Navigation Discipline Report for the AAF Passenger Rail Project from Orlando to Miami, Florida

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List of Acronyms and Abbreviations

AAF	All Aboard Florida Operations, LLC
AMEC	AMEC Environment & Infrastructure, Inc.
CFR	Code of Federal Regulations
CRA	Community Redevelopment Agency
DDA	Downtown Development Authority
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FDEP	Florida Department of Environmental Protection
FDOR	Florida Department of Revenue
FDOT	Florida Department of Transportation
FEC	Florida East Coast
FECR	Florida East Coast Railway, LLC
FFWCC	Florida Fish and Wildlife Conservation Commission
FRA	Federal Railroad Administration
GIS	geographic information system
GOAA	Greater Orlando Aviation Authority
GPS	Global Positioning System
I-95	Interstate-95
MBE/DBE/WBE	Minority, Disadvantaged and Women-owned Business Enterprises
MCO	Orlando International Airport
MF+10	multi-family residences with more than 10 units
MF-10	multi-family residences with 10 or fewer units
MHWL	mean high water level
MIASF	Marine Industries Association of South Florida
mph	miles per hour
MPO	Metropolitan Planning Organization
ROW	right-of-way
RTC	Rail Traffic Controller
SDVOSB	service-disabled veteran-owned small business
SF	single family
SFRTA	South Florida Regional Transportation Authority
SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District
SR 528	State Road 528
TCRPC	Treasure Coast Regional Planning Council
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOT	United State Department of Transportation
VHB	Vanasse Hangen Brustlin, Inc.
VHF	very high frequency
VMF	Vehicle Maintenance Facility
VOSB	veteran-owned small business
WFP	waterfront residential property

Executive Summary

All Aboard Florida-Operations, LLC (AAF) has prepared this Navigation Discipline Report to evaluate the effect of its proposed passenger rail service on maritime traffic and the marine industry at three operable bridges located within the existing freight rail corridor operated by Florida East Coast Railway, LLC (FECR) in south Florida (corridor). This Navigation Discipline Report provides details of the proposed project, current and proposed freight and passenger rail service within the corridor, the location and operation of three operable bridges, and a summary of findings.

ES.1 Project Description

The proposed AAF project (Proposed Action), will consist of a 235-mile intercity passenger rail service connecting Miami and Orlando International Airport (MCO). It will include the following two connected corridors and a new Vehicle Maintenance Facility (VMF):

- A Miami-to-Cocoa corridor (North-South Corridor) that includes approximately 195 miles of rail improvements between Miami and Cocoa, Florida, within an existing, active freight rail right-of-way (ROW).
- An east-west corridor (East-West Corridor) of approximately 40 miles from Cocoa to Orlando, generally parallel to the existing State Road 528 (SR 528 or Beachline Expressway), which would extend the service to MCO). The new VMF is proposed at MCO.

This Navigation Discipline Report focuses on three operable bridges located within the existing FECR Corridor, between Miami and West Palm Beach. These include the New River Bridge in Broward County, the Loxahatchee River Bridge in Palm Beach County, and the St. Lucie River Bridge in Martin and St. Lucie Counties. These locations were selected for evaluation because they are located over navigable waters, and their operations (opening and closing) affect maritime traffic.

ES.2 Navigation Study Purpose and Methodology

The purpose of this study is to provide navigational information for consideration by the United States Coast Guard (USCG) to allow informed decision-making on the Proposed Action.[1] This evaluation considers the potential for environmental, economic and navigational effects associated with the Proposed Action. More specifically, this study estimates the extent to which the projected changes in bridge closure frequency and duration due to the Proposed Action might affect commercial and recreational vessels traversing FECR's moveable bridges at the New River, Loxahatchee River, and the St. Lucie River.

This study considers data presented in previous traffic studies performed by others, and includes detailed analyses and simulation modeling results based on current and future freight train operations, proposed passenger rail and recent boat traffic surveys. These studies and analyses include:

- Literature reviews of vessel traffic studies conducted at each bridge;
- Summaries of 2014 vessel traffic surveys gathered through video assessments;
- Summaries of bridge closure data;
- A detailed analysis of the existing vessel traffic and bridge schedules;
- A detailed analysis of the marine industry at each bridge;
- Socioeconomic analyses; and
- Results from a discrete-event simulation model of vessel traffic.

These data were used to complete an analysis comparing the No-Build Alternative (as defined in Table ES-1 below) to the Proposed Action. The No-Build Alternative evaluated as part of this analysis involves no changes to the rail infrastructure within the FECR Corridor beyond those that

[1] United States Coast Guard (USCG) Bridge Program. Reasonable Needs of Navigation: White Paper. Version 1.1, October 5, 2012

are currently planned and funded, no new rail line construction within the East-West Corridor, and considers expected growth of freight traffic.

ES.3 Description of Proposed Action and Effects Determinations at Each Operable Bridge

The effect determination for each bridge was assessed considering the potential to impact identified navigational needs, as per USCG guidance (Section 2.6.1), of the No-Build Alternative, the Proposed Action and the Combined Effect (defined as the Proposed Action combined with freight traffic that is projected to exist within the FECR Corridor in 2016). A summary of the descriptions for the No-Build Alternative and Proposed Action for each bridge is described in Table ES-1.

Table ES-1. Description of No-Build Alternative and Proposed Action

Actions Considered	Bridge	Description
No-Build Alternative	Same for all bridges	– No changes to the rail infrastructure will occur within the FECR Corridor beyond those that are currently planned and funded, and no new rail construction within the East-West Corridor. – Daily operation frequency at the three bridges includes a projected increase to 20 freight trains by 2016 with a 3% growth per year thereafter in operations.
Proposed Action	New River Bridge	– Will include rail infrastructure work, which will not change the vertical clearance or footprint of the bridge that accommodates two tracks over the entire span. – Daily operation frequency includes 32 passenger trains per day.
	Loxahatchee River Bridge	– Will include rail infrastructure work which will not change the vertical clearance or footprint of the bridge to restore the double-tracks over the entire span of the bridge. – Daily operation frequency includes 32 passenger trains per day.
	St. Lucie River Bridge	– Will include rail infrastructure work, which will not change the vertical clearance or footprint of the bridge that currently accommodates a single track over the entire span. – Daily operation frequency includes 32 passenger trains per day.

The criteria defined for the effects determination on meeting reasonable needs of navigation for the No-Build Alternative, the Proposed Action, and the Combined Effect are summarized in Table ES-2. As the study shows, there are no major or enhanced impacts and those few moderate impacts will become minor or minimal or will be eliminated altogether with readily achievable mitigation.

Table ES-2. Description of Impacts to Navigation for Effect Determinations During Peak Hours for Vessel Traffic

	Description of Impact to Navigation			
Impact	**Vessel Passage**	**Queue Length and Probability**	**Extended Closure Times**	**Economic Impact**
No Impact	Alternative results in no change in vessel that experience a wait during peak traffic hours	Alternative results in no change in vessel queue length during peak traffic hours	Alternative results in no increase in bridge closure times during peak traffic hours	Alternative results in no economic impact to marine industry as a result of longer wait times during peak vessel traffic hours
Minimal	Alternative results in slight changes not expected to be measureable in % of vessels that experience a wait during peak traffic hours	Alternative results in slight changes not expected to be measureable in vessel queue length during peak traffic hours	Alternative results in slight changes not expected to be measureable for bridge closure times during peak traffic hours	Alternative results in slight changes (< 0.1% change) not expected to be measureable to marine industry as a result of longer wait times during peak vessel traffic hours
Minor	Alternative results in <25% of vessels that experience a wait during peak traffic hours	Alternative results in an increase in vessel queue lengths >10 with a probability <2.5% during peak traffic hours	Alternative results in single bridge closure times that are < 30 minutes long during peak traffic hours	Alternative results in a > 0.1% but < 1% increase in the cost of waiting compared to the marine industry value
Moderate	Alternative results in >25% but <40% of vessels that experience a wait during peak traffic hours	Alternative results in an increase in vessel queue lengths >10 with a probability >2.5% but <5% during peak traffic hours	Probability that Alternative will results in single bridge closure times that are ≥30 and ≤45 minutes long during peak traffic is less than 1%	Alternative results in a > 1% but < 5% increase in the cost of waiting compared to the marine industry value
Major	Alternative results in >40% of vessels that experience a wait during peak traffic hours	Alternative results in an increase in vessel queue lengths >10 with a probability >5% peak traffic hours	Probability that Alternative will results in single bridge closure times that are ≥30 and ≤45 minutes long during peak traffic is more than 1%	Alternative results in a > 5% increase in the cost of waiting compared to the marine industry value
Enhanced	Alternative results in a decrease in number of vessels that wait during peak traffic hours	Alternative results in a decrease in queue lengths during peak traffic hours	Alternative results in a decrease in bridge closures times during peak traffic hours	Alternative results in a decrease in cost of waiting as a result of longer wait times during peak vessel traffic hours

In order to establish the effects determinations based on the criteria above, measurable and predictable operational parameters were utilized to analyze potential impacts to navigational needs and the local marine industry. The operational parameters include:

- Vessel Passage: This criterion allows for a comparison of the overall number of vessels that will be delayed when traversing each bridge location under each operating scenario. Lower percentages for this parameter would result in less impact.
- Queue Length and Probability: This parameter is based on the probability that a queue length of 10 boats or greater will occur during a bridge closure. A lower probability of occurrence is considered to have less effect.
- Extended Closure Times: This parameter considers the length of individual closure times for each bridge location during peak traffic hours. Individual closure durations (as compared to total daily closure times) are useful for determining vessel wait times and queue lengths.

- Economic Impact: The aforementioned criteria, along with economic data specific to the marine industry and local jurisdiction, are used to estimate economic impacts to the marine industry due to changes in vessel wait times. This estimate includes potential impacts to boaters, the marine industry (such as marinas) and non-marine industry businesses (such as local stores).

It should be noted that these criteria were evaluated utilizing data from periods of peak vessel traffic estimates to provide a conservative evaluation. Key findings of the navigational study are summarized below.

ES.4 Key Findings

Results from vessel simulation and economic models performed for the three operable bridges allowed for identification of economic and navigational effects of projected increases in freight operations and the addition of passenger rail operations. Table ES-3 summarizes key findings prior to mitigation for peak vessel traffic periods. During these periods, more vessels will be required to wait at each bridge location. However, average wait times are reduced at all three bridge locations. The effect on costs to the marine industry will minimally decrease at the New River and Loxahatchee River Bridges and minimally increase at the St. Lucie Bridge.

In addition, the likelihood of a 30+ minute bridge closure at any of the three operable bridges is unlikely, with less than 1% probability of such a closure occurring.

Furthermore, there is a 90% probability that a single vessel will not have a wait time of greater than 12.2 minutes at the New River Bridge, 9.8 minutes at the Loxahatchee River Bridge, and 17.6 minutes at the St. Lucie River Bridge.

Table ES-3. Summary of Key Findings for the Combined Effect (Freight plus Passenger Rail) Prior to Mitigation. A Decrease in Change from the No-build indicates the Combined Effect has a Positive Effect on the Criteria Listed. An Increase in Change from the No-Build indicates the Combined Effect has a Negative Effect on the Criteria Listed.

New River Bridge		
	Combined Effect* Freight+Passenger	Change from No-Build
Average Wait for Vessels Waiting (minutes)	6.3	Decrease 1.6
Most Likely Vessel Wait Time; >90% Probability of Occurring (minutes)	≤12.2	Decrease 4.2
Estimated Cost to Marine Industry as Percentage of Industry (percent)	0.0029	Decrease 0.0094
Loxahatchee River Bridge		
	Combined Effect* Freight+Passenger	Change from No-Build
Average Wait for Vessels Waiting (minutes)	5.7	Decrease 3.7
Most Likely Vessel Wait Time; >90% Probability of Occurring (minutes)	≤9.8	Decrease 6.9
Estimated Cost to Marine Industry as Percentage of Industry (percent)	0.0156	Decrease 0.0032
St. Lucie River Bridge		
	Combined Effect* Freight+Passenger	Change from No-Build
Average Wait for Vessels Waiting (minutes)	8.1	Decrease 1.8
Most Likely Vessel Wait Time; >90% Probability of Occurring (minutes)	≤17.6	Decrease 0.7
Estimated Cost to Marine Industry as Percentage of Industry (percent)	0.0167	Increase 0.007

* Effect determination prior to mitigation measures

The findings of this study indicate that the Proposed Action does not have a major socioeconomic, navigational or maritime delay impact on any of the three operable bridges based on the areas of required evaluation by the USCG. Furthermore, the application of proposed mitigation measures

would enable any identified impacts to be reduced to a level equal or better than the No-Build Alternative conditions.

The following section describes mitigation options being considered by AAF to further reduce impacts to navigation at each bridge location.

ES.5 Mitigation

Overall, impacts from the No-Build and Proposed Action range from minimal to moderate. The level of impacts associated with the Proposed Action can be reduced or eliminated through mitigation options. With the use of appropriate mitigation alternatives, the effects of the Proposed Action can be reduced to those expected for the No-Build (minimal to minor impacts), and for select effects criteria, it could be reduced to conditions better than those expected for the No-Build.

Mitigation options being considered by AAF to improve operations at the New River Bridge, Loxahatchee River Bridge, and St. Lucie River Bridge include:

- Addition of a tender at the New River Bridge to allow better communication with commercial vessels.
- Develop a schedule for the down times of the bridge for passenger rail service.
- Provide public access to the bridge closure schedules in an internet-accessible format. Schedules for each bridge may be posted on the AAF website and/or the USCG website. This will allow the boating community to plan their trips to avoid wait times and related costs associated with the Proposed Action.
- Implement a notification sign/signal/horn at each bridge location with count downs to indicate the times at which the bridge will begin to close and open.
- Develop formal contact with first responders and emergency personnel.
- Develop coordination plans between AAF and local authorities during peak vessel travel times on holidays and major public events.
- Develop coordination plans between AAF and the USCG to promote communication with the commercial and recreational boating communities.

The results of the mitigation measures being considered are summarized in Table ES-4.

Table ES-4. Effect of Proposed Action to Navigational Needs at New River, Loxahatchee River and St. Lucie River After Mitigation

Effect Determination Criteria [a]	New River after Mitigation	Loxahatchee River after Mitigation	St. Lucie River after Mitigation
Obstruction of passage *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minimal	Minor
Most navigationally limiting structure *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minimal	Minor
Impacts to jobs, economic growth and development *Economic Impacts*	No Impact	No Impact	No Impact
Economic impacts to existing or planned commercial/industrial developments *Economic Impacts*	No Impact	No Impact	No Impact
Impacts to unique or critical infrastructure	No impact (N/A)	No impact (N/A)	No impact (N/A)
Impacts to USACE transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minimal	Minor
Impacts to USCG transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minimal	Minor
Impacts to existing and future cruise ship ports-of-call/terminals	No impact	No impact	No impact
Impacts to commercial freighters	No impact (N/A)	No impact (N/A)	No impact (N/A)
Impacts to ports supporting post-panamax vessels	No impact (N/A)	No impact (N/A)	No impact (N/A)
Impacts to vessels that produce unique products for the region	No impact (N/A)	No impact (N/A)	No impact (N/A)
Impacts to vessels that require tug boats *% of vessels that wait* *Queue length* *Extended closure times*	No impact	No impact	No impact
Impacts to proposed commercial vessels as a result of proposed development	Minimal	Minimal	Minimal
Ability of vessels to adjust operations without significant economic loss in order to transit the Proposed Action	No impact (N/A)	No impact (N/A)	No impact (N/A)
Availability of alternative routes for vessel passage	No impact (N/A)	No impact (N/A)	No impact (N/A)
Ability of vessels to transit at typical lower water stages	No Impact	No Impact	No Impact

Note: [a] Effect determination for factors to be considered by the USCG was determined based on the identified criteria in italics of either % of vessels that wait, queue length, economic impacts and extended bridge closures or a combination of these criteria.

The overall effect determination reflects the highest impact of the combined impact determination criteria of each category.

As presented in the table above, and detailed in the following Navigational Study, there are no major impacts to the marine industry and/or to vessels traversing the New River, Loxahatchee River, and St. Lucie River Bridges anticipated as a result of the Proposed Action.

1.0 Introduction

1.1 Purpose and Need for Navigation Analysis

All Aboard Florida-Operations, LLC (AAF) has prepared this Navigation Discipline Report to evaluate the effect of its proposed passenger rail service on maritime traffic and the marine industry at three operable bridge locations within the existing freight rail corridor operated by Florida East Coast Railway, LLC (FECR) between Miami and Cocoa (corridor). The Navigation Discipline Report provides details of the proposed project, current and proposed freight and passenger rail service within the corridor, the location and operation of three operable bridges and a summary of findings.

1.2 Project Description

The proposed AAF project (Proposed Action), will consist of a 235-mile intercity passenger rail service connecting Miami and Orlando International Airport (MCO). It will include the following two connected corridors and a new Vehicle Maintenance Facility (VMF):

- The Miami-to-Cocoa corridor (North-South Corridor), a north-south alignment that includes approximately 195 miles of rail improvements within an existing, active freight rail right-of-way (ROW); and
- The east-west corridor (East-West Corridor), extending approximately 40 miles from Cocoa to Orlando, and generally parallel to the existing State Road 528 (SR 528 or Beachline Expressway), which would extend passenger service to MCO, where the new VMF would be constructed.

This Navigation Discipline Report (NDR) focuses on three operable bridges located within the existing FECR Corridor, between Miami and Cocoa. These include the New River Bridge in Broward County, the Loxahatchee River Bridge in Palm Beach County, and the St. Lucie River Bridge in Martin County. These locations were selected for evaluation because they are located over navigable waters, and their operations (i.e., opening and closing) directly affect maritime traffic.

The purpose of this study is to provide information for consideration by both the Federal Railroad Administration (FRA) and the United States Coast Guard (USCG) to allow informed decision-making on the Proposed Action.[2] The USCG, in its June 2, 2014 letter[3], supports including the NDR as “an attachment to the DEIS as it informs the choice of alternatives for analysis.”

