garden Street) between Park Avenue and Indian River Avenue … In addition to the lane reduction, the City of Titusville would also like to express its support for the proposed roundabouts… at SR 406 and Singleton Avenue and the system involving the rework of the interface between US 1 and SR 406."

4.4.2 Agency Update Presentations

An update presentation was given at the conclusion of the study, during the regularly scheduled City of Titusville City Council meeting and the Space Coast Transportation Planning Organization (SCTPO) Board and sub committees meetings. The update presentations provided the final findings and recommendations of the study for final comment and acceptance. Meeting summaries can be found in **Appendix G**. The following lists the dates of the meetings presented at:

- City of Titusville City Council – September 25, 2018
- SCTPO Technical and Citizens Advisory Committee (TAC/CAC) – October 08, 2018
- SCTPO Board – October 11, 2018

4.4.3 Additional Communication

Additional communication with the public made throughout the study, but not during… Meetings were also documented and are summarized in Table 24. This includes communication by mail, telephone, and email. Copies of the additional communication is included in **Appendix G**.

Table 24: Additional Public Communication

Sender	Initial Contact Date	Form of Communication	Subject
Don Forward	September 11, 2018	E-mail	General Questions
"Titusville, Fl....The TRUTH about what's happening?" Facebook Group	September 13, 2018	Facebook Group	Community Discussion on the Topic

5

Alternatives Selection and Refinement

5.1 Alternatives Selection

The proposed alternatives for US 1 are derived from the preceding US 1 Corridor Planning Study as well as extensive review of existing and future conditions and a thorough public engagement process. Because of the acceptable no-build LOS for the roadways, many of the improvement strategies are focused on safety instead of capacity. The first alternative advanced out of the Planning Study was a roundabout at Grace Street and US 1. The second was a roundabout at both US 1 one-way pairs and SR 406 (Garden Street). The following section discusses both these alternatives in detail.

Also identified in the CPS were crosswalk enhancements and signing and pavement markings enhancements. At the end of the CPS it was determined to hand this study off to traffic operations in order to determine the best way to meet these needs.

5.1.1 US 1 & SR 406 (Garden Street) Roundabout

A roundabout at Grace Street and US 1 was proposed during the Corridor Planning Study and moved forward into analysis during the Concept Development phase of the project. The roundabout was initially selected at a proposed alternative but failed the Step 1 roundabout screening due to low side-street AADT, low crash rate history, significant access issues for the surrounding businesses and therefore, potentially significant business relocation costs. More details can be found in the roundabout screening section below.