This NDR considers the potential for environmental, economic, and navigational impacts associated with the Proposed Action. More specifically this study estimates the extent to which the projected increase in bridge closure time due to the Proposed Action will affect the commercial and recreational vessels traversingFECR’s operable bridges at the New River, Loxahatchee River, and/or St. Lucie River. This report presents:

- Literature reviews of vessel traffic studies conducted at each bridge;
- Summaries of 2014 vessel traffic surveys gathered through video assessments;
- Summaries of bridge closure data;
- A detailed analysis of existing vessel traffic and bridge operations data;
- A socioeconomic analysis of the marine industry in the vicinity of each bridge; and
- Results from a discrete-event simulation model of vessel traffic.

These data were used to complete an analysis comparing a No-Build Alternative to the Proposed Action. The No-Build Alternative involves:

[2] United States Coast Guard (USCG) Bridge Program. Reasonable Needs of Navigation: White Paper. Version 1.1, October 5, 2012
[3] USCG. Letter to the author. June 2, 2014. TS.

- No changes to the rail infrastructure within the FECR Corridor beyond those that are currently planned and funded;
- No new rail infrastructure within the East-West Corridor; and
- Consideration of expected growth of freight to an average of 20 trains per day by 2016.

1.3 Cases Evaluated for Navigation Study

The following four cases (Sections 1.3.1 through 1.3.4) were analyzed to evaluate potential impacts due to the Proposed Action.

1.3.1 Existing Conditions

There are three existing operable bridges located within the Project Area. These include the New River Bridge in Broward County, the Loxahatchee River Bridge in Palm Beach County, and the St. Lucie River Bridge in Martin County. All three of these operable bridges remain in the open position to allow for vessel traffic passage except for when freight trains approach. Existing (2013) freight operations consist of freight trains that average 8,150 feet in length, and are comprised of two locomotives (each 89 feet long) and 101 rail cars (each 79 feet long). According to historical trends obtained from the FRA Crossing Inventory, approximately half of the freight operations occur at night (10 pm to 7 am), and half during the day (7 am to 10 pm). Daily operation frequency includes an average of 10 bridge closures to allow for the passage of approximately 10 to 13 freight trains, at average speeds of 22.6 miles per hour (mph) in Broward County, 30.3 mph in Palm Beach County, and 32.0 mph in Martin County.

These FECR bridges are not tended, but remain open with green lights illuminated indicating that marine vessels may pass. When a train approaches, the lights flash red and a horn sounds four blasts, pauses, and then continues four blasts. After eight minutes, the FECR bridges go down and lock, provided the scanning equipment reveals nothing under the draw. The draw remains down for a period of eight minutes or for as long as the track circuit is occupied. After the train has cleared, FECR bridges open and the lights return to green.

All train operations are controlled by FECR's dispatch center in Jacksonville. This includes both train scheduling and bridge operations. It has been observed that bridges occasionally remain closed when not required to facilitate train crossing. These bridges are sometimes down due to required maintenance as the FECR needs to inspect the bridge, tracks and signal systems.

1.3.2 No-Build Alternative

The No-Build Alternative evaluated as part of this analysis involves no changes to the rail infrastructure within the FECR Corridor beyond those that are currently planned and funded, and no new rail construction within the East-West Corridor. The upgrades to the FECR Corridor contemplated as part of the Proposed Action would not occur in the near term as part of the No-Build Alternative; however, under the No-Build Alternative, freight operations by FECR would continue and are expected to increase in frequency. Historically, FECR operated 24 daily trains in 2006, and had projected growth of 5-7% between today and 2016. However, in light of delays in the expansion of the Panama Canal and other factors, it is now expected that freight operations will increase to 20 trains per day by 2016, and at a 3% annual growth after 2016. As such, the No-Build Alternative assumes an increase to 20 freight trains in 2016, with operations at the three operable bridges at average speeds of 22.6 mph in Broward County, 30.3 mph in Palm Beach County, and 32.0 mph in Martin County by 2016. Projected 2016 operations are used for analyzing potential impacts of the Proposed Action because they coincide with the proposed start-up of AAF's passenger rail service.

1.3.3 Proposed Action

The Proposed Action will cross the three operable bridges located within the Project Area: the New River Bridge in Broward County, the Loxahatchee River Bridge in Palm Beach County, and the St.

Lucie River Bridge in Martin County. The proposed modification to the New River Bridge contemplated as part of the Proposed Action includes rail infrastructure work, which will not change the vertical clearance or footprint of this double-track bridge. There are no plans to modify the bridge foundations located in the New River as part of the Proposed Action.

The proposed modifications to the Loxahatchee River Bridge contemplated as part of the Proposed Action includes rail infrastructure work, which will not change the vertical clearance but will restore and upgrade the double-tracks over the entire span. In addition, the bridge foundations located in the Loxahatchee River will not be modified by the Proposed Action.

The proposed modification to the St. Lucie River Bridge contemplated as part of the Proposed Action includes rail infrastructure work, which will not change the vertical clearance or footprint of the bridge that currently accommodates a single track. Providing a double-tracked bridge in this area would have required construction of a new adjacent bridge, a second-track and associated ballasts over the span of this long bridge, which is not planned as a part of this Proposed Action. Instead, this bridge will remain single-tracked. As such, the bridge foundations located in the St. Lucie River will not be modified by the Proposed Action for which AAF plans to complete upgrades to the FECR track on the St. Lucie River Bridge.

Table 1.1-1. Bridge Modifications under the Proposed Action

Bridge	Proposed Modification	Change to Vertical / Footprint Dimensions
New River Bridge	Upgrade existing double track	None
Loxahatchee River Bridge	Restore and upgrade previously existing double track	None
St. Lucie River Bridge	Upgrade existing single track	None

The use of all three operable bridges by AAF as part of the Proposed Action will result in an increase in the number of times per day that the bridges would need to close to allow for the passage of trains. However, the rail infrastructure improvements being considered as part of the Proposed Action (including the installation of new track with new ballast and ties, new turn outs and upgrades to existing turn outs, double tracking, and grade crossings) will serve to increase the speed at which trains may cross the bridges, thereby reducing the total closure time necessary for each train crossing of each bridge and increasing safety. As shown in Table 1.1-2, average speeds for the Proposed Action will be approximately 61 mph for passenger trains and 38 mph for freight trains in Broward County, approximately 76 mph for passenger trains and 39 mph for freight trains in Palm Beach County, and approximately 77 mph for passenger trains and 36 mph for freight trains in Martin County. A summary of bridge operations for these waterways can be found in USCG rule 33 Code of Federal Regulations (CFR) 114 -118 for operable bridges.

Table 1.1-2. Average Speeds of Passenger and Freight Trains

	No-Build	Proposed Action	
County	Freight (mph)	Passenger Train Speed (mph)	Freight Train Speed (mph)
Broward	23	61	38
Palm Beach	33	76	39
Martin	32	77	36

1.3.4 Combined Effect – Proposed Action with Improved Freight

Infrastructure improvements in the Proposed Action will enable track speeds to increase for freight rail. The corresponding improved freight efficiency is evaluated as part of this study. This case considers the planned AAF passenger rail operations in conjunction with the projected 2016 FECR freight operations (20 freight trains per day).

2.0 Methodology and Approach

2.1 Marine Industry Analysis

The following sections summarize the data sources and methodologies utilized to analyze the effects of the Proposed Action.

2.1.1 Waterway Features Inventory Methodology

The Waterway Features Inventory of recreational and commercial vessel access facilities prepared for this report includes boat ramps, marinas, dry storage facilities, anchorages, commercial entities, and waterfront residences with dockage or slips along the New River (in Broward County), Loxahatchee River (including portions of Palm Beach and Martin Counties) and St. Lucie River (including portions of Martin and St. Lucie Counties). The inventory was compiled through extensive review of existing data sets. Data sources included:

- Geographic information system (GIS) data and aerial photographs;
- Relevant websites (e.g., Florida Department of Revenue [FDOR]);
- Florida Marina Monitoring and Tracking database;
- Florida Boat Launch Ramp database maintained by the Florida Fish and Wildlife Research Institute; and
- Other studies and surveys performed along these waterways.

These databases contain records of more than 2,700 boating access locations and facilities including commercial marinas, condominiums with boating facilities, and hotels/restaurants with an associated boating facility.

The Florida Marina Monitoring and Tracking database and the Florida Boat Launch Ramp database maintained by the Florida Fish and Wildlife Research Institute were developed as part of the Florida Boating Access Facilities Inventory and Economic Study Report.[4] The statewide databases contain records of launches from and arrivals at more than 3,100 boat ramps. Boating facility data reported for the affected study areas was confirmed utilizing aerial data from Google Earth (aerial imagery from 26 March 2011). For the purposes of this report, the extent of the navigable area west of the operable bridges and to the Intracoastal Waterway to the east was reviewed.

A sampling procedure was used to estimate the number of wetslips and the dimensions of broadside berthing available at waterfront residential properties within the Project Area. These largely private boating facilities are located at single-family homes, apartment buildings, condominiums and mobile home parks. The county-level waterfront residential property (WFP) Waterway Features Inventory consisted of a stratified random sampling design. For each applicable county, residential property parcel grids were used to define WFP parcels, which were cross referenced with zoning information to provide a characterization of WFP development type [single family (SF) residences; multi-family residences with 10 or fewer units (MF-10); multi-family residences with more than 10 units (MF+10), and condominium complexes (Condo)]. These strata were available as GIS coverage for Broward, St. Lucie, Martin, and Palm Beach counties.

A stratum sampling frame for potential WFPs was created using GIS software to select polygons from the county residential property parcel coverage that met the stratum definition and whose boundaries fell within the 75-foot buffered water layer for New River, Loxahatchee River, and St. Lucie River. Because verification of true WFP status requires labor-intensive interpretation of aerial photographs, it was impractical to identify all true WFPs for some strata. Instead, a random stratum sampling frame of 100 parcels was carried out for single-family residences and multi-family residences, with the true WFPs in the sampling frame being viewed as a subpopulation of the

[4] Florida Fish and Wildlife Research Institute. 2009. Florida Boating Access Facilities Inventory and Economic Study: A Report to the Florida Fish and Wildlife Conservation Commission. August.

property parcels meeting the 75-foot buffer zone criterion. The databases and the residential sampling, taken together, are considered a reliable approximation of the current supply of recreational boating facilities along the New River, Loxahatchee River, and St. Lucie River.

2.1.2 Demand Forecast

To estimate the number of registered vessels in the Project Area in 2016, historic vessel registration information for Broward, Palm Beach, Martin, and St. Lucie counties from 2003 to 2013 were compared to county population to obtain a ten-year average of registered vessels per capita for each county. This per capita average was then compared to county population growth forecasts obtained from the Bureau of Economic and Business Research.[5] Using the growth forecasts for 2016, the increase in anticipated vessel traffic was calculated for each river. This forecast was utilized to quantify potential social and economic effects resulting from anticipated changes to the operation of the operable bridges on the New River, Loxahatchee River, and St. Lucie River.

2.2 Economic Analysis

The economic value of the marine industry for the three affected waterways was determined by estimating the economic value of the marine industry to each of the counties in which these rivers are located and then assigning the approximate percentage of this value to the appropriate waterway. Therefore, the first step of this analysis is to determine the economic value of the marine industry to Broward, Palm Beach, Martin, and St. Lucie Counties.

2.2.1 Economic Value by County

The State of Florida has performed extensive studies regarding the economic value of the marine industry. These studies include analysis of spending on vessels (e.g., boat sales, storage, repairs) and recreation (e.g., restaurants, fishing, tackle, ski/boating instruction). These studies also provide information about the economic value of marine-related activities by county. Given the depth and breadth of these studies, they were used to estimate the economic value of the marine industry in 2013 in order to determine a cost per trip to facilitate a quantitative socioeconomic impact analysis.

2.2.1.1 Direct Economic Benefits

The economic benefits of marine-related activities on the inland waterways for each of the counties considered were previously analyzed in the following years: 2007 for Broward County, 2006 for Palm Beach County, and 1999 for both Martin and St. Lucie Counties. The State of Florida updated these studies in December 2011 to reflect the economic value of the marine industry in each county for 2009 values (based on the most recently available data at the time)[6]. The State's studies identify and quantify the total economic benefit of each county's waterways, including direct benefits, indirect benefits, and induced benefits associated with marine-related activity. The analysis includes benefits related to expenditures in the marine industry as well as expenditures outside of the marine industry but directly related to marine activities (e.g., groceries purchased for a boating trip). These analyses do not include the impact of the marine industry on property values; accordingly, property value impacts will not be discussed in this report. Broward and Palm Beach Counties are the only counties within the study area that support port operations. The analyses for these counties included revenue from these operations; however, port operations are not part of the economic activity on the New River or Loxahatchee River, so these data were excluded from the economic analysis conducted for this study.

The analysis of total economic value of the marine industry for this navigation study relies on the methodology used by the State of Florida in its 2011 update of marine industry to determine the total

[5] Bureau of Economic and Business Research, University of Florida. 2003-2013. Population Estimates for Florida Counties. April 2013.

[6] Florida Inland Navigation District, December 2011. Update of the Economic Benefits of the District's Waterways in Florida, Main Report (Appendices J, K, L, and M). Available at http://www.aicw.org/studies.jhtml?method=list

value of the marine industry by county in December 2013. This analysis also expands on the previous methodology to estimate growth in direct, indirect, and induced economic activity (see Table 2.2-1), including total business volume, personal income, and employment.

The methodology used for calculating growth in the marine industry involved projecting all retail sales based on the growth in estimated gross sales in the marine industry, as recorded by the FDOR in the Validated Florida Sales Tax Return Receipts Monthly Statistics by Business by County. These data contain monthly totals for gross sales and taxable sales by county and by Kind Code up to December 2013. (Kind Codes are used to classify the main, but not the only, line of business of a particular establishment; currently, there are 85 Kind Codes in use.) Kind Code 28 consists of Motorboats, Yachts, Marine Parts, Accessories, and Boat Dealers. For each county, Kind Code 28 was used to determine growth in the marine industry by calculating the percentage growth in this industry between the base date of the original study and December 2013. The same level of growth was applied to all retail values that were calculated in the original study for that particular county. The results often showed a decline in the industry due to the economic recession in 2008. Table 2.2-1 indicates gross sales in Kind Code 28 and associated growth between the base year and December 2013 for each county.

The values for purchases from non-marine businesses for use in the marine industry (e.g., gasoline, food, drinks, and ice that were purchased for boating trips) were updated using different escalators because they are not as directly related to growth in the marine industry. These purchases are less influenced by local marine-related sales and more by macroeconomic factors within the region. Therefore, this portion of the direct economic value of the marine industry was updated to December 2013 using economic growth in the entire state. The 2013 values for each county identified in Table 2.2-1 were determined by using the percent change in gross sales for all Kind Codes in the State of Florida between the base year and December 2013. The gross sales for all Kind Codes in the State of Florida in 1999 were not available, so the non-marine expenditures for the two counties with a base year of 1999 (i.e., Martin and St. Lucie Counties) were escalated using the Consumer Price Index. See Table 2.2-1 for the dataset that was used and a summary of associated growth between the base year and December 2013 for each county.

Table 2.2-1. Data Sets and Growth Percentages Used to Escalate Values

County (Base Year)	Data Set	Value in Base Year	Value in 2013	Growth
Broward (2007)	Kind Code 28 (County)	$1,698,280,456	$1,610,441,108	-5.17%
	All Codes (State)	$1,802,537,274,026	$1,956,911,596,398	8.56%
Palm Beach (2006)	Kind Code 28 (County)	$571,635,414	$460,028,541	-19.52%
	All Codes (State)	$1,790,827,125,285	$1,956,911,596,398	9.27%
Martin (1999)	Kind Code 28 (County)	$161,500,000	$256,347,656	58.73%
	CPI-U (Nation, All Items)	168.3	233.049	38.47%
St. Lucie (1999)	Kind Code 28 (County)	$42,300,000	$63,161,543	49.32%
	CPI-U (Nation, All Items)	168.3	233.049	38.47%

Source: Values for Kind Code 28 by county and all Kind Codes for the State of Florida were obtained from the Florida Department of Revenue and are available at http://dor.myflorida.com/dor/taxes/colls_from_7_2003.html#county. The Consumer Price Index (CPI-U) data was obtained from the Bureau of Labor Statistics and is available at http://www.bls.gov/cpi/

2.2.1.2 Direct, Indirect, and Induced Economic Benefits, including Business Volume, Personal Income, and Employment

Direct expenditures associated with the marine industry affect the local economy in two primary ways. First, these expenditures support local employment and personal income for employees at businesses engaged in this industry as well as businesses that receive money due to economic activity in the industry (e.g., grocery stores selling food that is used during vessel trips). Second, these expenditures produce indirect and induced economic benefits to the area as the initial expenditures go through successive rounds of spending, a portion of which is spent in the local area. Estimating these benefits helps explain how money spent in one industry impacts the economy

through successive rounds of spending. Table 2.2-2 presents a description of direct, indirect, and induced effects as well as an example to illustrate these effects.

Table 2.2-2. Definition and Example of Direct, Indirect, and Induced Economic Effects

Type of Effect	Definition	Illustrative Example
Direct	The initial change in the industry in question (e.g., expenditures in the marine industry).	For example, when a boater pays for repairs to his vessel, this spending is considered a direct effect of the industry.
Indirect	Changes in inter-industry transactions when supplying industries respond to increased demands from the directly affected industries (e.g., impacts from non-wage expenditures).	When repairing the vessel, the mechanic uses a portion of these funds to purchase epoxy; if this expenditure occurs in the same region it would constitute an indirect economic effect of vessel industry spending.
Induced	Changes in local spending that result from income changes in the directly and indirectly affected industry sectors (e.g., impacts from wage expenditures).	The vessel mechanic would earn income that can then be spent in the local economy, thereby producing induced benefits to the local economy.

The original economic studies, which have been prepared by the State of Florida since the early 1990s and are updated periodically for each of the affected counties, included the value of the marine industry in terms of direct, indirect, and induced economic activity. These data includes total business volume, personal income, and employment. Because the general mix of sub industries that are included in the marine industry for each county are roughly the same as in the original studies, indirect and induced effects would represent a similar portion of the total economic value as in the original study. Therefore, this analysis uses multipliers based on the results of the original studies in order to estimate the December 2013 indirect and induced economic value based on the newly estimated direct value of the marine industry for each county. Based on this assumption, personal income and employment should maintain a similar distribution as well; therefore, this methodology was also employed for calculating the direct, indirect, and induced personal income and employment for each county.