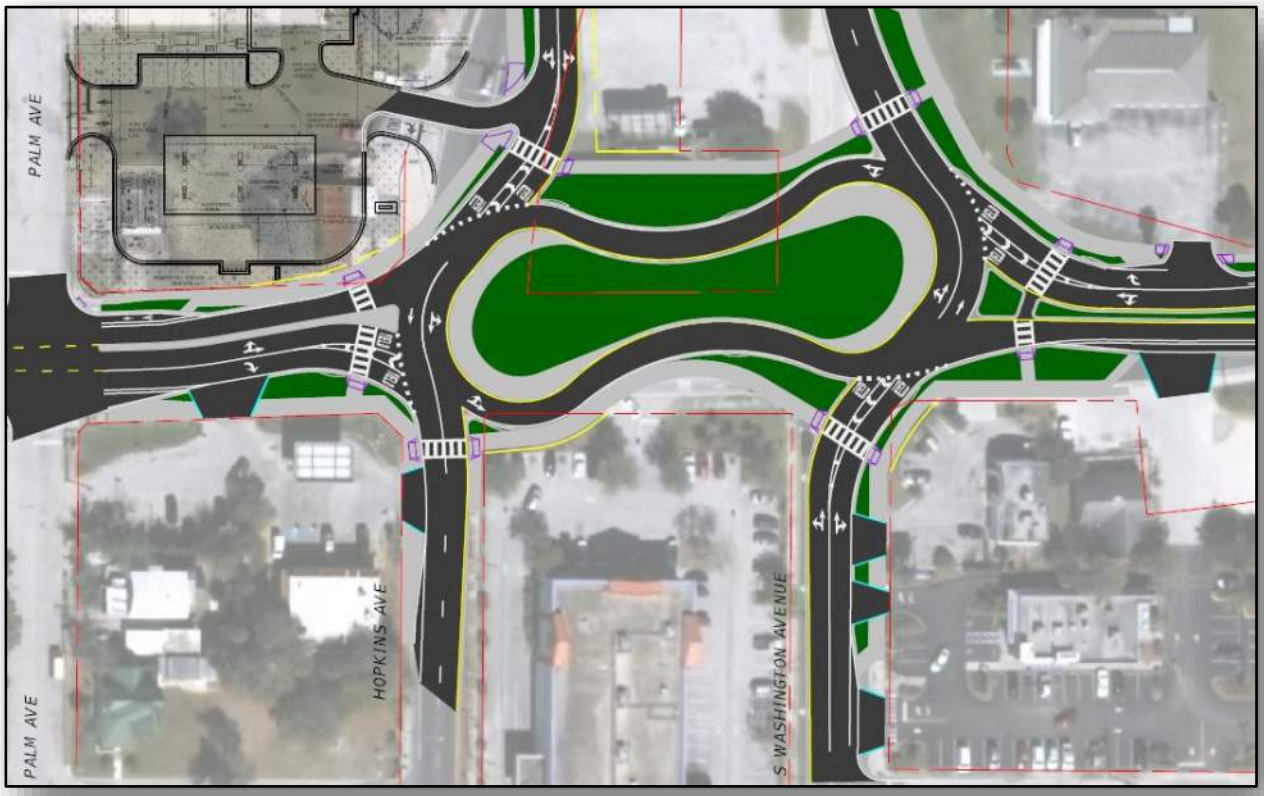
Figure 29: US 1 and Grace Street Roundabout Concept

5.1.2 US 1 & SR 406 (Garden Street) Roundabout

There is one proposed build scenario for the US 1 corridor. The main feature of this proposed alternative is a roundabout at SR 406 (Garden Street). It will serve as a safety improvement for downtown Titusville. The roundabout at SR 406 (Garden Street) offers a unique solution for the removal of the two existing signals in order to potentially reduce current high crash rates.

This concept is shown in Figure 30 below. Detailed plan sheets for this roundabout can be found in **Appendix H**. Overall, this concept dependent on a lane modification from five to three lanes along SR 406, which is proposed in the SR 406 Concept and Development Evaluation Study (FM #: 436187-1).

Figure 30: US 1 and SR 406 (Garden Street) Roundabout



5.2 2040 Proposed Alternatives Analysis

5.2.1 2040 Proposed Alternatives Projected Roadway Operations

This section analyzes future traffic projections in 2040 if the proposed improvements are implemented. The generalized peak hour directional service volumes for the LOS letters "A" through "F" were obtained from Table 25 of the 2012 FDOT Quality/Level of Service Handbook and compared with projected 2040 roadways volumes. The 2040 roadway volumes were calculated using the 2017 existing roadway volumes with the previously-identified 0.77% annual growth factor applied. The 2040 projected roadway operations are provided in Table 25 for daily, AM peak hour, and PM peak hour. Future volume analysis sheets are located in **Appendix C**.

Table 25: 2040 Projected Roadway Level of Service: Proposed Alternatives

Roadway/Segment	Daily		AM Peak (Peak Direction)		PM Peak (Peak Direction)	
	AADT	LOS	Volume	LOS	Volume	LOS
US 1 (2-Way Section)						
Laurel Place to Grace Street	27,000	C	1,200 (NB)	C	1,300	C
US 1 SB (Hopkins Avenue) (One Way)						
Grace Street to SR 405	14,000	C	980	C	1,100	C
SR 405 to SR 406	14,000	C	1,000	D	1,100	D
SR 406 to Indian River Avenue	10,000	D	770	C	850	C
US 1 NB (Washington Avenue) (One Way)						
Grace Street to SR 405	14,000	C	1,000	C	1,200	C
SR 405 to SR 406	14,000	D	1,000	C	1,200	C
SR 406 to Indian River Avenue	9,800	D	710	C	870	C

2012 FDOT Quality/Level of Service Handbook Tables / Brevard County 2016 Peak Season Factor Category Report
*AADT = Data Collected * Seasonal Factor (1.06) * Axle Factor (0.98) (if need)*

As shown in Table 25, US 1, under the proposed alternatives, is projected to operates within acceptable LOS standards in YR 2040.

5.2.2 2040 Proposed Alternatives Projected Intersection Operations

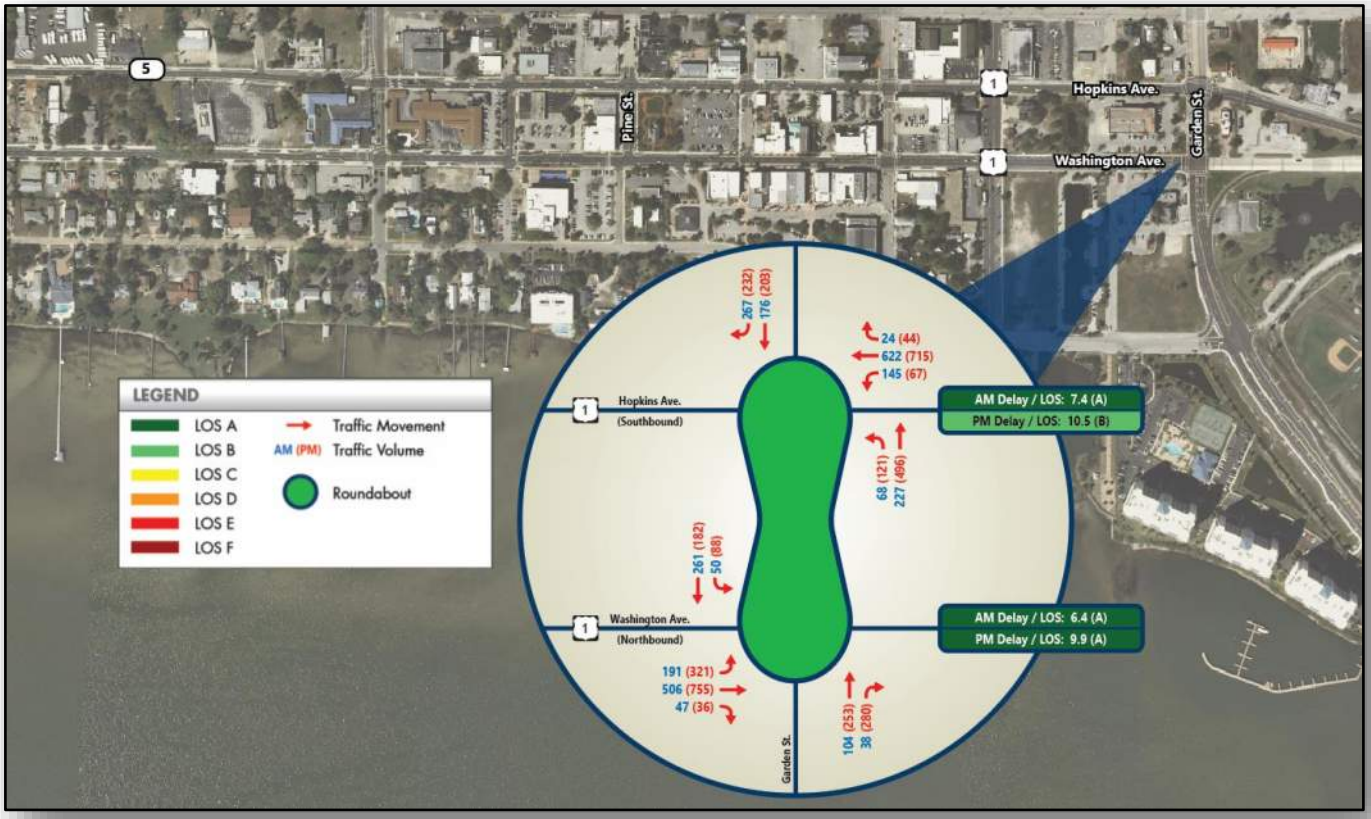
According to the HCM 2010, for signalized intersections, and average control delay per vehicle from 55 seconds up to 80 seconds is considered to be a LOS E condition. Beyond 80 seconds is considered to be a LOS F condition. A summary of the 2040 projected intersection operations for all study area intersections is provided in Table 26 for the AM and PM peak hours.