2.2.2 Economic Value of the Marine Industry by Waterway

In order to determine the economic value of the specific waterways considered in this analysis, the relative importance of each waterway was determined as a percentage of the marine industry in the county in which it is located. In the case that a particular waterway is located in two counties, its relative importance in each county was considered and then the results for each county were summed to obtain the total economic value of the waterway.

In order to assess the importance of a river relative to the county in which it is located, the total number of wetslips at marinas, dockuminiums, clubs, and hotels/restaurants along the river were compared to the total number of wetslips at these types of facilities in the entire county. The resulting percentage was used to assign the relative percentage of the marine industry that each waterway represents in the county or counties in which it is located (see Table 2.2-3). After obtaining the relative importance of the waterway, the total economic value of the marine industry was determined by multiplying the total value in the county by the relative importance of the specific waterway. If the waterway lies in two counties, this was performed for each county and then the numbers were summed to get the total value of the marine industry along the entire waterway. Because these values are based on the updated values of the marine industry for December 2013, they represent the economic value of the marine industry associated with each waterway at that time.

Table 2.2-3. Percent Representation of each River Relative to the County in which it is Located

River	County	Number of Wetslips at Marinas, Dockuminiums, Private Clubs, and Hotels and Restaurants		Percentage Represented by the River
		On the River	In the County	
New	Broward	818	2,500	32.7%
Loxahatchee	Palm Beach	534	2,300	23.2%
	Martin	0	900	0.0%
St. Lucie	Martin	746	900	82.9%
	St. Lucie	222	1,450	15.3%

2.2.3 Socioeconomic Impact

Recreational and commercial boating activities bring revenue for local businesses and governments. The potential economic impacts to the marine industry for the three waterways of interest—New River, Loxahatchee River, and St. Lucie River—were estimated by first determining the economic value of recreational and commercial vessel trips and then calculating the waiting time value based on the average amount of time that would be spent waiting at the bridge crossing due to the Proposed Action.

For recreational boating, the value of a recreational vessel trip is assumed to be equivalent to the total cost associated with the trip. The State of Florida has published extensive studies (e.g., Florida's Recreational Marine Industry-Economic Impact and Growth 1980-2005, November 2005; The Value of Recreational Boating in Florida, March 2010) regarding the economic value of recreational boating at the county level, including total expenditures on vessel trips (e.g., marina services, restaurants, fuel) and vessel ownership (e.g., loan payments, vessel repairs, insurance). The four counties that provide recreational activities along the New River, Loxahatchee River, and St. Lucie River include Broward, Palm Beach, Martin, and St. Lucie Counties. For this analysis, the value of a vessel trip on a particular river is based on the weighted average between the counties in which the river is located. The respective weighting was determined based on the number of docks and slips on the portion of the river in each county, as shown in Table 2.2-4. Once the value of a recreational vessel trip on each river was defined, this number was divided by the average trip duration to obtain the cost per hour of recreational boating.

Table 2.2-4. Relative Percentage of River Represented in Each County

	New River	Loxahatchee River		St. Lucie River	
	Broward County	Palm Beach County	Martin County	Martin County	St. Lucie County
Residential Properties with Docks	3,750	703	358	1,307	734
Residential Slips	1,551	110	118	571	150
Commercial Slips	818	534	0	746	222
Residential plus Commercial Docks and Slips[a]	6,119	1,347	476	2,624	1,106
Relative Weight to each County[b]	100.0%	73.9%	26.1%	70.3%	29.7%

Notes: [a] Each property with a dock was assumed to have only one dock.
[b]This relative weight was determined based on the percentage of the water body was in each county. The New River is entirely with Brevard County; however, the Loxahatchee River and the St. Lucie River are both in two counties.

For the commercial boating industry, the economic value of commercial activities is expected to be at least equal to the cost of providing the service, including vessel and vessel employee costs. For this analysis, the cost of operating a commercial vessel was used to represent the value of this use. In order to determine the cost of operating a vessel, the costs from the state's recreational survey were used. Because commercial operations along the three rivers of interest are generally related to water transportation and charter activities, the vessels used for these operations are similar in size and costs to those used in the recreational boating industry along these rivers. The full costs associated with vessel ownership were considered; however, only a portion of the costs associated with recreational trip spending was included in the analysis for commercial operations. The costs

that were included were boat fuel and marine supplies, while the costs that were excluded were comprised of costs such as lodging, restaurants, and groceries.

The cost of operating a commercial vessel also includes employee costs. Because the majority of commercial activity along the rivers is comprised of water transportation (e.g., water taxis), sightseeing activities, and charter boats, the average wages that were used for this analysis are those associated with these industries for the State of Florida. The commercial operations along the three rivers generally consist of smaller vessels; therefore, the crew size was assumed to be approximately two people per vessel - although some large vessels like the Jungle Queen could potentially require more than two operators. The majority of the commercial vessels in these areas are water taxies, which require an average of two operators per vessel. According to the U.S Bureau of Labor Statistics, the average annual wage for an employee engaged in the industry of scenic and sightseeing transportation on water in the state of Florida is $29,812[7]. Assuming this employee works 40 hours per week, the hourly cost of this employee is $13.31 per hour. The cost of two crew members per vessel was included in the hourly costs of operating commercial vessels.

This analysis considers the potential effects of the Proposed Action as compared to the No-Build Alternative, to obtain the average economic effect on the local economy due to bridge closure delays. The bridge operations model included in Section 2.4.3 was used to determine the total number of minutes of waiting time resulting from the Proposed Action to both recreational and commercial boaters by multiplying the daily number of vessels by the average amount of wait time per vessel (referred as non-zero wait time in the Appendix of this report). The waiting time was then multiplied by the cost per hour of operating recreational and commercial vessels on each of the three rivers. The sum of these costs constitutes the total value to the marine industry and recreational boaters associated with increased bridge closures due to the Proposed Action.

2.2.4 Public Outreach

Since AAF made the first public announcement of its proposed passenger rail project in Florida, a comprehensive public engagement strategy has been employed. AAF has participated in more than 300 informational meetings, briefings, presentations, and telephone calls with stakeholders, community leaders, neighborhood representatives, and elected officials. These efforts, which began in March 2012, represent AAF's proactive plan to work collaboratively with federal, state, and local agencies (e.g., FRA, US Army Corps of Engineers [USACE], US Coast Guard [USCG, South Florida Water Management District [SFWMD], etc.). Outreach that occurred in the vicinity of the New River, Loxahatchee River, and St. Lucie River is summarized in Sections 3.2-5, 4.2-5, and 5.2-5, respectively.

2.3 Vessel Traffic Survey

Data required to conduct this analysis was gathered through literature review of existing vessel traffic studies, interviews with Marine Industry Association personnel, video recordings of vessel traffic provided by AAF, and live video feeds. Additional information was obtained from GIS data sources. Projected operations schedules for freight and passenger traffic was provided by AAF. This collective dataset representing vessel traffic at the affected bridges was used to assess the potential for navigation impacts.

2.3.1 Literature Review of Vessel Traffic Studies

Preliminary vessel traffic studies were identified for the Loxahatchee River and New River, but no studies or readily available data were identified for the St. Lucie River. However, data from live video feed were used to characterize vessel traffic on the St. Lucie River (see Section 2.3.2). The information gathered from preliminary vessel studies was summarized and compared to vessel

[7] From the U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages for NAICS 4872, Scenic and sightseeing transportation, water. Available at http://www.bls.gov/data/#wages

traffic data collected from the video footage and live feed assessment to evaluate changes in vessel traffic. It was also used to evaluate the reliability of previous navigation studies in determining the socioeconomic impacts of the Proposed Action.

2.3.2 2014 Vessel Traffic Survey

Video recordings from permanent cameras located at FECR's bridges located at New River, Loxahatchee River and St. Lucie River were provided by FECR. The videos contain approximately two to three weeks of data during December and January, and in some instances a holiday. The videos were used to quantify the number and types of vessels that pass under the bridges. The raw data collected includes the number and size of commercial and recreational vessels that pass under the bridges. These data were summarized and organized to show differences and patterns between and within weekdays, weekends and different times of the day.

2.4 Bridge Operation Survey and Modeling

Data required to conduct this analysis were gathered through literature review of existing studies that investigated the rail bridge operations, video recordings of bridge operations provided by FECR, and live video feeds available for the New River, Loxahatchee River, and St. Lucie River FECR Bridges. Additional information obtained from GIS data sources and the projected operations schedule for freight and passenger traffic provided by AAF were also used to assess the potential for navigation impacts.

2.4.1 2014 Video Survey

Video recordings provided by FECR were used to collect bridge operation data for FECR's bridges at Loxahatchee River and St. Lucie River. The time of day (hour:minutes:seconds) when the bridge initially begins to close was recorded, and train schedule times were recorded relative to this initial closure time.

The location of the camera did not provide a line of sight on the New River Bridge. Accordingly, existing bridge operations data (time it takes the bridge to open and close during each train crossing) could not be collected from the video provided by FECR at this location. Instead, information on current bridge operations and vessel traffic at the New River Bridge was gathered through monitoring of live video feed available at this location: http://www.microseven.com/tv/livevideo-esplanade.html. This effort was conducted for five days during the peak season for vessel traffic (as characterized by previous studies, see Table 3.3-1), including weekdays and one full weekend. Live video feed data collection included vessel direction (heading east or west), vessel type (commercial or recreational), vessel size, bridge operations (e.g., closing times, the time the train arrives, and time it clears the bridge), as well as pictures of the vessels traversing the bridge.

2.4.2 Development of GIS Maps

GIS maps were developed to show the location of FECR's bridges at New River, Loxahatchee River and St. Lucie River as well as marine facilities, land use and population density along the three rivers. Source data included information from the following sources: ESRI GIS, Florida Geographic Data Library, National Bridge Inventory, Florida Fish and Wildlife Commission, and FDOR.

Bridge location maps show: 1) the location of the FECR bridge relative to the inlet of the river (east); 2) additional bridges in the inlet, confluence, and north and south forks of each river; and 3) the extent of waterfront development for vessel traffic (west). The extent of waterfront development was determined through a Google Earth imagery analysis.

Coastal areas are major destinations for tourism, which represents one of the fastest-growing sectors in the US economy[8]. Accordingly, urban growth and the concentration of people in coastal and riverside areas have environmental and socioeconomic impacts at local, regional and global scales. When assessing the impact of population and population growth it is important to consider spatial distribution, rather than absolute numbers. Population data were extracted from 2010 US Census Bureau as population counts at the block level, which allows analysis at a relatively fine spatial scale, and then converted into population density as number of individuals per square mile. Population densities were divided into five classes and are defined as follows:

- Class 1: < 2,500 people per square mile
- Class 2: 2,501 to 5,000 people per square mile
- Class 3: 5,001 to 7,500 people per square mile
- Class 4: 7,501 to 10,000 people per square mile
- Class 5: > 10,000 people per square mile

Land use was defined by three main categories, residential, commercial and marine facilities.

2.4.3 RTC Modeling of Bridge Operations

Rail Traffic Controller (RTC) is a rail traffic simulation tool developed by Berkeley Simulation Software. It is the de facto simulation tool used by Class I carriers (the seven largest North American railroads) and the majority of rail consulting firms. The primary purposes of the tool are to quantify the operating results (e.g., on-time performance, velocity, delay) of infrastructure changes (e.g., construction of new rail, improvement of existing rail) and to measure the impact of train schedule changes. For the Proposed Action, RTC modeling was used to fulfill both needs.

Specific to the three movable bridges affected by the Proposed Action, RTC modeling was used to determine the times that trains would occupy the span over the waterway. Once these occupancies were determined, a secondary (Excel-based) process used the RTC model data to determine the times that the waterway would be unavailable to vessel passage. This includes time that the bridge is in the process of closing before a train's arrival. On this point, it should be noted that the bridge must be closed several minutes prior to the train's arrival to allow the signaling system to permit the safe and efficient passage of the train. The bridge must be completely closed approximately 5 minutes in advance so that trains approaching the area receive a proceed indication via the signal system. As an example, if the bridge is not closed completely, the signal immediately adjacent to the bridge will be red. The next signal, two to three miles back from the bridge, will be a yellow. This means that a train that is approximately 3 minutes from the bridge (and that observes a yellow aspect) must begin slowing down. In order to keep that train traveling at the maximum possible speed, the bridge must be closed, which would permit all signals between the train and the bridge to remain green.

There are many factors that influence how far in advance the bridge must be down including, train speed, switch position, etc. Following the train traversing the bridge, the waterway remains unavailable for a period of time until the bridge is raised.

2.5 Discrete-Event Simulation Model

2.5.1 Scope of the Model

A discrete-event simulation model of scheduled train arrivals at a bridge and their corresponding impacts on commercial and recreational marine traffic was developed using Rockwell Software's Arena Professional. The model includes the following unit operations:

[8] World Travel & Tourism Council. March 7, 2012. Travel & Tourism forecast to pass 100m jobs and $2 trillion GDP in 2012. Available at: http://www.wttc.org/news-media/news-archive/2012/travel-tourism-forecast-pass-100m-jobs-and-2-trillion-gdp-2012/

- Scheduled movements of freight and passenger trains on the FECR line and their interaction with the operable bridge at the river crossing. Data for scheduled train movements were provided by AAF (Section 2.4.3).
- Commercial and recreational marine vessel traffic arrivals at the operable bridge in both directions along the river that were surveyed as part of this report.
- Operable bridge operation at:
  - New River Bridge in Fort Lauderdale
  - Loxahatchee River Bridge in Jupiter/Tequesta
  - St. Lucie River Bridge in Stuart

The simulation model was used to estimate the effect of train movements on the FECR line to marine vessel movements at three operable bridge locations Four scenarios were modeled that considered current and projected freight crossings and planned passenger crossings. Since the Proposed Action includes rail infrastructure upgrades that would improve freight movement, freight scenarios for the Proposed Action and the No-Build Alternative were also evaluated. The four scenarios examined include:

- Case 1: 2013 Freight Traffic with 2013 Infrastructure (Existing Conditions)
- Case 2a: 2016 Freight Traffic with 2013 Infrastructure (No-Build Alternative)
- Case 2b: 2016 Freight Traffic with 2016 AAF Improved Infrastructure (2016 Improved Freight)
- Case 3: 2016 Freight and Passenger Traffic with 2016 AAF Improved Infrastructure (Combined Effect)

Case 2b was examined to evaluate the effect of rail infrastructure improvements for the Proposed Action on projected 2016 freight traffic.

2.5.2 Inputs and Assumptions

2.5.2.1 Rail Traffic

The estimates of rail traffic arrivals are based on the existing schedule. A model to predict this schedule was generated using RTC. Specific to the three movable bridges, RTC was used to determine the arrival times of trains and the extent of time required to cross over the waterway. Bridge closure time starts when the bridge is in the process of closing before a train's arrival. Early bridge closures prior to the train's arrival will start the signaling system to warn vessel traffic, allowing a safe and efficient passage of the train. Under Existing Conditions, the closure time prior to the train arrival is approximately 12 minutes. With the Proposed Action and associated improvements in rail infrastructure, closure times prior to the train's arrival are expected to be reduced to approximately 7 minutes.

The train occupancy data from the RTC model was used as the basis for generating train arrivals at the bridges in the discrete-event model. Freight train arrivals were grouped by day-of-week and time-of-day. For example, Table 2.5-1 below shows the expected arrival times of Train 202 at the New River Bridge for one week.

Table 2.5-1. Sample of Expected Freight Train Arrivals by Day-of-Week Case 1: 2013 Freight Traffic with 2013 Infrastructure (Existing Conditions)

Freight Train Schedule Example								
Train		**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**	**Sun**
202	Intermodal North (RTC Data)	14:40	13:31	14:19	13:31	14:58	14:40	15:23

When examining the train arrival data above, one can observe a variation in the arrival times of the train from day to day. This is due to differences in departure times and delays in route and is part of the RTC model simulation. To maintain some variability in the discrete-event model, the model generates train arrivals at the bridge using the arrival times produced by the RTC model with a

variance of ±10 minutes to maintain some randomness in forecast train arrivals at the bridges. For example, on Mondays, the train will arrive at the bridge at 14:40 ± 10 minutes, etc.

Passenger train arrivals provided by the RTC model are at regular intervals, approximately once per hour in each direction. Since the predictability of the passenger service schedule is critically important to overall performance, the RTC data provides for no variability in passenger train arrival times and, therefore, the discrete-event model also does not include any variance.

2.5.2.2 Marine Traffic

Data for marine traffic were derived from video camera footage of the three crossings over the following periods during winter:

- New River: January 14 through 27, 2014;
- Loxahatchee River: December 31, 2013 through January 21, 2014; and
- St. Lucie River: January 3 through 17, 2014.

Traffic counts were sorted by vessel type (commercial or recreational), direction of travel, and were only assessed during daylight hours, from 6:00 AM to 6:30 PM.

Observations were also made regarding the characteristics of vessel traffic at New River Bridge. These observations included information on vessel size and traffic behavior and information on crossing times, and include the following:

- Vessels take between 1.5 to 7 seconds to cross under the bridge depending on size and speed.
- Most small vessels take approximately 2 seconds to cross.
- Medium vessels (e.g., the water taxi) take approximately 3.5 seconds to cross.
- Larger vessels (e.g., the Jungle Queen and sunset cruises) take approximately 5 to 6 seconds to cross.
- Two small vessels can cross at the same time in the same or opposite direction.
- A medium and small vessel were observed crossing at the same time (heading opposite directions).
- A small vessel will cross the bridge just behind a large vessel, reducing the amount of time it takes to cross by approximately 1 second.
- When a large vessel like the Jungle Queen crosses, no other vessel can cross and they are required to queue to the side of the river.
- Some small vessels, such as jon boats, can cross when the bridge is down.
- Small vessels will cross the bridge as it is going down and some will cross before the bridge is fully open.

2.5.2.3 Infrastructure Changes

Proposed rail infrastructure changes would include extending the double track of the mainline across the Loxahatchee River Bridge and up to the St. Lucie River Bridge, which will remain single tracked. The result would be that a second train, waiting for a train coming from the opposite direction to cross the bridge, would be staged closer to the bridge. This would reduce delays for trains that must currently slow or stop to yield to oncoming train traffic. The assumptions used in the model for trains encountering oncoming traffic are delays of 10 minutes for Existing Conditions (2013) and 5 minutes for the Proposed Action (2016). Since the New River Bridge is currently double-tracked, siding delays are not considered in either the Existing Conditions or the Proposed Action.

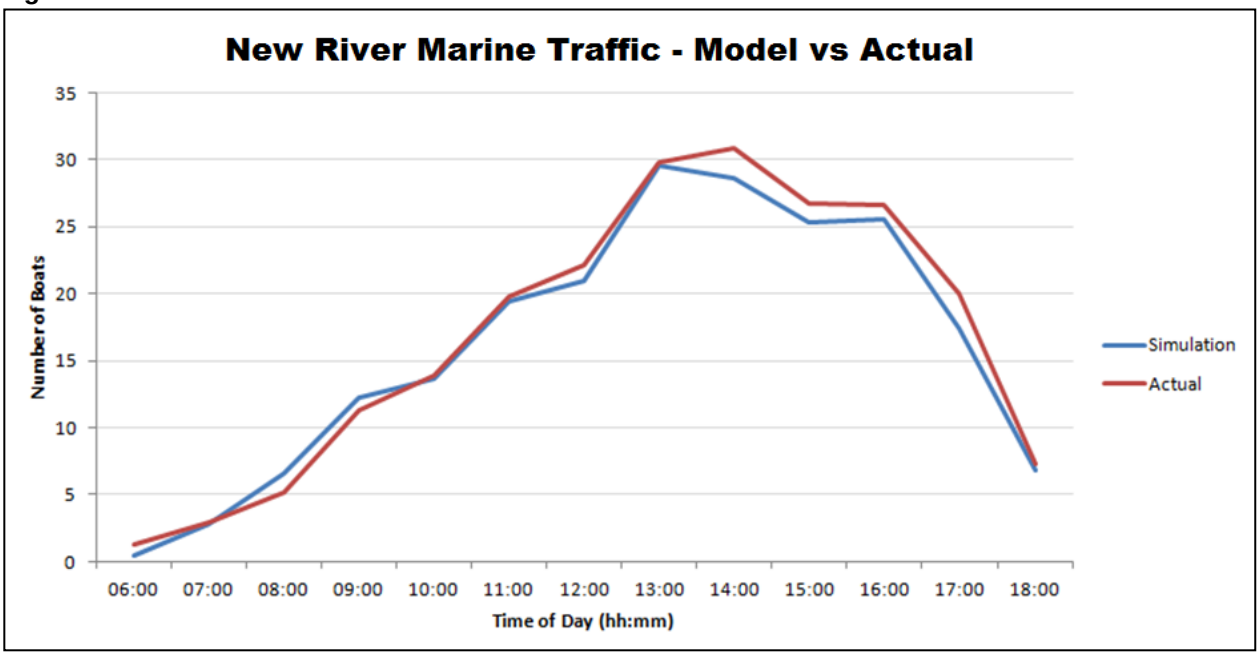
Currently, the bridges are controlled from a central dispatching facility in Jacksonville. On average, the controller deploys the bridge approximately 12 minutes before the arrival of a train and may or may not raise the bridge after the train has cleared it, depending on the expected arrival of the next train. The assumption for the Combined Effect (Case 3) is that the planned changes in dispatching procedures, result of the Proposed Action, will allow for the bridges to be deployed 7 minutes prior to

the arrival of a train and that each bridge will be raised if the next train is not expected to arrive within the next 7 minutes. This is the assumption used in the simulation model.

2.5.3 Model Calibration

The simulation model was run and results were compared with the data outputs from the RTC model and actual marine traffic as observed on the surveillance video for the New River Bridge. The simulation model results are similar to those of the RTC model, in most cases within 1% of the RTC values. This suggests that the model calibrated well and accurately predicts moveable bridge operations. The total number of train crossings per week is almost identical and the day-to-day numbers are also within one to two trains of the RTC values. For marine traffic, hour-by-hour marine traffic arrivals at New River Bridge were compared to the observed values from the available video footage. Figure 2.5-1 shows the correlation.

Figure 2.5-1. Marine Traffic - Simulation Model versus Actual



The simulation model is designed to introduce some variation when generating train and marine traffic arrivals, so the results from run-to-run will not be identical. The results above show a good correlation between the simulation results and observed data. Therefore, it is concluded that the model is performing satisfactorily and, given the model inputs and assumptions, is calibrated. Following model calibration, the scenarios identified in Section 2.5.1 were examined to estimate the effect of train movements across the bridges on marine vessel movements.

2.6 Effect Determination

2.6.1 Determining Impacts on Reasonable Needs of Navigation

To determine whether the Proposed Action would unreasonably obstruct marine traffic, while at the same time accounting for the reasonable needs of land traffic, this analysis was developed pursuant to USCG Bridge Administration Manual COMDTINST M16590, which provides that drawbridge operating regulations must balance the needs of vessel, vehicular, and rail traffic in the overall public interest.

The USCG guidance for bridges that have the potential to impact identified navigational needs (waterway usage) outlines several factors that need to be considered in order to assess potential

impacts of the Proposed Action.2 The following factors will be considered to determine if the Proposed Action - when compared to the No-Build Alternative - meets the reasonable needs of existing and future navigation:

1. **Obstruction of Passage:** *Does the Proposed Action completely obstruct the passage of any existing waterway users or the access to waterborne facilities?*

   The Existing Conditions, the No-Build Alternative, and the Proposed Action were evaluated using the RTC model results to determine whether there is a complete obstruction of passage of any existing waterway users, or the access to waterborne facilities. To determine an impact rating, vessel wait times during bridge closures for the No-Build Alternative (2016 freight traffic with 2013 infrastructure) were evaluated against Existing Conditions (2013 freight traffic with 2013 infrastructure); and the Proposed Action (2016 passenger traffic with 2016 infrastructure) and Combined Effect (2016 passenger and freight traffic with 2016 infrastructure) were evaluated against the No-Build Alternative (2016 freight traffic with 2013 infrastructure). Impact ratings were then assigned based on the associated increase or decrease in wait time.

2. **Most Navigationally Limiting Structure:** *Does the Proposed Action establish a new navigational limiting factor (i.e., will the Proposed Action be the most restrictive/obstructive structure across the waterway)? Does the Proposed Action match the navigational clearance of other existing structures on the waterway?*

   To determine if the Proposed Action establishes a new navigational limiting factor, the vertical clearance of any infrastructure crossing the river, and thus considered a navigationally limiting structure, (bridges and power cables) within the defined extent of waterfront development (Figures 3.1-1, 4.1-1, and 5.1-1) were examined. Bridges were also categorized as operable or fixed for this purpose.

3. **Impacts to Jobs, Economic Growth, and Development:** *Would implementation of the Proposed Action impact present or prospective commercial activity on the waterway (e.g., jobs, and economic growth and development)?*

   An economic analysis was performed to evaluate the potential socioeconomic impacts associated with the Proposed Action.

4. **Economic Impacts to Existing or Planned Commercial/Industrial Development:** *Would implementation of the Proposed Action impact existing or planned commercial/industrial developments in the affected area (e.g., within waterways or on adjacent land-based properties)? What are economic impacts on these businesses?*

   The same technique described for “Impacts to Jobs, Economic Growth, and Development” was used to characterize potential impacts to this criterion.

5. **Impacts to Critical or Unique Infrastructure:** *Does the Proposed Action impact existing facilities on the waterway that are or could be considered critical infrastructure, key resources, or important/unique US industrial capability (i.e., are these facilities unique or one of only a few of the type in the area)?*

   There are no critical or important/unique industrial facilities within the Project Area, and therefore, this criterion is not discussed.

6. **Impacts to USACE Transit Ability:** *Does the Proposed Action impact USACE ability to transit the bridge in a federal project channel?*

   The evaluation methodology used to determine “Obstruction of Passage” impacts is the same as that used to determine impacts to USACE Transit Ability.

7. **Impacts to USCG Transit Ability:** *Does the Proposed Action impact USCG and other government vessels’ ability to Transit Bridge to conduct mission essential functions (icebreakers, patrols, etc.)?*

The evaluation methodology used to determine "Obstruction of Passage" impacts is the same as that used to determine impacts to USCG Transit Ability.

8. **Impacts to Existing and Future Cruise Ship Ports-of-Call/Terminals:** *Does the Proposed Action impact existing and future cruise ship ports-of-call/terminals?*

   Large cruise ships do not operate up and down each of the three rivers due to navigational constraints. Therefore, this criterion is not discussed.

9. **Impacts to Commercial Freighters:** *Does the Proposed Action impact commercial freighters.*

   All three of the rivers within the Project Area do not support large commercial freighters, due to navigational constraints. Therefore, this criterion is not discussed

10. **Impacts to Ports Supporting Post-Panamax Vessels:** *Does the Proposed Action impact ports supporting post-panamax vessels?*

    All three of the rivers within the Project Area do not support large commercial freighters, due to navigational constraints. Therefore, this criterion is not discussed.

11. **Impacts to Vessels that Require Tug Boats:** *Does the Proposed Action impact vessels that require helper boats/tugs (note the combined clearance requirement of the vessel and the helper boat/tug)?*

    Based on the characterization of the rivers as described in this report, it is assumed that helper boats/tugs are of the same vertical clearance, if not smaller, than the large boats included in this study. Therefore, the impacts characterized under "Obstruction of Passage" are applied to this criterion, as well.

12. **Impacts to Proposed Commercial Vessels as a Result of Proposed Development:** *Does the Proposed Action impact proposed commercial vessels as a result of proposed development on waterway?*

    The evaluation methodology used to determine "Impacts to Jobs, Economic Growth, and Development"; as well as "Economic Impacts to Existing or Planned Commercial/Industrial Development" was used to address this criterion.

13. **Ability of Vessels to Adjust Operations without Significant Economic Loss in Order to Transit the Proposed Action:** *Can vessels and cargoes be partially disassembled/dismantled in order to transit the Proposed Action, and if so, is it economically reasonable? The Coast Guard must take into consideration a vessel's ability to adjust its operations without significant economic loss. Adjustment or mitigation techniques may include using other routes, lowering electronics (Global Positioning System [GPS], radar, communication antennae, etc.), lowering crane booms, etc.*

    Large commercial freighters and cargo ships do not operate up and down each of the three rivers due to navigational constraints. Therefore, this criterion is not discussed.

14. **Availability of Alternative Routes for Vessel Passage:** *Are alternative routes available for vessel passage?*

    Since each bridge is located at the confluence of each respective river, alternate routes (that do not exhibit equal or greater obstruction as presented by the Proposed Action) for vessel passage are not available. Therefore, this criterion was not considered in the effect determination.

15. **Ability of Vessels to Transit at Typical Lower Water Stages:** *Can vessels transit at typical lower water stages (mean low water, mean pool level, etc.)?*

    The evaluation methodology of "Obstruction of Passage" was applied to determine the "Ability of Vessels to Transit at Typical Lower Water Stages".

2.6.2 Evaluation Criteria

After assessing the potential of the No-Build Alternative and the Proposed Action to impact identified navigational needs as per USCG guidance (Section 2.6.1), a determination was made as to whether the Proposed Action meets or impacts the reasonable needs of existing and future navigation. The determinations of impacts to reasonable needs are described below:

- **No Impact** – No impact and/or change expected.
- **Minimal** – Impacts are not expected to be measurable, or are measurable but are too small to cause any change in environment.
- **Minor** – Impacts that are measureable but are within the capacity of the affected system to absorb the change, or the impacts can be compensated with little effort and few resources so that the impact is not substantial.
- **Moderate** – Impacts that are measurable but are within the capacity of the affected system to absorb the change, or the impacts can be compensated with effort and resources so that impact is not substantial.
- **Major** – Environmental impacts that, individually or combined, could be substantial.
- **Enhanced** – Positive impacts are anticipated.

For those navigational needs that required interpretative analysis of modeling results (obstruction of passage; impacts to jobs, economic growth and development; economic impacts to existing or planned commercial/industrial development; impacts to USACE transit ability, impacts to USCG transit ability, and impacts to proposed commercial vessels as a result of proposed development), criteria for the selection of an impact determination were developed to define determinations to the level of detail required (see Section 6.0 for this criteria matrix).

3.0 Characterization of New River Bridge

3.1 Project Area Description

3.1.1 Location of New River Waterway

The New River originates in the Everglades and flows east to the Atlantic Ocean, entirely within Broward County. The inlet of the New River is located north of the Port Everglades cut in the City of Fort Lauderdale. The waterway travels from the Intracoastal Waterway on the east to the west past residences and through the Central Business District of the City of Fort Lauderdale. West of the Central Business District, the river splits into north and south forks (North Fork and South Fork, respectively). The North Fork of the New River is a shallow meandering tributary, bordered primarily by residences with private docks for approximately 1.5 miles east before the waterway narrows along the south side of Sunrise Boulevard. The South Fork is a wider tributary for approximately 3.0 miles to the south, where the waterway narrows and forks to either the North or South New River Canal. The South Fork is deeper, supports larger vessels, and is bordered by residences and commercial marine industries.[9] Most marinas on the South Fork are located approximately 2.5 to 3.5 miles from the New River Bridge, and numerous boat yards extend to approximately 6.8 miles from the New River Bridge (Figure 3.1-1).

The New River is traversed by multiple operable and fixed bridges. Characterization and location of these bridges, within the extent of waterfront development as defined in Figure 3.1-1 in the upper confluence and North and South Forks, can be found in Table 3.1-1.

Table 3.1-1. Characterization of Bridges Crossing the New River

Bridge Name	Type of Bridge	Location Where Bridge Crosses the River	Vertical Clearance (feet)	Horizontal Clearance (feet)
State Hwy A1A Bridge	operable/bascule	East Intracoastal Waterway	55	125
Southeast 3rd Ave Bridge	operable/bascule	Confluence east of the rail bridge	16	60
Andrews Ave Bridge	operable/bascule	Confluence east of the rail bridge	21	60
New River Bridge	operable/bascule	Confluence	4	60
William Marshall Memorial Bridge	operable/bascule	North Fork	20	60
Southwest Eleventh Avenue Bridge	operable/swing	North Fork	<5	ND
Broward Boulevard Bridge	fixed	North Fork	<5	ND
Davie Boulevard Bridge	operable/bascule	South Fork	21	60
Interstate-95 (I-95) Bridge	fixed	South Fork and North Fork	55	68
CSX Railway Bridge	operable	South Fork and North Fork	2	ND

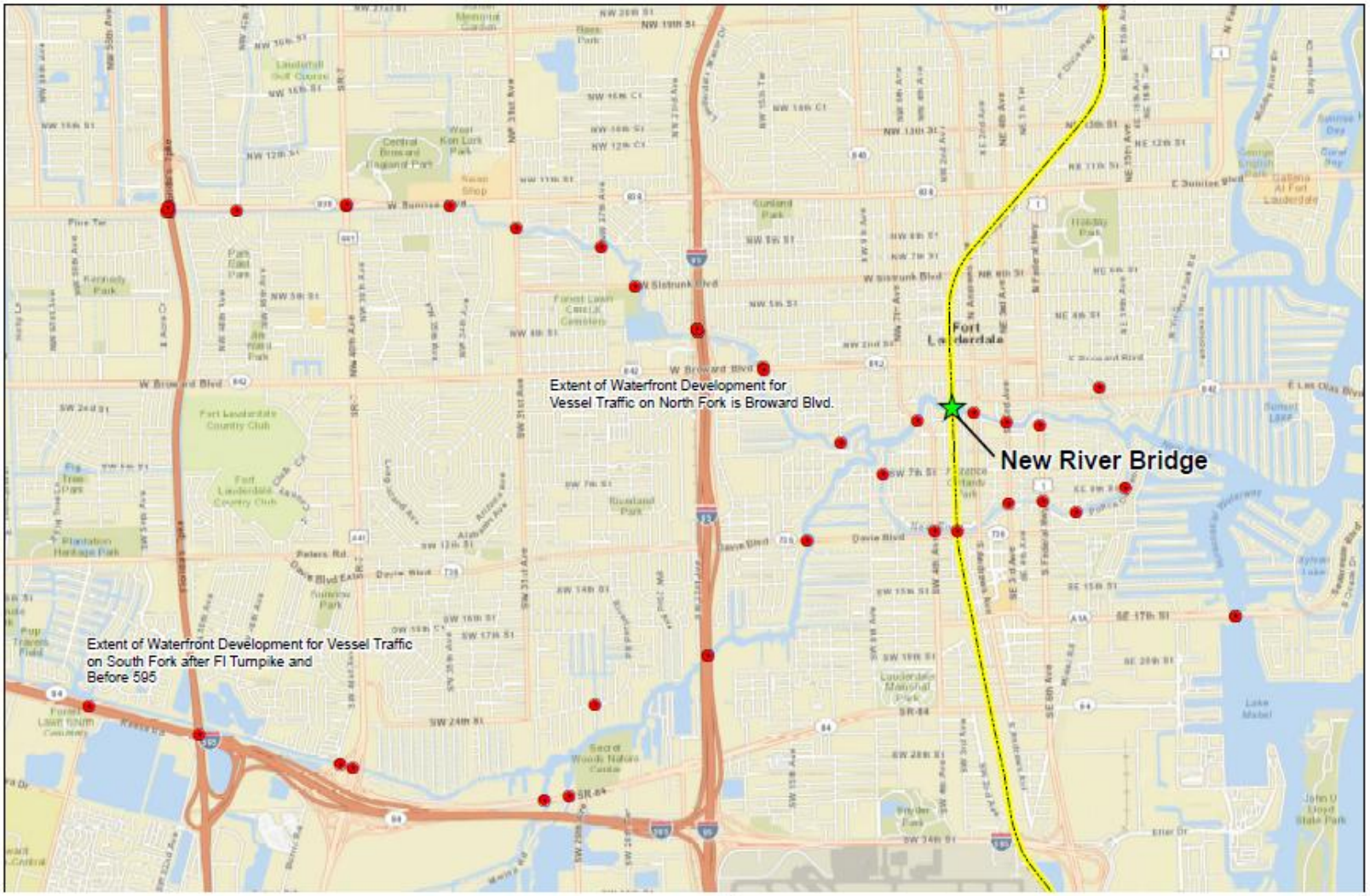
Notes: ND=no data

3.1.2 Location of New River Bridge

The New River Bridge is located approximately 4 miles west of the New River's inlet (26° 7'7.75" N and 80° 8'43.54" W) (Figure 3.1-1). This operable bridge has a vertical clearance of 4 feet and horizontal clearance of 60 feet. Although in general the bridge remains open to allow a constant flow

[9] RS&H. 2012. New River Boat Survey and Preliminary Bridge Opening Analysis. FM Number: 417031-3-22-01

of vessel traffic, it currently closes an average of 10 times daily to accommodate freight rail service. While closed, most vessels (with the exception of small recreational vessels requiring less than 4 feet of draw) are unable to pass underneath the bridge deck, and must queue while waiting for the bridge to re-open.