Table 26: 2040 Projected Intersection Level of Service: Proposed Alternatives

Intersection	Control	AM Peak		PM Peak	
		Delay	LOS	Delay	LOS
US 1 NB (Washington Avenue)/SR 406 (Garden Street)	Roundabout	6.4	A	9.9	A
US 1 SB (Hopkins Avenue)/SR 406 (Garden Street)	Roundabout	7.4	A	10.5	B

As presented in Table 26 above, all of the study area intersections are anticipated to operate at acceptable LOS levels in 2040. The 2040 projected intersection operations are presented in Figure 31 for the AM and PM peak hours. Synchro reports are located in **Appendix C**.

Figure 31: 2040 Projected Intersection Volumes and Operations: Proposed Alternatives



5.2.3 Access Management

According to the FAC Rule 14-97, signalized intersections must be spaced at least 1,320 feet apart. There are several links that do not meet this standard, due to the grid pattern of downtown Titusville. Because of the area type and one-way facilities, no changes to the current access are proposed. Figures 8 through 10 show the existing access management along US 1 from Grace Street to SR 406 (Garden Street).

5.2.4 Drainage

Stormwater runoff from the US 1 corridor flows to the St. Johns River, west of the Study Area, and the Indian River, east of the Study Area. The roadway runoff is conveyed to a curb and gutter system that provides drainage for the US 1 corridor. Along the corridor there are curb inlets and

catch basins that are connected to a storm sewer system directing runoff to wetlands, a stormwater management facility, or directly to an outfall.

The proposed drainage system should consist of the following:

From Station 182+00 to Sta 187+00 the proposed roadway improvements include the addition of a new roundabout at US1. There are existing inlets in this section that will need to be relocated and additional inlets will be needed at strategic locations along this intersection and to pick up roadway runoff from new low points. New inlets can connect to the existing stormsewer pipes under the roadway and continue to outfall to the same location as in the existing condition. There is no net additional impervious area added to this outfall.

Environmental Permitting of Proposed Improvements

The proposed improvements described above do not add any additional impervious area and thus stormwater runoff to the ultimate outfalls either remains the same or is decreased. There is a strong possibility that the improvement options will be exempt from permitting per 62-330.051 (4)(c). The SJRWMD considers many of the proposed roadway improvements as safety improvements. Safety improvements qualify under the following conditions for a permit exemption under certain length and width thresholds:

(4)(c) Minor roadway safety construction, alteration, or maintenance, and operation, provided:

1. There is no work in wetlands other than those in drainage ditches constructed in uplands;
2. There is no alteration to a project previously permitted under Part IV of Chapter 373, F.S.; and
3. All work is conducted in compliance with subsection 62-330.050(9), F.A.C.; and
4. The work is limited to:
    a) Sidewalks having a width of six feet or less;
    b) Turn lanes less than 0.25 mile in length, and other safety-related intersection improvements; and
    c) Road widening and shoulder paving that does not create additional traffic lanes and is necessary to meet current, generally accepted roadway design and safety standards.