Explanation of Features

- New River Bridge
- Adjacent Bridges
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012, NBI 2010, FWC 2009

New River Bridge Location Map

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Ft

U.S. Department of Transportation Federal Railroad Administration

Figure 3.1-1

3.1.3 Land-use and Population Density

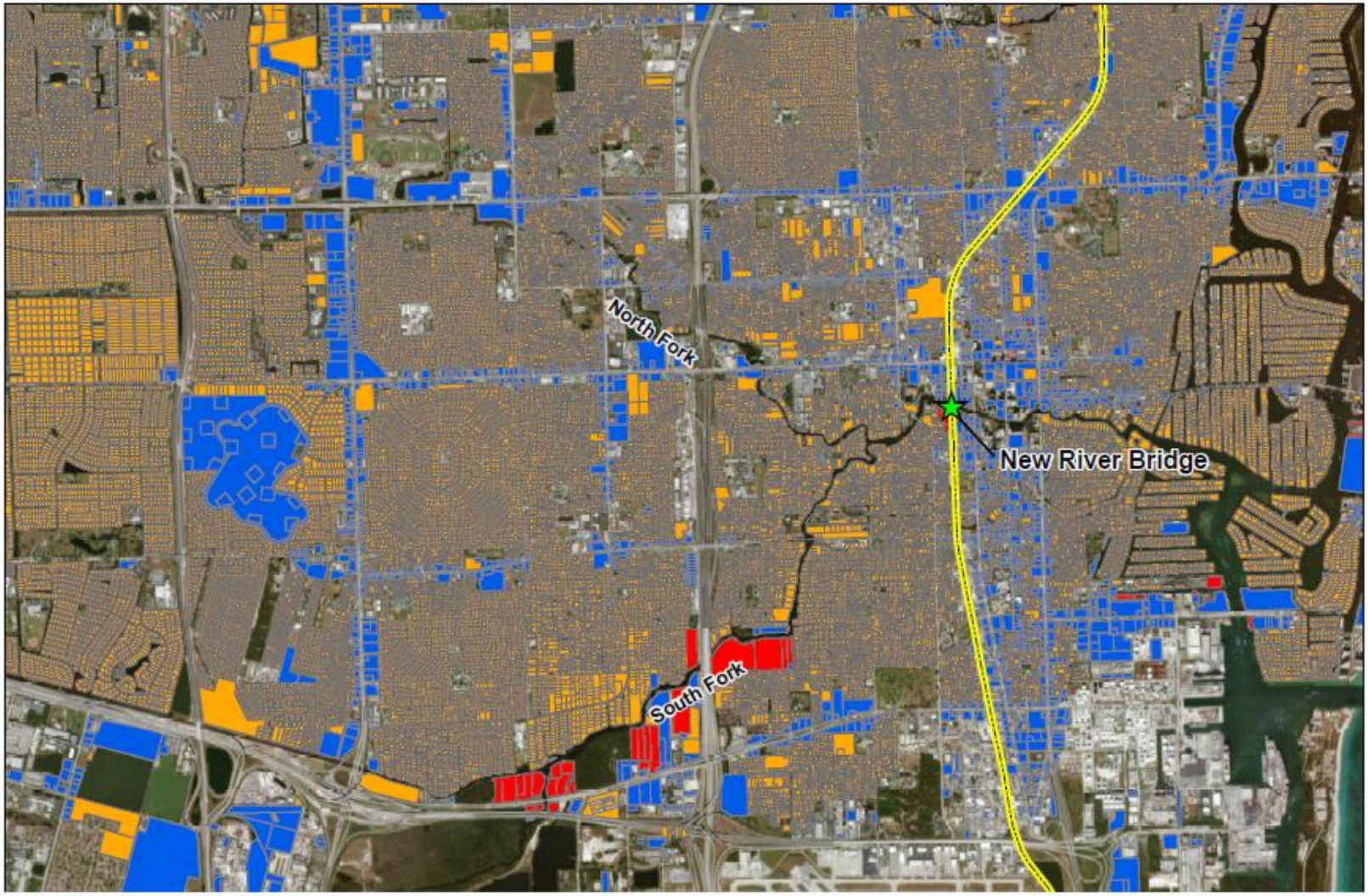
The land use adjacent to the New River waterline is composed mainly of residential areas, with the exception of a large commercial sector north of the New River Bridge, at Las Olas Boulevard (Figure 3.1-2). Las Olas Boulevard, is one of the largest commercial areas in Broward County and hosts many hotels and mixed-use condominium developments. Office buildings and high-rises include Las Olas River House, Las Olas Grand, 110 Tower (formerly AutoNation Tower), Bank of America, One Financial Plaza, Broward Financial Center, One East Broward Boulevard, Barnett Bank Plaza, PNC Center, New River Center, One Corporate Center, SunTrust Centre, and SunTrust Tower. A high density of commercial facilities can also be found south of the New River Bridge.

Marine facilities are located approximately 1.5 miles from the New River inlet, immediately after the A1A Route Bridge, and southeast and southwest of the New River Bridge; however, most marine facilities are concentrated within the river's South Fork, approximately 3 miles west of the New River Bridge (Figure 3.1-2).

Population density maps developed through analysis and development of GIS data show lands adjacent to the New River have census blocks with population densities that extend from Class 1 to Class 5. Class 1 and Class 2 population density can be found by the New River Inlet (Figure 3.1-3), while waterfront areas at the confluence of the New River have population densities in the range of Class 2 to Class 5. About 20 square miles of land adjacent to the New River have waterfront access. The population in this area is approximately 62,507 to 85,031 people (Table 3.1-2).

Table 3.1-2. Land Area and Population Density with Waterfront Access at the New River

Class	Total Area (square miles)	Area with Waterfront Access (square miles)	Percent with Waterfront Access	Population within Waterfront Access Size Class
1	18.5	10.5	57%	26,300
2	13.6	5.7	42%	21,517
3	10.9	2.3	21%	14,533
4	3.5	1.0	27%	8,323
5	2.8	0.3	11%	3,097



Explanation of Features

- N-S Corridor
- RESIDENTIAL
- COMMERCIAL
- MARINE FACILITIES

Data Sources: ESRI StreetMap, AAF 2012, NBI 2010, FWC 2009, FGDL

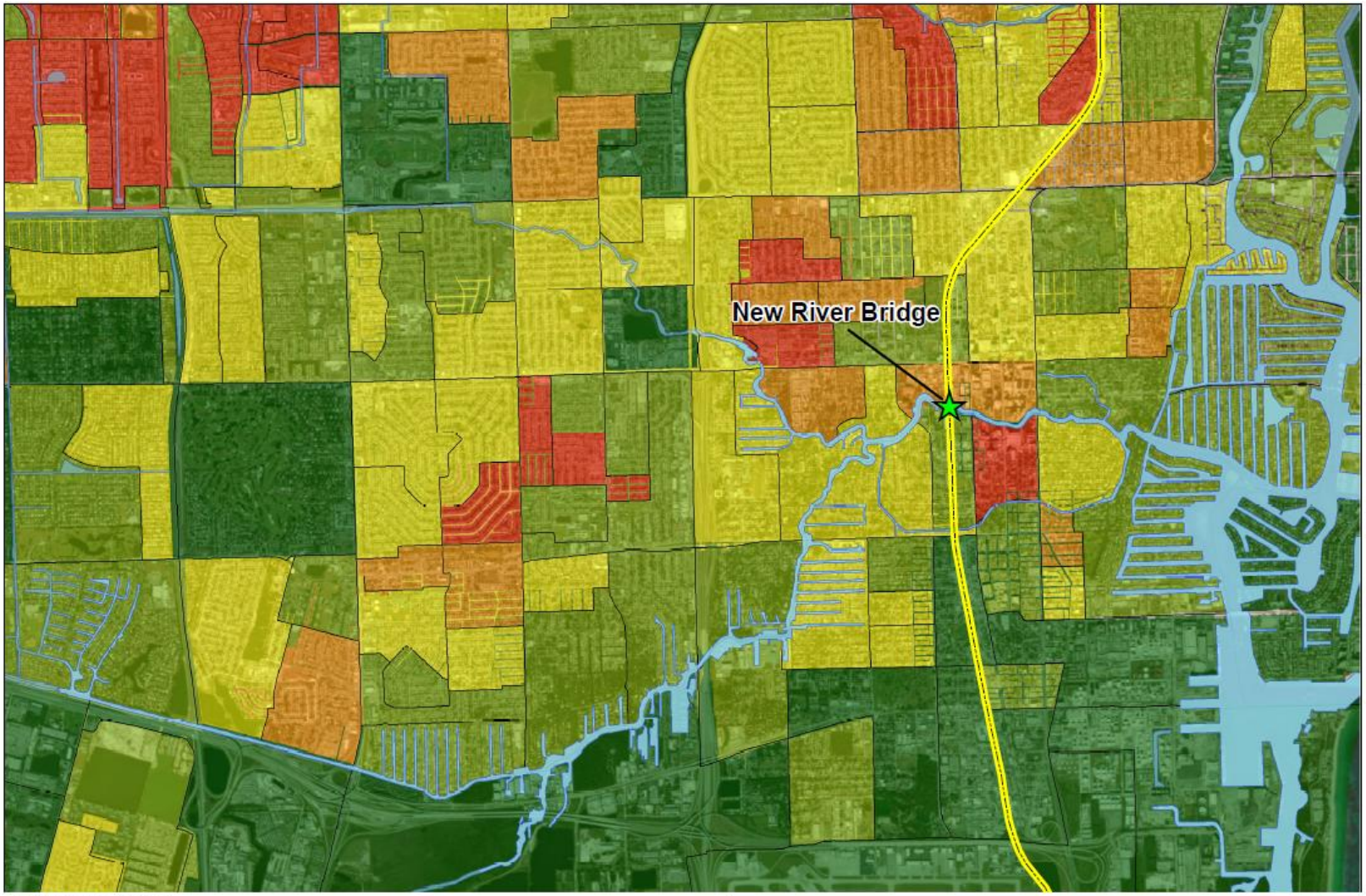
New River Bridge Adjacent Land Use

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Ft

U.S. Department of Transportation
Federal Railroad Administration

Figure 3.1-2



Explanation of Features

- Class 1 (< 2,500 people per SqMI)
- Class 2 (2,501 - 5,000 people per SqMI)
- Class 3 (5,001 - 7,500 people per SqMI)
- Class 4 (7,501 - 10,000 people per SqMI)
- Class 5 (>10,001 people per SqMI)
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012, FGDL 2012, DOR 2012

New River Bridge Adjacent Population Density per Census Block

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Ft

U.S. Department of Transportation **Federal Railroad Administration**

Figure 3.1-3

Path: F:\PEC\PECI_GDB\MXD\EA\Figure 5.1-3 New River Adjacent Population Density per Census Block.mxd

Project # 6063-12-0212

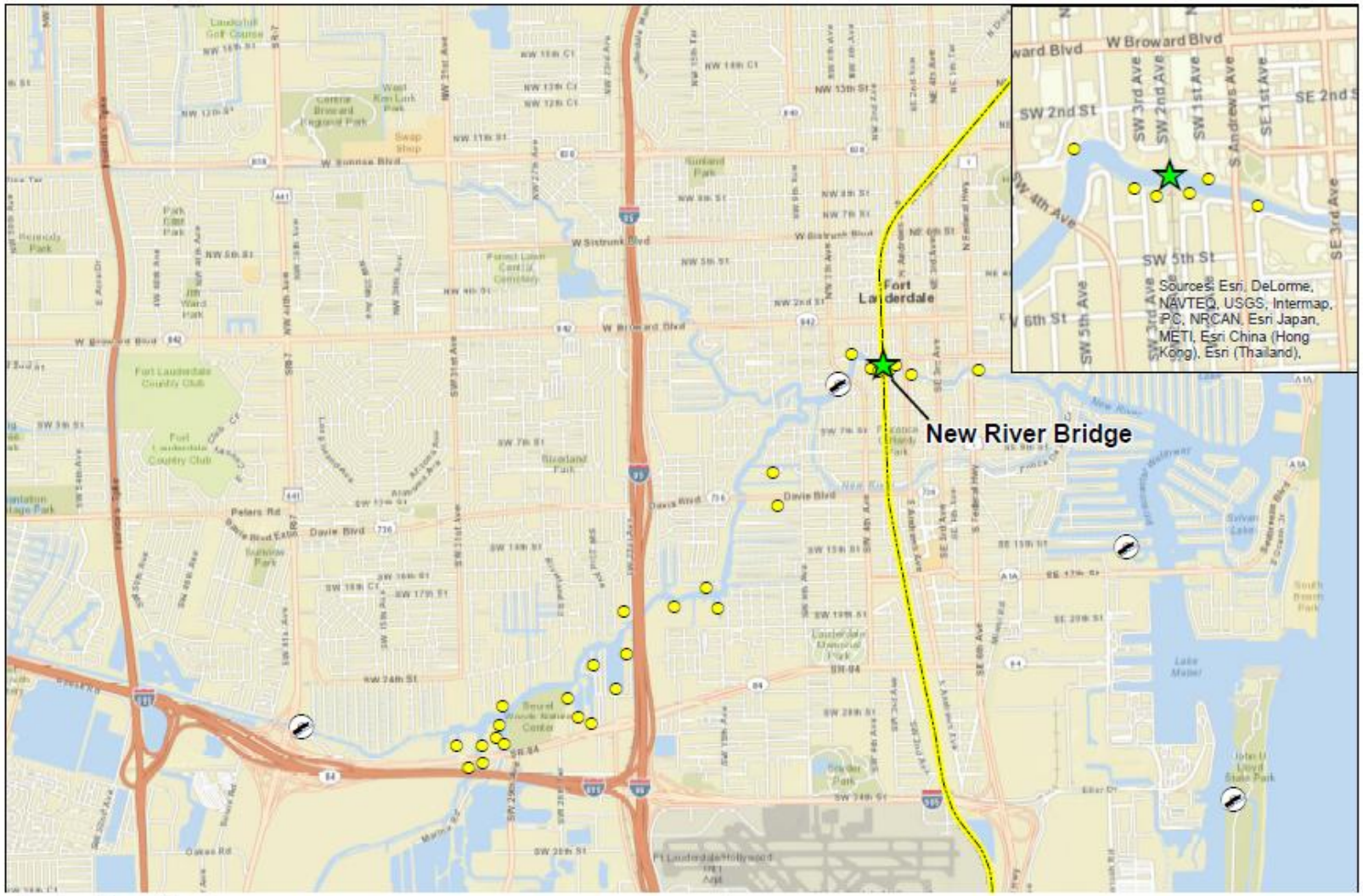
3.2 Marine Industry at New River Bridge

The New River has a robust waterfront industry, with vessel traffic utilizing a broad array of public and private marine facilities including 12 marinas and four boat ramps, as well as four boat/yacht clubs, two waterfront restaurants and two waterfront hotels that cater to mariners (Figure 3.2-1). Additionally, residential and commercial development occurs along the navigable extent of the New River, which provides approximately 280 private slips and 3,750 private docks.4 This waterway overview provides a description of the navigable extent of the New River and a characterization of the vessel traffic, waterway facilities, and the current and proposed use of the river.

3.2.1 Vessel Traffic Patterns

Navigational constraints and regional land use dictate vessel traffic patterns on the New River. These factors result in varied navigational use of the New River, which is a travel corridor offering restaurants and entertainment venues that cater to marine vessels. Boating destinations on the New River include the Central Business District, Lauderdale Marine Center and the Port Everglades Inlet to the Atlantic Ocean.

The New River going inbound (or upriver) starts at river markers 5 and 6. The river is approximately 450 feet wide through marker 11 where the river makes an “S” turn to marker 12, known as the Tarpon Bend. Beyond marker 12 and into the Central Business District, the river is on average less than 150 feet wide, but can be as little as 100 feet wide at some narrower turns. This section of the river can be too narrow for larger vessels, which can include yachts up to 140 feet in length. Tow boats are often utilized to tow 100 foot yachts and larger vessels up and down the New River to and from several large boat yards that cater to yachts (e.g., Lauderdale Marine Center). All of the commercial vessels; such as the tour boats, tow boats and fuel barge boats; as well as bridges (including the FECR New River Bridge), monitor very high frequency (VHF) channel 9. From marker 12, the New River runs about a quarter mile to the next bend.



Explanation of Features

- Marina
- Boat Ramp
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012, FWC

Marinas and Commercial Docks Along New River

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Ft

U.S. Department of Transportation Federal Railroad Administration

Figure 3.2-1

Approximately 0.3 miles upriver from the Southwest 4th Avenue Bridge, the New River splits into the North Fork and South Fork. The North Fork of the New River is a shallow meandering tributary, bordered primarily by residences with private docks for approximately 1.5 miles before the waterway narrows into a canal that flows east along the south side of Sunrise Boulevard. The North Fork is primarily utilized as a travel corridor to and from residences Due to reduced depth and reach, the North Fork is less accessible to larger vessels. Additionally, the Broward Boulevard fixed bridge and the Southwest 11th Avenue swing bridge both have clearances less than 5 feet, which limits larger vessels from traversing this area.

The South Fork is a tributary that is generally wider than the North Fork, but can be narrow at river bends. The South Fork conveys most of the larger vessel traffic; primarily to the commercial boatyards located approximately 1.5 miles south of the river fork (refer to Figure 3.2-1). The Davie Boulevard Bridge, a bascule bridge that has a vertical clearance of 21 feet, is located approximately halfway from the river fork and commercial boatyards to the south. Boatyards are located on both the east and west side of the I-95 high-level fixed bridge (vertical clearance of 55 feet) and adjacent to the CSX Railroad Bridge. From these boatyards, the South Fork disperses into several inshore waterways.

The inshore waterways of the New River are primarily comprised of a network of man-made canals. These canals function essentially as a travel corridor to and from small marinas, boat ramps, and waterfront residential facilities. Vessel traffic on these waterways is limited to smaller vessels along a relatively narrow waterway for passage to and from their destinations. These canals are maintained for navigability by the USACE and Florida Inland Navigation District. Navigation can be limited in the upper portions of the New River, particularly where canals cross underneath low clearance bridges.

3.2.2 Vessel Registration and Population Trends

Vessel registration information for Broward County from 2003 to 2013 was obtained from the Florida Department of Highway Safety and Motor Vehicles, indicating an overall reduction in vessel registration of 15.1 percent over this period.[10] Vessel registration grew by approximately 4.1 percent between 2003 and 2008; however, during the recession from 2009 to 2013, vessel registration declined by approximately 18.9 percent from 2006 levels, which represented the peak vessel registration for the study period.

Broward County, home to 1.69 million people in 2003, had grown by approximately 5.1 percent to a population of 1.78 million people in 2013. The county's population is projected to grow to 1.81 million people by 2016 and to 1.90 million by 2025.5 Most municipalities are forecast to experience steady growth; however, Fort Lauderdale and Hollywood show the greatest growth over the 25-year period due to future housing unit construction in each city's downtown area.5

Based on County population and vessel registration data for 2003 to 2013, 2.69% of the population is estimated to own/operate a vessel. This average number of registered vessels per capita was then compared to county population growth forecasts obtained from the Bureau of Economic and Business Research.5 Based on these population forecasts, it is anticipated that registered vessels in Broward County will increase to 48,629 by 2016 (Table 3.2-1).

[10] Florida Department of Highway Safety and Motor Vehicles. 2014. Florida Vessel Owners Statistics: 2000-2013. Available at http://www.flhsmv.gov/dmv/vslfacts.html. Accessed 3 March 214. *Online data available was only available back to 2000. Request for data prior to 2000 indicate that this information is no longer maintained by the State of Florida.*

Table 3.2-1. Population and Vessel Registration in Broward County (2003 through 2016)**Error! Bookmark not defined.**

Year	Total Population	Total Vessel Registration	Percentage of Population with Registered Vessels
2003	1,698,425	49,041	2.89%
2004	1,723,131	49,470	2.87%
2005	1,740,987	51,105	2.94%
2006	1,753,162	51,375	2.93%
2007	1,765,707	50,623	2.87%
2008	1,758,494	51,057	2.90%
2009	1,744,922	45,373	2.60%
2010	1,748,066	42,976	2.46%
2011	1,753,162	42,687	2.43%
2012	1,771,099	42,131	2.38%
2013	1,784,715	41,657	2.33%
2016 (projected)	**1,807,075**	**48,629**	**2.69% (11-year average)**

Source: Florida Office of Economic and Demographic Research, 2013. Based on the results from the Florida Demographic Estimating Conference, February 2013 and UF, BEBR, Florida Population Studies, Volume 46, Bulletin 165, March 2013 medium county projections.

3.2.3 Inventory of Waterway Features

The Waterway Features Inventory of recreational and commercial boating access facilities includes boat ramps, marinas, dry storage facilities, anchorages, and commercial entities (Table 3.2-2). The number of waterfront residences with dockage or slips along the New River was also estimated. Additionally, a sampling procedure was utilized to estimate the number of wetslips and docks available at waterfront residential properties within the navigable extent of each waterway, extending inland from the Intracoastal Waterway. For the purposes of study, the New River was surveyed for the extent of its navigable area west of the operable bridge and east to the Intracoastal Waterway.

Table 3.2-2. Overview of Waterway Features in Broward County and the New River

Boating Facility	Broward County	New River	Percent of Broward County Inventory on New River
Marinas			
Marina	37	12	32.4%
Private Club	9	4	44.4%
Hotels/Restaurants	12	4	33.3%
Boat Ramps			
Private	0	0	-
Public	35	4	11.4%

3.2.3.1 Marinas, Boat Ramps and Repair/ Support Facility Inventory

The New River contains 12 public and private marinas. These marinas range in capacity from 5 slips to more than 190 slips, with an average of approximately 42 slips per marina. Marinas on the New River comprise approximately one third of all marinas in Broward County (Table 3.2-3). The largest concentration of marinas is located on the South Fork of the New River approximately two miles west of the New River Bridge.

Table 3.2-3. Overview of Waterway Features in the New River and Associated Waterways

Boating Facility	Number	Slips	Location Relative to New River FEC Corridor Railway Bridge	
			East	West
Commercial Marina	9	502	2	7
Public Marina	3	190	2	1
Private Club	4	79	2	2
Hotel/ Restaurant	4	47	4	-
Total	**20**	**818**	**10**	**10**

Source: Florida Fish and Wildlife Research Institute, 2009

Four locations on the New River have boat ramps (Table 3.2-4). All boat ramps on the New River are public, with three located west of the New River Bridge and one to the east. Only two anchorages occur in the vicinity of the New River, both located east of the New River Bridge. The New River, and Fort Lauderdale in general, are known for recreational vessel services, and contains a relatively high number of vessel and yacht service companies. Most of these vessel repair and service facilities are located west of the New River Bridge, particularly concentrated on the South Fork of the River. These commercial repair and support facilities provide a variety of services including vessel repair, cleaning, sales, and temporary dry docking. These services provide economic benefits to the City of Fort Lauderdale and the regional economy (refer to Section 3.2.2).

Table 3.2-4. Boat Ramps, Anchorages, and Vessel Repair Facilities on the New River

Boating Facility	Number	Location Relative to New River FEC Corridor Railway Bridge	
		East	West
Boat Ramp	4	1	3
Anchorage	2	2	-
Repair/ Support Facilities	15	5	10
Total	**21**	**8**	**13**

Source: Florida Fish and Wildlife Research Institute, 2009

3.2.3.2 Residential Boating Facility Inventory

The New River and nearby area islands in the Intracoastal Waterway have a high number of residential waterfront properties and numerous residential neighborhoods with waterway access to the River. These parcels contain a large number of docks, while only approximately 6% contain a slip. Overall, approximately 89% of all waterfront properties contain either a dock or a slip (Table 3.2-5). The majority of the small private waterfront housing developments on the New River only meets the boating needs of the residences, and do not provide any public boating access. While secondary to marinas and other public marine facilities, an inventory of the docks and slips at waterfront housing developments is important to provide an overall picture of the complete marine industry and recreational use of the New River. Utilizing methodology provided in Section 2.1, the approximate number of docks and slips for single family, multi-family greater than 10, multi-family less than 10, and condominiums were counted or estimated (Table 3.2-5).

Table 3.2-5. Overview of Residential Boating Features of Waterfront Properties on the New River

Land Use	Total Waterfront Properties	Estimated Properties with Docks	Estimated Properties with Slips	Estimated Properties with Docks or Slips
Single Family	4,218	3,627[a] (86%)	169[a] (4%)	3,796 (90%)
Multi Family <10 Units	194	114[a] (59%)	56[a] (29%)	170 (88%)
Multi Family >10 Units	23	4 (17%)	10 (44%)	14 (61%)
Condominiums	72	5 (7%)	45 (63%)	50 (70%)
Total Waterfront Properties	**4,507**	**3,750 (83%)**	**280 (6%)**	**4,030 (89%)**

Note: [a] Estimated based on a percent of parcels with docks or slips from a random sample of 100 WFP parcels on the New River

3.2.3.3 Purpose and Use of Navigation Infrastructure (Commercial versus Recreational Vessel Traffic)

Navigation on the New River is predominantly recreational, with limited commercial and marine industry vessel traffic. The size of the waterway and adjacent land uses limit the extent of commercial marine activities on the New River. Commercial barge traffic primarily occurs in the vicinity of the Port of the Everglades. Inland commercial vessel activities are primarily associated with water taxi/bus, restaurant, and touring operations.

3.2.4 Economic Analysis

The total economic value of the marine industry along the New River is based on all marine related sales along this river, including those directly related to marine services (e.g., vessel sales, vessel repairs, recreational equipment) and those that are outside the marine industry but related to marine activity (e.g., sales of food and ice for boating trips). The type of sales that were considered in the marine industry include:

- Vessel and yacht sales;
- Vessel accessories and replacement parts (e.g., trailers, electronics);
- Vessel services (e.g., repair, maintenance, interior design);
- Vessel storage (e.g., marinas, onshore storage);
- Sales at businesses frequented during boating trips (e.g., hotels and restaurants);
- Recreational equipment and instruction (e.g., dive equipment, fishing tackle, water ski instruction);
- Inland waterway businesses (e.g., water taxis and charter boats); and
- Other miscellaneous costs (e.g., insurance, business/personal services).

This analysis estimates the direct, indirect, and induced benefits of the marine industry to the local economy. In order to determine the direct economic value of the marine industry along the New River, the total direct economic value of the marine industry in Broward County was estimated, and then the relative percentage of the industry that can be attributed to the New River was applied. This value was then used to determine the resulting indirect and induced benefits. This analysis also considers the number of jobs that are supported by the economic activity associated with the marine industry along the New River.

3.2.4.1 Economic Benefits of the Marine Industry in Broward County

The direct economic value of the marine industry in Broward County was determined by updating the economic analysis performed by the State of Florida in 2011. The state's study was updated from the base year of 2007, when the original study for Broward County was performed, to reflect the total

value of the industry in December 2013. The direct economic value of the marine industry associated with the New River includes all marine-related spending by the individuals and businesses utilizing the waterway.

The direct benefits of the marine industry in Broward County were determined by escalating the values determined in the base year of 2007 in accordance with growth experienced between that time and December 2013. The gross sales in Kind Code 28 for Broward County declined by 5.17% in that period while gross sales across all Kind Codes in the state of Florida grew by 8.56%. In accordance with the methodology described in Section 2.2, retail sales were escalated by -5.17%, while port operations and non-marine benefits were escalated by 8.56%. As seen in Table 3.2-6, the resulting estimated total economic value of the marine industry (not including port tenants) in Broward County was $3,748.3 million, a decrease of $192.6 million (5%) from the 2007 value of $3,940.8 million.

Table 3.2-6. Direct Benefits of the Marine Industry in Broward County

Business Type	2007 Marine Business Volume [a]	2013 Marine Business Volume
Total Direct Benefits (marine only)	$3,858,775,858	$3,659,190,239
Non-marine Benefits (gas, food, drink, ice)	$82,100,000	$89,131,273
Total Marine and Non-marine Benefits	$3,940,875,858	$3,748,321,512

Source: Original 2007 marine business volume obtained from Appendix M of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

Note: [a] Excludes receipts from port tenants since the port operations in Broward County are not associated with the New River.

Due to indirect and induced effects of expenditures in the marine industry in Broward County, the total economic value of the industry is greater than the initial direct spending. The total economic value of the marine industry for Broward County, including direct, indirect, and induced effects, was generated by using IMPLAN economic modeling software for the 2007 data. Because the distribution of economic value is similar to the distribution at the time of the original study, the relative indirect and induced effects would also be similar. Therefore, extrapolating from the data obtained for the 2007 model results, the estimated 2013 results show that the total value of the marine industry in Broward County is $5,268.0 million, with $3,748.3 million in direct sales, $820.2 million in indirect benefits, and $699.4 million in induced benefits (see Table 3.2-7).

The economic activity associated with Broward County's marine industry also supports local area employment, including jobs associated with the direct effects of spending in the industry as well as jobs associated with indirect and induced economic activity. These benefits, including both the number of jobs and personal income, were estimated using the same methodology of applying the 2007 IMPLAN model run percentages to determine the total effects. The results show that direct spending in the marine industry supports 15,185 jobs and $638.7 million in personal income. Additionally, the total spending associated with the marine industry, including direct, indirect, and induced effects, supports 27,592 jobs and $1,186.8 million in personal income (see Table 3.2-7).

Table 3.2-7. Direct, Indirect, and Induced Benefits of the Marine Industry in Broward County

Benefit	Original 2007 Model Results				Estimated 2013 Figures			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Business Volume (in millions)	$4,325.8	$946.6	$807.2	**$6,079.6**	$3,748.3	$820.2	$699.4	**$5,267.9**
Personal Income (in millions)	$737.1	$364.2	$268.3	**$1,369.6**	$638.7	$315.6	$232.5	**$1,186.8**
Employment	17,524	7,415	6,904	**31,843**	15,185	6,425	5,982	**27,592**

Source: Original 2007 model results obtained from Appendix M of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

3.2.4.2 Economic Benefits of the Marine Industry associated with the New River

The New River represents approximately 32.7% ($1,723.7 million) of the marine activity and economic value in Broward County, excluding port activities. This total value is comprised of $1,226.5 million in direct expenditures, $268.4 in indirect effects, and $228.9 million in induced effects. This activity supports a total of 9,028 jobs and $388.3 million in personal income (see Table 3.2-8).

Table 3.2-8. Direct, Indirect, and Induced Benefits of the Marine Industry along the New River

Benefit	Direct	Indirect	Induced	Total
Business Volume (in millions)	$1,226.5	$268.4	$228.9	**$1,723.7**
Personal Income (in millions)	$209.0	$103.3	$76.1	**$388.3**
Employment	4,968	2,102	1,957	**9,028**

Source: Original 2007 model results obtained from Appendix M of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

3.2.5 Public Outreach

Since AAF made the first public announcement of its proposed passenger rail Project in Florida, a comprehensive public engagement strategy has been employed. A series of meetings, briefings, speeches and telephone calls with stakeholders, community leaders, neighborhood leaders and elected officials have been ongoing and will continue. AAF has participated in more than 300 meetings with residents, business and community leaders, and public agencies throughout the State. Further to these efforts that began in March 2012, AAF has undertaken earlier coordination efforts to work proactively with federal, state and local agencies (e.g., FRA, USACE, USCG, SFWMD, etc.). Public outreach activities in Broward County, particularly in the vicinity of the New River, are provided in Tables 3.2-9 and 3.2-10. Additionally, the Environmental Impact Statement (EIS) scoping meeting and meetings that specifically addressed navigation issues on the New River are outlined in Table 3.2-9.

Table 3.2-9. Community Outreach Data (page 1 of 4)

Presentation Made To	Type of Event
April 2012	
City of Fort Lauderdale	Briefing - Lee Feldman, City Manager
Broward County	Call - Commissioner Kristin Jacobs
Florida Minority Firms	Presentation – Coordinated by United States Congresswoman Corrine Brown
May 2012	
Broward County	Meeting - Bertha Henry, County Administrator
Broward Metropolitan Planning Organization (MPO)	Presentation – Board Meeting
Central Florida Partnership	Presentation – Board Meeting
City of Fort Lauderdale/ Broward County	Briefing - Lee Feldman, City Manager Bertha Henry, County Administrator Chris Walton, Transit Director
City of Fort Lauderdale	Follow Up - Lee Feldman, City Manager Planning Staff: Diana Alarcon, Sharon Dreesen, Jenni Morejon
Broward County	Briefing - Bertha Henry, County Administrator
Fort Lauderdale Downtown Development Authority (DDA)	Briefing - Chris Wren, Executive Director
South Florida Regional Planning Council	Presentation – monthly board meeting
South Florida Regional Transportation Authority (SFRTA)	Joseph Giuletti, Executive Director, & Staff
Transit Oriented Development	Briefing - Tony Brown, Executive Director Commissioner Lowe Scott Evans, Planning Director

Table 3.2-9. Community Outreach Data (page 2 of 4)

Presentation Made To	Type of Event
June 2012	
Center for Urban Transportation Research	Meeting - Jason Bittner
Citizen's Independent Transportation Trust	Meeting - Charles Scurr, Executive Director
FL House of Representatives	Meeting - Rep. Lori Berman
July 2012	
Broward County Planning Council	Briefing - Henry Sniezek, Executive Director
Florida Coalition of Railroad Passengers	Presentation – Spring/Summer meeting
City of Fort Lauderdale	Briefing – Jenni Morejon, Deputy Director Renee Cross, Senior Transportation Planner Diana Alarcon, Transportation & Mobility Director Kevin Walford, Transportation Planner
Florida Department of Transportation (FDOT) - District 5	Meeting - Secretary Noranne Downs
Floridians for Better Transportation	Presentation – 2012 Transportation Summit
Fort Lauderdale City Commission	Presentation – monthly City Commission meeting with all city commissioners
United State Department of Transportation (USDOT)	Meeting - Secretary Ray LaHood
August 2012	
Florida Department of Environmental Protection (FDEP), USACE, SFWMD, St. Johns River Water Management District (SJRWMD) and others	Tiger Team Meetings (held monthly)
Broward County	Senior Staff Meeting
Environmental Group Meeting	Meeting with: Everglades Foundation Audubon Society Florida Conservation Council Sierra Club
Myregion.org	Presentation – monthly board meeting
Greater Fort Lauderdale Alliance Meeting – Boating Community	Meeting with: Greater Fort Lauderdale Alliance Fort Lauderdale DDA Broward MPO Lauderdale Marine Center Stiles Marine Advisory Board Ward's Marine Electric Riverfront Marina, Cymbal Development Winterfest Tow Boat US Fort Lauderdale City of Fort Lauderdale Roscioli Yacht Center Bradford Marine Fiberglass Coating Frank & Jimmies Propeller, Neptune Boat Lift
Broward County Commissioners	Individual briefings with: Dale Holness, Barbara Sharief, and Ilene Lieberman
September 2012	
City of Hollywood, FL	Briefing - Mayor Peter Bober and staff
Broward County Planning and Environmental Regulation Division	Pre-application meeting
Florida East Coast Railway Society	Presentation – historical society
Greater Fort Lauderdale Alliance	Presentation – Corporate Council
Treasure Coast Regional Planning Council (TCRPC)	Presentation – monthly board meeting

Table 3.2-9. Community Outreach Data (page 3 of 4)