There is also a possibility that any sidewalk widening option will be exempt from permitting per 62-330.051 (10)(b):

(10)(b) Have a width of eight feet or less for pedestrian paths, and 14 feet or less for multi-use recreational paths.

A pre-application meeting SJRWMD would confirm the improvements are exempt from permitting and the project is exempt from providing any additional water quality or attenuation volumes.

5.2.5 Roundabout Process

Steps one through three of the FDOT roundabout process were conducted for the US 1 intersections at Grace Street and SR 406 (Garden Street). Details of the screenings can be found in **Appendix I**.

Grace Street Roundabout

The Grace Street roundabout failed during Step 1 of the FDOT roundabout process, which is intended to quickly assess project-specific conditions to determine the viability of the roundabout. It was still advanced into Step 2, where a Benefit-Cost Analysis was performed, in order to better understand the potential value of the concept. The results of this analysis are below in Table 27. While there are achievable safety benefits (along with aesthetic benefits) of implementing the roundabout, capital costs, including $2,000,000 in R/W costs, made the project infeasible in light of low side-street AADT, low crash rate history and significant access issues. Full cost estimates can be found in **Appendix I**.

Table 27: Grace Street Roundabout Benefit-Cost Analysis

Safety Benefit of Roundabout	**$ 4,628,366**
Delay Reduction Benefit of a Roundabout	$ (37,617)
Total Benefit	**$ 4,590,749**
Added O & M Costs of a Roundabout	$ (37,600)
Added Capital Costs of a Roundabout	$ 5,000,000
Total Cost	**$ 4,962,400**
Life Cycle Benefit/Cost Ratio	**0.9**

US 1 and SR 406 (Garden Street) Roundabout

The US 1 and SR 406 (Garden Street) roundabout passed the initial Step 1 FDOT screening. During Step 2 of the process, a Benefit-Cost Analysis was performed. The results of this analysis can be seen in Table 28. While the costs are significant, the robust crash history at this location justifies a significant investment. The details of this analysis can be seen below in Table 28. Full cost estimates can be found in **Appendix I**.

Following comments from the Roundabout Committee, design for the US 1 and SR 406 (Garden Street) roundabout was updated to improve safety and performance. Updates in design were minimal and only increased total R/W necessary for taking by 1,273 total square feet, therefore it was determined that a revision of the Roundabout Screening Process would not change the outcome of Step 2. The roundabout is recommended, further updates can be completed during the design phase with more current data as needed. At this point, Step 3 of the process would be conducted.

Table 28: US 1 & SR 406 Roundabout Benefit-Cost Analysis

Safety Benefit of Roundabout	**$ 18,702,673**
Delay Reduction Benefit of a Roundabout	$ 2,071,919
Total Benefit	**$ 20,774,592**
Added O & M Costs of a Roundabout	$ (37,600)
Added Capital Costs of a Roundabout	$ 16,261,687
Total Cost	**$ 16,224,087**
Life Cycle Benefit/Cost Ratio	**1.3**

5.2.6 Utilities

All utility impacts for the proposed alternatives are at the US 1 and SR 406 (Garden Street) intersection. Several utility relocations will be required including ITS, overhead power (distribution) and roadway lighting at the intersection of US 1 and SR 406 (Garden Street). This includes, lighting to be relocated at the southwest corner of roundabout (at Hopkins Avenue), the relocation of the ITS and DMS poles between Washington Avenue and Hopkins Avenue, and utilities impacted on northeast corner of Hopkins Avenue, including a signal cabinet. The overhead power and fiber on the north side of the intersection will require relocation. Other buried utilities, including Verizon Business buried cable on the north side of SR 406 (Garden Street) at the US 1 intersections could potentially be impacted. There will be minimal utility impacts to lighting facilities along SR 406 (Garden Street) that should be coordinated with this process. More specific notes on utilities can be found in the field review notes in **Appendix D** and Utility notes in **Appendix B**. Further analysis and coordination will be required during the design phase.

5.2.7 Transportation Systems Management and Operations (TSM&O)

Transportation Systems Management and Operations (TSM&O) is a program that provides alternative transportation strategies that are tailored toward improving safety and mobility in a cost-efficient and effective manner. These strategies typically focus on operational improvements that can maintain and even restore the performance of the existing transportation system before major capital improvement projects are needed.

The *TSM&O Strategy Guide*, developed by FDOT District Five for use in Planning and PD&E studies, was consulted to identify potential TSM&O strategies that could be applied to identified transportation issues in the study corridor. Issues found in the study area that were entered into the TSM&O Strategy Guide include:

- High Crash Rate (Various)
- Minimal Bike/Ped Infrastructure

Based on these inputs, some of the TSM&O strategies suggested by the application include:

- Adaptive Signal Control
- Arterial Access Management
- Enhance Bike/Ped Infrastructure (bike lanes and sidewalks)
- Roadway Diet (Lane Modification)
- Roundabout

While the US 1 corridor is not in need of capacity improvements, the proposed US 1 and SR 406 (Garden Street) roundabout seeks to improve the safety and efficiency of the intersection.

In addition to the proposed roundabout at US 1 and SR 406, other TSM&O strategies were considered. A roundabout was originally proposed at US 1 and Grace Street to improve safety, provide for additional connectivity for bicycle infrastructure, and act as a gateway feature for the downtown core. This roundabout will not be recommended, however, as side street volumes do not warrant the improvement and, with commercial/office buildings abutting the property lines, the necessary R/W would be cost-prohibitive.

Based on stakeholder feedback, pedestrian crossings were also considered along both US 1 Northbound (Washington Avenue) and US 1 Southbound (Hopkins Avenue). Through the coordination process, the District Five Operations unit has indicated it would review pedestrian crossing opportunity(ies) independent of this study. Bicycle lanes were also considered for the study corridors. However, due to R/W constraints and a new bicycle facility along the parallel Indian River Avenue, bicycle lanes were removed from consideration.

The Space Coast TPO ITS Master Plan calls for fiber to be installed along US 1 from NASA Causeway north to SR 406, designating the project as Priority #4 in the Priority List. There may be opportunities to align this priority with the reconstruction of the US 1 and SR 406 intersection. As part of the reconstruction, the existing CCTV at the intersection will need to be moved/replaced to accommodate the roundabout.

As part of the development of alternatives, Adaptive Signal Control Technology (ASCT) was considered for US 1. However, it was not recommended. It was determined that the existing and future traffic conditions of the corridor do not merit the ASCT deployment. In addition, the ITS cost breakdown for Priority #4 (US 1 from NASA Causeway to SR 406) did not include components for Adaptive Signal Control (*SCTPO ITS Master Plan, **Appendix J***).

5.2.8 Right of Way

R/W and utility impacts are significant for this intersection, with an estimated cost of $12,519,500. The most significant cost will be the relocation of the KFC located between Hopkins Avenue and Washington Avenue on the North side of SR 406. This will require taking the full 12,791 square foot parcel plus an additional 1,717 square feet to the northwest of the parcel, which will result in a required Project Development & Environment (PD&E) Study. Additionally, 507 square feet of landscaping is required from the northwest corner of the parcel currently occupied by Papa Johns at the southwest corner of Washington Avenue and SR 406 (Garden Street), 1,282 square feet is required to be taken from the northwest corner of the parcel currently occupied by CVS on the south side of SR 406 (Garden Street), and 861 square feet is required to be taken from the

southeast portion of the parcel currently occupied by Cumberland Farms on the northwest corner of SR 406 (Garden Street) and Hopkins Avenue. None of these impacts are expected to significantly affect property owners besides the taking of KFC. The square feet used to calculate the benefit-cost analysis for the roundabout screening was 15,885 square feet. With the redesign of the roundabout, it was determined that 17,158 square feet will need to be taken to construct the roundabout.