Presentation Made To	Type of Event
October 2012	
USCG	Pre-application meeting
United States House of Representatives Subcommittee on Railroads, Pipelines, & Hazardous Materials	Briefing- Joyce Rose
Southeast Florida Transportation Council	Presentation – scheduled board meeting
Tom Gustafson	Briefing – Florida House of Representatives candidate
City of Delray Beach	Briefing – Mayor Woodie McDuffie
November 2012	
Marine Industries Association of South Florida (MIASF)	Boat tour – MIASF representatives and the City of Fort Lauderdale
City of Fort Lauderdale	Briefing –Lee Feldman, City Manager
City of Fort Lauderdale	Briefing – Mayor Jack Seiler
December 2012	
South Florida Regional Planning Council	Presentation – Monthly board meeting
Sun Sentinel	Editorial board
United States House of Representatives	Briefing – Congressman Mario Diaz Balart
FL House of Representatives	Briefing – Representative Will Weatherford
Broward County	Meeting – Bertha Henry, County Administrator
January 2013	
Broward MPO	Briefing – Greg Stuart, Executive Director, and James Cromar, Planner
Broward County Planning and Environmental Regulation Division	Permit review meeting
Environmental groups	Meeting: Everglades Foundation Audubon Society 1,000 Friends of Florida
National Railroad Construction Conference	Presentation – yearly conference
MIASF	Briefing – Kristy Hebert, President, and Patience Cohn
February 2013	
Broward County	Briefing – Commissioner Sue Gunzburger
Florida Chamber of Commerce – Transportation Summit	Presentation – Mobility and Investment Strategies Panel
City of Fort Lauderdale	Presentation – Marine Advisory Board
United States House of Representatives Transportation & Infrastructure Committee – Subcommittee on Railroads, Pipelines, and Hazardous Materials	Briefing - Mike Friedberg, Staff Director, and Fred Miller, Counsel
Broward County	Meeting - Bertha Henry, County Administrator, and staff
Brevard County	Briefing – Commissioner Trudie Infantini
Brevard County	Briefing – Commissioner Mary Bolin Lewis (staff)
March 2013	
Broward County	Briefing – Commissioner Martin David Kiar
Broward County	Briefing – Commissioner Stacey Ritter
April 2013	
Biscayne Gardens Civic Association	Presentation – monthly neighborhood meeting
Village of Biscayne Park	Briefing – Mayor Noah Jacobs and Manager Anna Garcia
Fort Lauderdale Economic Development Advisory Board	Presentation –monthly board meeting
AAF/Broward County Marine Advisory Committee	Presentation/Meeting – first meeting of a group convened by AAF to discuss and reach solutions on marine industry concerns
Life Sciences South Florida Executive Committee	Presentation –monthly board meeting

Table 3.2-9. Community Outreach Data (page 4 of 4)

Presentation Made To	Type of Event
April 2013 (continued)	
Mayors Mean Business – Florida League of Mayors	Presentation – more than 50 mayors at annual Florida League of Mayors meeting
City of Dania Beach	Briefing – Vice Mayor Al Jones, Community Redevelopment Agency (CRA) Director Jeremy Earle, Economic Development Manager Dan Murphy
City of Hollywood	Briefing – Commissioner/Broward MPO Chair Richard Blattner, Public Works Director Sylvia Glazer, Director of Parking & Intergovernmental Affairs Lorie Mertens-Black
Notice of Intent published April 15, 2013 initiated EIS scoping process	
May 2013	
Broward County	Briefing – Vice Mayor Barbara Sharief (staff)
Broward County	Briefing – Commissioner Chip LaMarca
City of Fort Lauderdale	Briefing – Commissioner Dean Trantalis
EIS Process scoping meeting/open house	Public meeting – Miami (Section 2.2.5)
EIS Process scoping meeting/open house	Public meeting – West Palm Beach (Section 2.2.5)
EIS Process scoping meeting/open house	Public meeting – Fort Pierce (Section 2.2.5)
City of Fort Lauderdale	Briefing – Vice Mayor Bruce Roberts
Broward County NAACP	Briefing – Greg Durden
City of Pompano Beach	Briefing – Mayor Lamar Fisher
Flagler Village Civic Association	Presentation – monthly neighborhood association meeting (Fort Lauderdale)
Efficient Transportation for the Community	Presentation – monthly board meeting
EIS Process scoping meeting/open house	Public meeting – Fort Lauderdale (Section 2.2.5)
June 2013	
Florida Planning & Zoning Association	Presentation at yearly conference
Mayor Steve Abrams' Roundtable District 4 Mayors/Managers meeting	Presentation to mayors and city managers from coastal cities in District 4 in Palm Beach County
City of Fort Lauderdale	Briefing – Commissioner Romney Rogers
City of Pompano Beach	Briefing – Vice Mayor George Brummer
City of Dania Beach	Briefing – Mayor Walter Duke
AAF sponsored Minority, Disadvantaged and Women-owned Business Enterprises (MBE/DBE/WBE) and veteran-owned small business (VOSB) and service-disabled veteran-owned small business (SDVOSB) Outreach Forum	Events held in Central and South Florida so DBE/MBE/WBE firms could discuss potential teaming opportunities with potential prime contractors
United States House of Representatives	Briefing – Congresswoman Corrine Brown
July 2013	
FL House of Representatives	Briefing – Representative David Richardson
Village of Biscayne Park	Presentation – monthly commission meeting
Black Archives	Briefing – Dr. Dorothy Fields, Founder
AFL-CIO Miami	Briefing – Ellis Canty, Board Member
October 2013	
City of Fort Lauderdale	Monthly meeting -Marine Advisory Committee

Table 3.2-10. Letters and Agreements of Support

Date	Document; Entity	Signatory
May 10, 2012	Resolution No. 05-01-12; DDA of Fort Lauderdale	Gregory Durden, Chairman; Chris Wren, Executive Director
July 24, 2012	Memorandum of Understanding; City of West Palm Beach	Geraldine Muoio, Mayor
July 24, 2012	Letter of Support; Broward MPO	Gregory Stuart, Executive Director
July 24, 2012	Letter of Support; South Florida Regional Planning Council	James F. Murley, Executive Director
July 24, 2012	Letter of Support; Hialeah Chamber of Commerce & Industries	Mandy Llanes, Chairman
July 24, 2012	Letter of Support; Greater Fort Lauderdale Alliance, Broward County	Bob Swindell, President and CEO
July 25, 2012	Letter of Support; Coral Gables Chamber of Commerce	Mark A. Trowbridge, President and CEO
July 25, 2012	Letter of Support; TCRPC	Michael J. Busha, AICP, Executive Director
July 31, 2012	Letter of Support; Broward County	Bertha W. Henry
July 31, 2012	Letter of Support, Florida Chamber of Commerce	David A. Hart, Executive Vice President

3.2.5.1 Fort Lauderdale EIS Scoping

The public scoping meeting to support preparation of the EIS was held at Holiday Park Social Center, 1150 G. Harold Martin Drive, Fort Lauderdale from 3:30 to 7:00 pm on May 29, 2013. Eighty (80) persons attended the meeting, and most of those indicated they were representing a local government agency, business, or homeowner association. Approximately 13 persons indicated they were not representing any organization. Twenty (20) attendees submitted either comments or completed a survey questionnaire.[11]

Public participants in the Fort Lauderdale meeting expressed concern regarding potential for adverse economic impacts on Fort Lauderdale's recreational boaters and marine industry due to more frequent crossings of the FECR operable bridge across the New River near the proposed station. Five (5) people addressed this topic at the meeting while an additional comment was received by email. Both traffic and boater congestion and public safety were a concern with respect to grade crossings in Fort Lauderdale, with specific concern regarding frequency of closing at Broward Boulevard and the New River Bridge.

3.2.6 Additional Public Comments

Additional comments delivered by mail or email were received during the scoping process. The FRA received an email from John R. Fiore, Associate Planner; Liaison, Broward County Marine Advisory Committee; Broward County Parks and Recreation Division. The comment sent on April 25, 2013 raised a concern that increased rail traffic on the FECR operable bridge across the New River in Fort Lauderdale will cause delays and boating safety hazards for recreational and commercial boaters using the New River waterway.

3.2.6.1 Marine Advisory Board Meeting, Fort Lauderdale

AAF presented to the City of Fort Lauderdale Marine Advisory Board in Fort Lauderdale, Florida on Thursday, February 7, 2013. The meeting took place at 6:00 pm in the 8th Floor Conference Room of 100 North Andrews Avenue. After the presentation by AAF staff, several members of the Marine Advisory Board expressed concerns related to additional closure of the New River Bridge and associated effects to marine traffic. Members wanted to know how long the New River Bridge would

[11] Vanasse Hangen Brustlin, Inc. (VHB). June 28, 2013. Scoping Report for All Aboard Florida Intercity Passenger Rail Project – Orlando to Miami. Prepared for Federal Railroad Administration

need to be down per crossing and per day. In addition, the inability to provide exact schedules for freight crossings due to irregular freight service was raised as an issue for marine traffic. The possible use of a bridge tender was also discussed.

Private citizens at the meeting had additional concerns related to safety in the event of marine emergencies as well as the effects of bridge closures on public events such as the Winterfest Boat Parade. A representative of the Marine Industries Association of South Florida (MIASF) expressed appreciation for the continuing dialogue and attention to the concerns of MIASF given by the AAF Project staff.

At the conclusion of the meeting, the marine Advisory Board passed a motion stating strong concerns over impacts to river traffic, especially for vessels traveling to Marina Mile boatyards and requesting AAF to continue dialogue with the City and marine interests (including MIASF) to ensure impacts are minimized and mitigated.

3.2.6.2 Broward County Marine Advisory Committee Meeting

The AAF Project was presented to the Broward County Marine Advisory Committee in Wilton Manors, Florida on Thursday, October 3, 2013. The meeting took place at 2:00 pm at the Island City Park Preserve located at 823 N.E 28th Street. After the presentation, the Committee expressed concern over long wait times for vessels during crossings.

3.3 Summary of Vessel Traffic Survey at New River

Vessel traffic was summarized at the New River Bridge and surrounding areas, including peak travel seasons, months, days, and times; vertical clearance; and nearby bridges over the New River. This summary includes a literature review of existing vessel traffic studies, and vessel traffic extracted from 2014 FECR's video recordings, and a live feed of the bridge. These combined data was used to analyze vessel activity within the New River and provides the information necessary to estimate impacts related to increased train traffic and associated closures of the New River Bridge. The information gathered from previous vessel studies along the New River was summarized and used in conjunction with vessel traffic data collected from the videos to evaluate changes in vessel traffic from 2004 to 2014, and to determine reliability of previous navigation studies to determine socioeconomic effects of the Proposed Action.

3.3.1 Literature Review Vessel Traffic Surveys

Vessel traffic studies along the New River have been conducted in 2004-2005[12], 2009[13] and 2011[9]. These studies include aerial and fixed point surveys, and provide estimated morning and afternoon vessel trends as well as seasonal trends separated by weekdays and weekends. Figure 3.3-1 depicts the locations for these studies.

3.3.1.1 Broward County Vessel Study

A vessel traffic study was conducted in Broward County via aerial surveys between May 7, 2004 and January 24, 2005.[12] Fixed point surveys were conducted via field team observers at Colee Hammock Park to record vessel traffic along the New River passing the park. Colee Hammock Park is located approximately 1.2 miles east of the existing New River Bridge (Figure 3.3-1). Observations were conducted on both weekdays and weekends throughout the summer and winter of 2004 and 2005. The data recorded during this period showed the number of average daily vessels observed during the summer were 224 for weekdays, and 591 for weekends, with a weekend/weekday ratio of 2.6

[12] Gorzelany, Jay F. 2005. MOTE Marine Laboratory. Recreational Boat Traffic Surveys of Broward County, Florida. Florida Fish and Wildlife Conservation, Final Report

[13] Gannett Fleming. 2009. South Florida East Coast Corridor Transit Analysis Study Phase 2 Navigable Waterway Analysis Technical Memorandum.

(Table 3.3-1). There were more vessels observed during the winter as compared to the summer, with an average of 340 vessels during weekdays and an average of 846 vessels observed during weekends. More vessels were observed on average in the afternoon as compared to the morning during both the summer and winter with 495 and 841 vessels, respectively. On average, peak vessel traffic appears to occur on Sundays with 442 vessels observed while Saturday counts averaged 277 vessels (Table 3.3-2). However, it is worth mentioning that the number of vessels observed in this study only reflect traffic east of the New River Bridge and not the number of vessels directly crossing New River Bridge.

Table 3.3-1. Summary of Vessel Traffic Observed at Colee Hammock Park in the New River East of the New River Bridge Collected via Video Cameras (2004 and 2005) Summarized by Season and by Time of Day

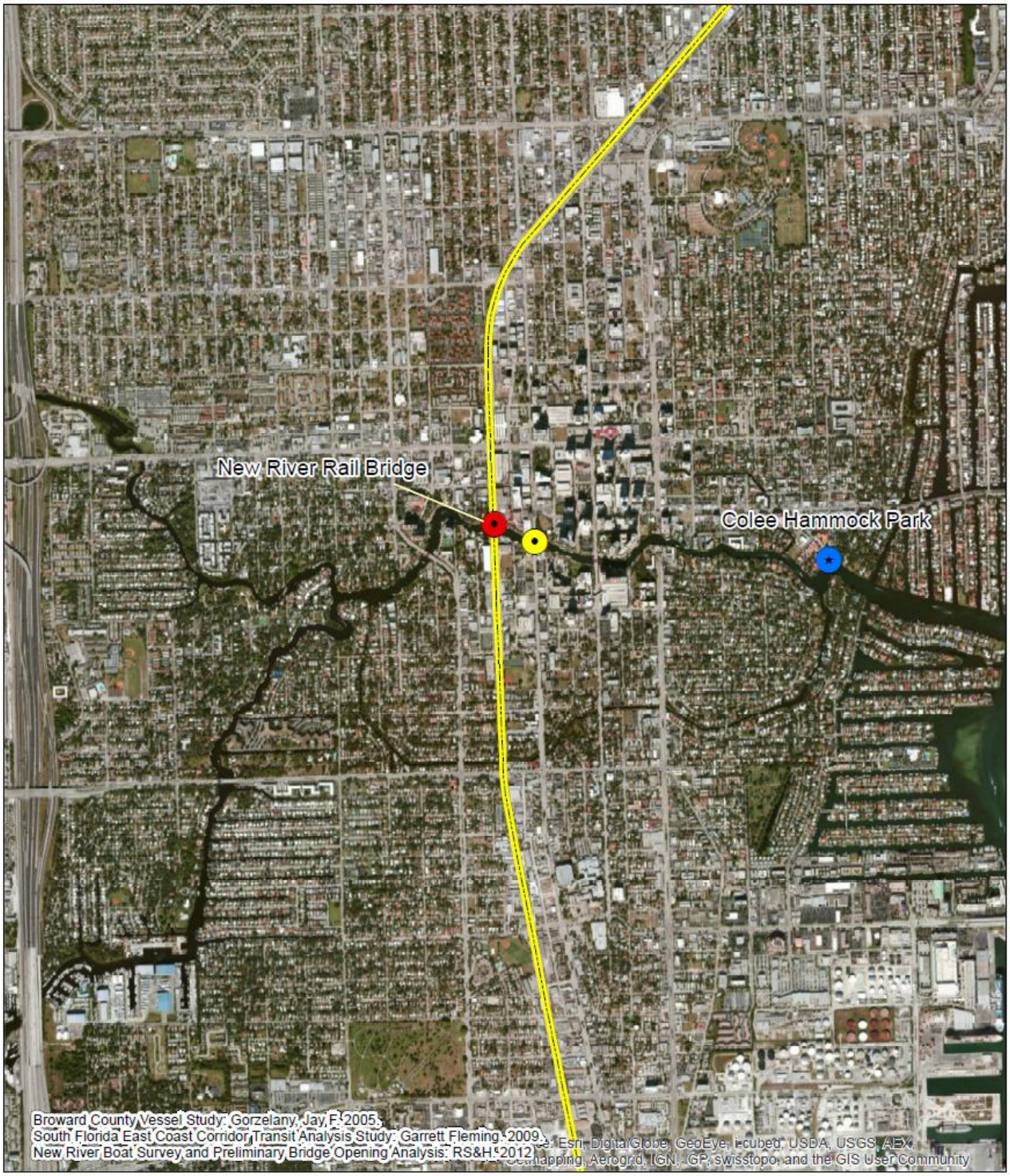
Season	Weekday (Average)	Weekend (Average)	Ratio (WE/WD)	Morning (am) (8:00 am to 11:59 am)	Afternoon (pm) (Noon to 3:00 pm)	Ratio (pm/am)
Summer	224	591	2.6	320	495	1.5
Winter	340	846	2.5	345	841	2.4

Source: Modified from Tables 10 and 11 from Gorzelany 2005[12]
Notes: WD = Weekday; WE = Weekend

Table 3.3-2. Summary of Vessel Traffic Observed at Colee Hammock Park in the New River East of the FECR Bridge Collected via Field Observers (2004 and 2005) Summarized by Day of the Week

Day	Number of Days Observed	Average
Sunday	2	442
Monday	1	87
Tuesday	1	167
Wednesday	1	173
Thursday	-	-
Friday	1	137
Saturday	2	277

Source: Modified from Tables 1 and 2 from Gorzelany, 2005[12]



Explanation of Features

- Broward County Vessel Study
- South Florida East Coast Corridor Transit Analysis Study
- New River Boat Survey and Preliminary Bridge Opening Analysis
- N-S Corridor

Data Sources: ESRI Bing Maps 2012 Imagery, AAF 2012, AMEC 2012

New River Vessel Survey Location

All Aboard Florida Intercity Passenger Rail Project

N 0 1,000 2,000 Feet

U.S. Department of Transportation **Federal Railroad Administration**

Figure 3.3-1

Path: F:\FECI\FECI_GDB\MXD\EA\Figure 3.3-1 New River Vessel Survey Location.mxd

This study also conducted aerial flight surveys to assess vessel traffic trends for all of Broward County.[12] Aerial surveys were conducted from May 2004 to January 2005 to estimate weekday and weekend vessel trends as well as trends throughout the week separated by morning and afternoon (Table 3.3-3). This study indicates that peak vessel activity occurs in the afternoon between noon and 3 pm with an average of 118 vessels counted on weekdays and an average of 347 vessels counted on weekends. Peak weekday vessel traffic occurs on Fridays with an average of 142 vessels, whereas weekend traffic peaks occur on Sundays with an average of 501 vessels. Morning vessel activity is considerably lower for both weekdays and weekends with 91 and 176 vessels observed, respectively (Table 3.3-3).