Figure 32: US 1 and SR 406 (Garden Street) Roundabout R/W Requirements

5.2.9 Cost Estimates

Costs for the US 1 corridor are concentrated at the SR 406 (Garden Street) intersection. Design for the roundabout is estimated to be $1.7 million, while construction and utility costs are estimated to be $2.4 million. The R/W costs are estimated to be $12,159,500 million. In total, the US 1 & SR 406 Roundabout is estimated to cost $16.3 million.

5.2.10 Measures of Success

Measures of success were identified during the Corridor Planning Study in order to evaluate the effectiveness of the recommendations selected for the study corridor. These measures are based on the guiding principles identified for the corridor.

Safety and pedestrian mobility are two of the guiding principles. The US 1 & SR 406 roundabout will add improved pedestrian facilities for the intersection. While today there are no pedestrian or bicycle facilities on the north side of the US 1 and SR 406 (Garden Street) intersection, the roundabout will add sidewalks. The connecting bicycle facilities on SR 406 (Garden Street) will improve bicycle movement and access along the US 1 corridor. In addition to these improvements FDOT Traffic Operations agreed to provide an analysis of midblock crossings and other pedestrian safety implementations.

Another guiding principle was economic development. The US 1 and SR 406 (Garden Street) roundabout will provide an aesthetically pleasing gateway feature into downtown Titusville. The roundabout, in conjunction with a proposed lane modification on SR 406 (Garden Street) will calm traffic and may contribute to increased property values along the corridor.

6

Conclusions and Implementation

Based on analysis performed to determine the 2040 projected volumes and operations of US 1 within the study area, the no-build demonstrates that there are no anticipated roadway capacity or intersection operational issues. This allowed the proposed alternatives to focus on improving safety and creating a multi-modal friendly environment.

The proposed US 1 and SR 406 roundabout is anticipated to operate at similar or better conditions in the 2040 future year when compared to the no-build scenario. This roundabout also provides the potential benefits of improving safety, encouraging slower speeds, and providing opportunities for aesthetic treatments including a gateway feature into the downtown Titusville area, as desired by local stakeholders.

The two signalized intersections at SR 406 (Garden Street) and the US 1 one-way pairs (US 1 Southbound and US 1 Northbound) currently experience high crash rates. The proposed SR 406 and US 1 roundabout provides a unique solution that removes two existing signals and combines the two intersections into one roundabout. This combined roundabout seeks to improve safety while maintaining acceptable operations.

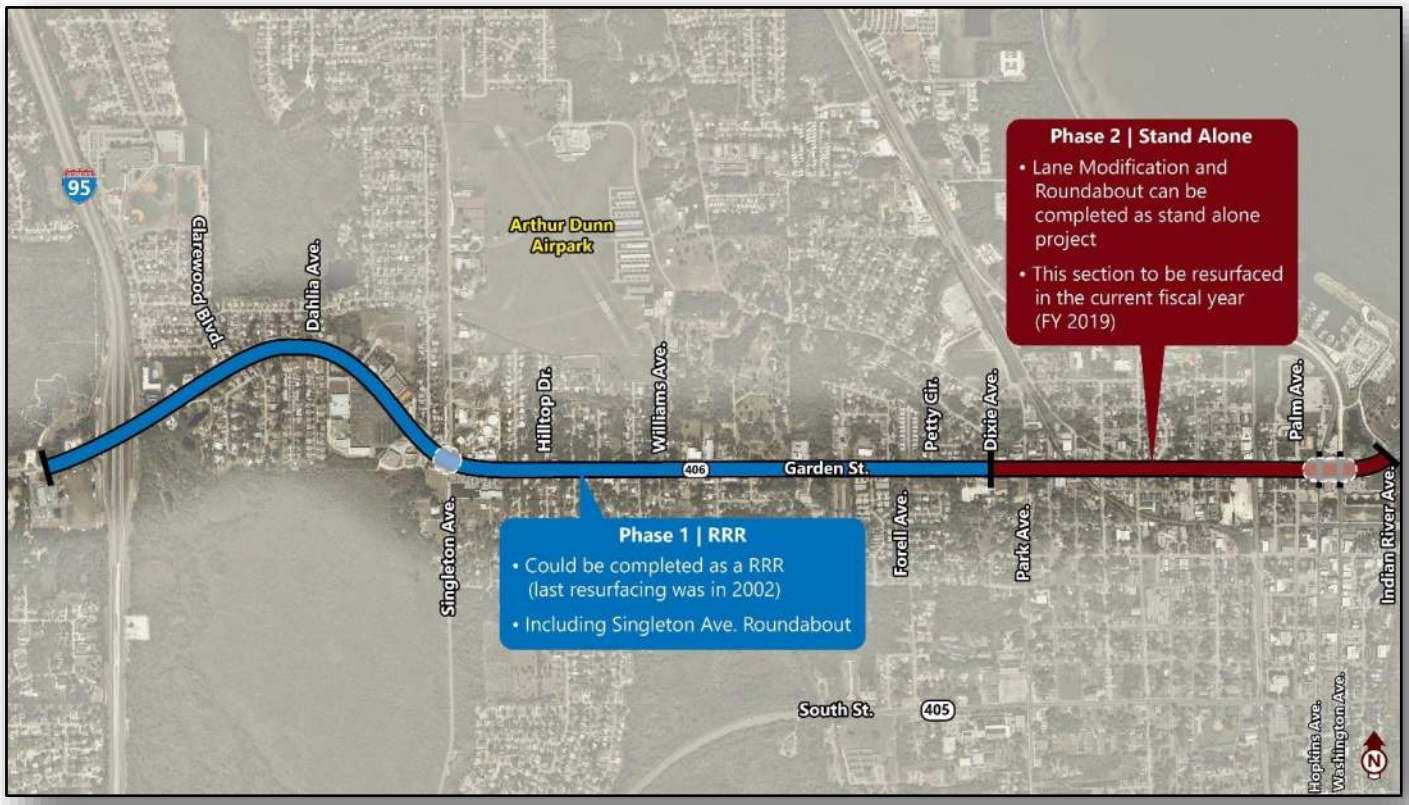
6.1 Implementation

While there is only one proposed alternative for the US 1 Corridor, this Concept Development and Evaluation Study was completed in conjunction with the SR 406 (Garden Street) Concept Development and Evaluation. This study produced several proposed alternatives, including a lane modification from Dixie Avenue through the US 1 and SR 406 (Garden Street). Because of the interdependencies in these implementations, it is recommended that the lane modification and US 1 at SR 406 roundabout be implemented and funded as an individual project. Other proposed alternatives for the SR 406 (Garden Street) corridor can be implemented in a prior phase, to be completed with an impending resurfacing to be schedule in the near future. This implementation will include access management improvements, the addition of bike lanes along the corridor and a roundabout at Singleton Avenue.

While neither of these phases are in the Space Coast TPO Long Range Transportation Plan, there is support from both the TPO and the City of Titusville for these projects. In a letter signed on July 2, 2018, the city said, “We are supportive of the Department proceeding with a lane reduction

along SR 406 (Garden Street) between Park Avenue and Indian River Avenue … In addition to the lane reduction, the City of Titusville would also like to express its support for the proposed roundabouts… at SR 406 and Singleton Avenue and the system involving the rework of the interface between US 1 and SR 406." For the implementation of these concepts to move forward, the Space Coast TPO would need to add the projects to their LRTP as priorities. At this point, funding could be explored through the Department or other interested agencies. Figure 36 shows the proposed phasing for both the US 1 and SR 406 (Garden Street) Concept Development proposed alternatives.

Figure 33: US 1 and SR 406 (Garden Street) Concept Development Proposed Implementation Phasing



CONCEPT DEVELOPMENT

US1

Florida Department of Transportation District 5

CONCEPT DEVELOPMENT AND EVALUATION TECHNICAL MEMO

FDOT