Table 3.3-3. Total Number of Vessels Observed in Broward County via Aerial Surveys Conducted in 2004 and 2005

	Morning (am) (8:00am to 11:59 am)		Afternoon (pm) (Noon to 3:00 pm)			Total	
	Number Days Observed	Average per day	Number days Observed	Average per day	Ratio (pm/am)	Number days Observed	Average per day
Weekday verses Weekend Summary							
Weekday	4	91	4	118	1.3		
Weekend	4	176	4	347	2.0		
Weekly Summary							
Sunday	1	191	2	501	2.6	3	398
Monday	1	63	1	79	1.3	2	71
Tuesday	-	-	-	-	-	-	-
Wednesday	1	97	1	128	1.3	2	113
Thursday	1	106	1	123	1.2	2	115
Friday	1	97	1	142	1.5	2	120
Saturday	3	171	3	304	1.8	6	237

Source: Modified from Tables 1 and 2 from Gorzelany, 2005[12]
Notes: WD = Weekday; WE = Weekend

3.3.1.2 New River Vessel Survey and Preliminary Bridge Opening Analysis

A vessel survey was conducted in April 2011, for the section of the New River upstream of the New River Bridge to I-95 on the South Fork, and Broward Boulevard on the North Fork.9 The purpose of this study was to evaluate vessel traffic that would require the opening of operable bridges east of the New River Bridge crossing, towards the Intracoastal Waterway, in Fort Lauderdale, Florida. Focus was placed primarily on vessels with vertical clearances higher than those of the Southeast 3rd Avenue Bridge (16 feet) and the Andrews Avenue Bridge (21 feet).

Results from this study show that 425 vessels upstream of the Southeast 3rd Avenue Bridge and Andrews Avenue Bridge would require bridge openings. Based on analysis of the confirmed vessel heights surveyed during February 2011, the most common vessel height requiring opening of the Southeast 3rd Avenue Bridge is 59 feet. Vessel heights requiring the majority of openings range from 50 to 70 feet. The most common vessel heights requiring opening of the Andrews Avenue Bridge are over 55 feet. Vessel heights requiring the majority of openings include the vessel heights mentioned above, as well as those vessels with a 64 foot vessel height.[9]

Estimates of the total number of vessels in the navigable waterways upstream of the Southeast 3rd Avenue Bridge (extending to the water control structures), and the number of vessels that appeared to have a vertical clearance requirement greater than 20 feet were approximated from aerial photography taken March 26, 2011. Downstream of I-95 (and Broward Boulevard on the North Fork) were approximately 1,186 vessels, approximately 484 (41%) of which appeared to have a vertical clearance requirement greater than 20 feet. Upstream of I-95 (and Broward Boulevard on the North

Fork) were approximately 1,406 vessels, approximately 289 (21%) of which appeared to have a vertical clearance requirement greater than 20 feet.[9]

3.3.1.3 South Florida East Coast Corridor Transit Analysis Study – Phase 2 Navigable Waterway Analysis Technical Memorandum

A navigable waterway analysis was published by Gannett Fleming in November 2009, which evaluated the vessel traffic traversing bridges along the New River, based on preliminary studies from 1999 and 2009. The January 1999 vessel survey at the CSX Railway crossing of the South Fork determined approximately 170 vessels pass underneath this bridge with the tallest vessel height reaching 48 feet. Based on personal communication from the USCG, under low tide vessels with heights close to 55 feet can transit under the CSX Bridge. The CSX Railway Bridge remains in the open position similar to New River Bridge and closes to facilitate train passage on an as-needed basis. Vertical clearance in the western reaches of the South Fork is restricted to 55 feet due to the I-95 fixed bridge. A field study conducted in March 2009 surveyed the vertical heights of the tallest sailing vessels moored between the Andrews Avenue Bridge and the New River Bridge, finding an average height of 54.5 feet. Based on interviews conducted during March 2009 with local marine businesses, River Bend Marine Center and Storm Rigging, the most common vertical clearance of sailing vessels coming for service were 60 feet and 63.5 feet, respectively. Although the charted clearance of the power cables west of New River Bridge is 80 feet, Storm Rigging indicated that the cables are actually at 105 feet, and therefore vessels reaching 95 feet in height can pass through the area, particularly during low tide.

3.3.2 2014 Vessel Traffic Survey

Video recordings from a camera placed by the New River Bridge were provided by FECR. These videos consist of two full consecutive weeks of the peak season for vessel traffic, from January 14th to the 27th, 2014 and were assessed to extract data of vessel traffic traversing the New River Bridge during daylight hours (from 6:00 am through 6:30 pm each day). In addition, this section summarizes vessel traffic data and traffic characteristics extracted from a survey of a live feed of the New River Bridge, February 2014.

3.3.2.1 Summary of Vessel Traffic Traversing New River FEC Bridge

<u>New River Bridge 2014 Video Assessment</u>

Based on the January 2014 FECR video, an average of 157 vessel crossings occurred at the New River Bridge (Min=99; Max=289) on a daily basis (6:00 am to 6:30 pm) from Monday through Friday compared to an average of 356 vessels (Min=262; Max=508) per day on a weekend day (Table 3.3-4). Both Sundays observed during this two week video assessment (January 19 and January 26) had the most vessel activity, with a total 304 and 508 vessel counts from 6:00 am to 6:30 pm, respectively. Wednesdays and Thursdays reported the lowest vessel activity with an average of 114 and 136 vessel counts, respectively. The average vessel count for Monday is likely higher than typical since it included data from January 20, 2014, which is a holiday.

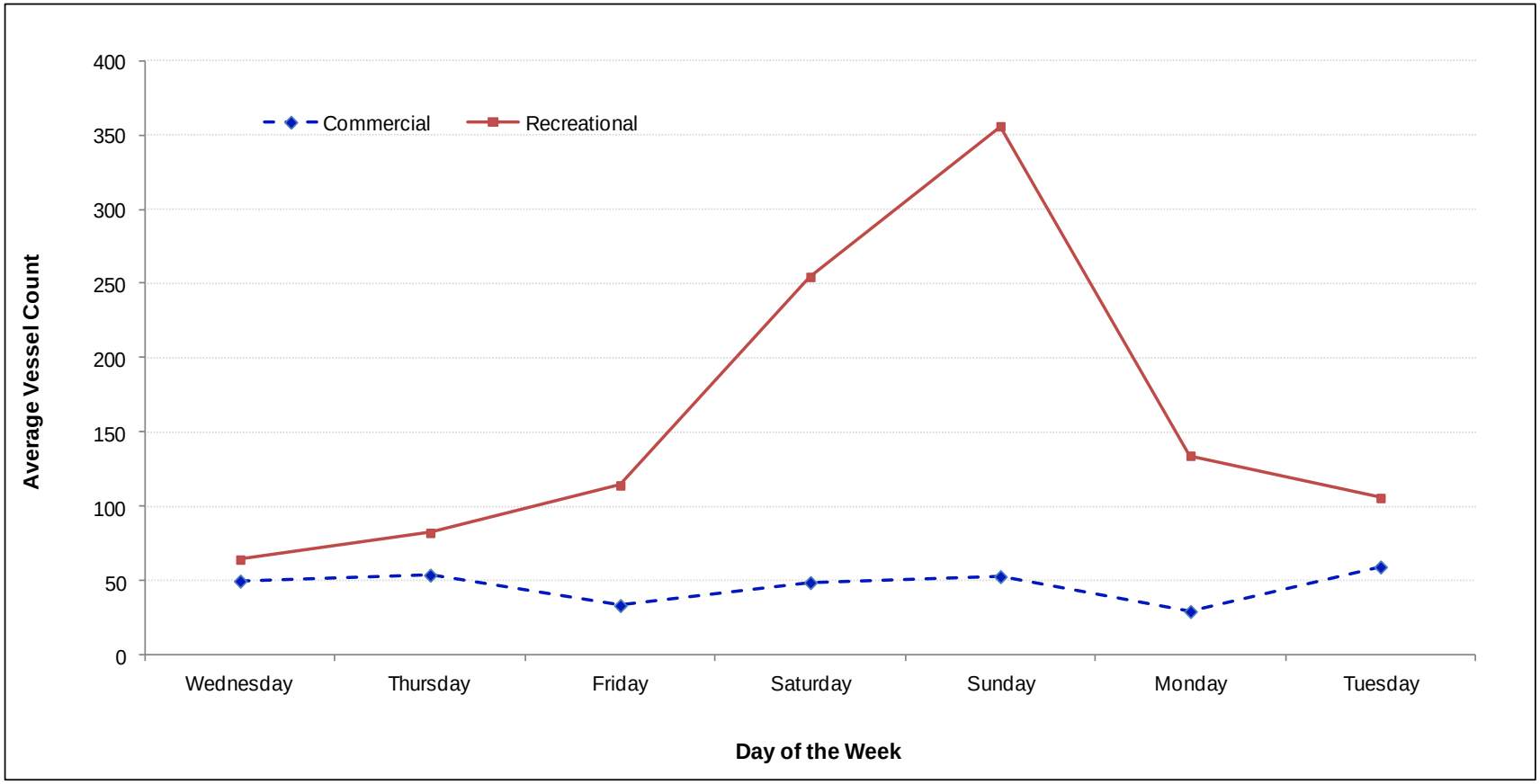
The average count of commercial vessels per day ranged from 29 to 59 (Figure 3.3-1). An increase in commercial crossings during the weekend was not observed during this two week assessment, but lower vessel counts were observed during Monday and Friday, with an average vessel count of 29 and 33 vessels, respectively. An average count of recreational vessels per day ranged from 64 to 356, with lower traffic during Wednesday and Thursday and an increase in vessel traffic of approximately 64% during the weekend (Figure 3.3-2).

Table 3.3-4. Vessel Traffic at New River Bridge Based on FECR Video Assessment from January 2014

Week Day	Date	Vessel Traffic at New River Bridge[a]						Total	Percent of Commercial Vessels/day	Percent of Recreational Vessels/day
		Morning (6:00 AM-9:59 AM)		Noon (10:00 AM-1:59 PM)		Afternoon to Overnight (2:00 PM-5:59 AM)				
		Commercial	Recreational	Commercial	Recreational	Commercial	Recreational			
Tuesday	1/14/2014	4	13	21	60	22	57	177	26.6%	73.4%
Wednesday	1/15/2014	9	9	20	21	20	20	99	49.5%	50.5%
Thursday	1/16/2014	7	8	17	22	24	32	110	43.6%	56.4%
Friday	1/17/2014	5	5	10	58	12	64	154	17.5%	82.5%
Saturday	1/18/2014	5	19	13	77	16	132	262	13.0%	87.0%
Sunday	1/19/2014	9	9	19	106	19	147	309	15.2%	84.8%
Monday	1/20/2014	6	16	17	113	18	119	289	14.2%	85.8%
Tuesday	1/21/2014	26	13	22	46	22	21	150	46.7%	53.3%
Wednesday	1/22/2014	10	6	19	34	22	38	129	39.5%	60.5%
Thursday	1/23/2014	7	6	24	35	28	61	161	36.6%	63.4%
Friday	1/24/2014	4	7	18	39	17	55	140	27.9%	72.1%
Saturday	1/25/2014	18	9	29	100	16	172	344	18.3%	81.7%
Sunday	1/26/2014	9	30	18	155	31	265	508	11.4%	88.6%
Monday	1/27/2014	9	10	8	10	ND	ND	37	45.9%	54.1%

Notes: [a] Vessel traffic was assessed primarily during January daylight hours (from 6:00am to 6:30pm), but casual observations late at night were also recorded; ND=no data

Figure 3.3-2. Average Vessel Count Traversing the New River Bridge



New River Bridge 2014 Live Video Feed Survey

The average vessel count observed during the February 2014 New River live feed observations was lower than values obtained from the January 2014 New River Bridge video assessment (Table 3.3-5). However, the density of traffic was similar throughout the week, with lower vessel traffic on Thursdays and an increase in vessel traffic over the weekend. A higher traffic of recreational vessels was observed compared to commercial vessels. Most commercial vessel trips account for those made by taxi boats, the Jungle Queen, a sightseeing riverboat cruise, and towing services (Table 3.3-6).

Table 3.3-5. Vessel Traffic at New River Bridge[a] Observed During Survey of Live Video Feed Assessment

Day	Number of Vessels (am)	Number of Vessels (pm)	Number of Vessels per day
Tuesday	ND	102	102
Thursday	16	67	83
Friday	ND	94	94
Saturday	85	305	390
Sunday	96	297	393

Notes: [a] Vessel traffic was assessed during January daylight hours, from 6:00am to 6:30pm; ND = no data

Table 3.3-6. Commercial Vessel Traffic at New River Bridge Observed During Live Video Feed Assessment on February 13, 2014

Vessel Type	Number of Trips	
	Morning	Afternoon
Water taxi	4	11
Jungle Queen	0	2
Towing service	1	4

3.4 Summary of Bridge Operation at New River

This section includes data gathered through existing bridge operation studies at and near the New River Bridge, bridge operation surveys performed from the live feed and the current and projected operations schedule for freight and passenger traffic provided by AAF. These data are summarized herein and will be used to assess projected changes in maritime traffic.

3.4.1 Literature Review of Bridge Operation Studies

Bridge operation studies along the New River were conducted in 2009[13] and 2011[9]. These studies include aerial surveys, along with fixed point surveys and provide average weekly and monthly bridge operation/openings as well as vertical clearances for bridges along the New River.

3.4.2 New River Vessel Survey and Preliminary Bridge Opening Analysis

A vessel survey and bridge opening analysis was conducted in April 2011 for the section of the New River upstream of the FECR Bridge to I-95 on the South Fork, and Broward Boulevard on the North Fork.[9] The purpose of this study was to evaluate vessel traffic that would require the opening of operable bridges east of the New River Bridge crossing, towards the Intracoastal Waterway, in Fort Lauderdale, Florida.

Bridge operation based on tender log data was used to determine the frequency of openings at the Southeast 3rd Avenue and Andrews Avenue bridges. A summary of the estimated number of openings per day of the week for each of these bridges is described in Table 3.4-1.9 In addition, the data demonstrate that in 2011 the Southeast 3rd Avenue Bridge was opened 10,821 times. Peak opening times occurred on Friday, Saturday, and Sunday with approximately 32, 33, and 31 daily openings, respectively (Table 3.1-1). The average bridge openings per day, week and month at the Southeast 3rd Avenue Bridge was approximately 30, 210 and 900 respectively. The Andrews

Avenue Bridge was opened 9,803 times during 2011, with peak opening times occurring on Friday and Saturday with approximately 31 and 29 daily openings, respectively. The average bridge openings per day, week and month at the Andrews Avenue Bridge was approximately 27, 190 and 820 respectively.

Table 3.4-1. Average Number of Openings per day at the Southeast 3rd Avenue Bridge and Andrews Avenue Bridge, April 2011

Bridge Name	Number of Bridge Openings						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Southeast 3rd Avenue Bridge	31	30	30	28	29	32	33
Andrews Avenue Bridge	27	28	28	25	27	31	29

Source: Modified from RS&H, 20129

The 2011 opening logs for the Andrews Avenue Bridge and Southeast 3rd Avenue Bridge from the Broward County Highway and Bridge Maintenance Division record the date, time and vessel that the bridge was opened for, as well as the vessel name and direction of the vessel, if available. Based on review of the opening logs, February was the month with greatest number of openings at both bridges. The estimated average number of daily openings by month for the Andrews Avenue Bridge and Southeast 3rd Avenue Bridge for the 2011 calendar year is summarized in Table 3.4-2.

Table 3.4-2. Average Number of Daily Openings per month at the Andrews Avenue Bridge and Southeast 3rd Avenue Bridge, Calendar Year 2011

Bridge Name	Average Number of Daily Bridge Openings											
	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Southeast 3rd Avenue Bridge	29	34	34	32	34	27	26	27	23	34	32	34
Andrews Avenue Bridge	27	30	29	29	30	27	26	26	23	28	29	31

Source: Modified from RS&H, 2012[9]

3.4.3 South Florida East Coast Corridor Transit Analysis Study – Phase 2 Navigable Waterway Analysis Technical Memorandum

A navigable waterway analysis was published by Gannett Fleming in November 2009 concerning bridge operations along the New River for the Andrews Avenue Bridge and the New River Bridge.[13] Based on data collected on November 2008, an estimated average of 11 freight trains crossed the New River daily and those trains accounted for an average bridge closure time of 3.4 hours per day. Depending on the number of freight trains and the train's length, closure times ranged from 1.5 hours to almost 6 hours per day.[13] Weekday closures were found to be longer than weekend closures (4 hours as opposed to 2 hours, respectively).[13]

The number of openings in one-hour periods throughout the day, as well as the average number of openings per day was determined based on the Andrews Avenue Bridge log of November, 2007. The largest number of bridge openings (33 to 34) took place on Sunday and Monday, respectively. The most navigational traffic occurred between 10 am and 4 pm, averaging approximately one opening per hour. Table 3.4-3 summarizes the estimated average number of openings per day of the week during the study period.[13] Results of this study were confirmed by a representative from the Broward County Streets and Highway Division, who through a phone interview stated the Andrews Avenue Bridge opens an average of 30 times per day and 800 to 1,000 times per month.[13]

Table 3.4-3. Average Number of Andrews Avenue Bridge Openings, November 2007

Day	Average Number of Openings per Day
Sunday	33
Monday	34
Tuesday	22
Wednesday	26
Thursday	23
Friday	24
Saturday	23

Source: Gannett Fleming, 2009 [13]

3.4.4 New River Bridge Operations Analysis

A bridge operation survey performed through observations of live feed indicates the New River Bridge is closed, on average, 19 minutes per closure (Table 3.4-4). This value is comparable to the values obtained through RTC modeled bridge operations using the freight traffic data provided by AAF, which shows the New River Bridge is closed about 19 minutes per closure under Existing Conditions (Table 3.4-5).

RTC model results for existing and projected bridge operations are provided in Table 3.4-5. Analysis of data suggests the No-Build Alternative (without the infrastructure contemplated as part of the Proposed Action) will increase the average time of each bridge closure by approximately 6 minutes. The projected freight traffic under the 2016 No-Build Alternative results in a total average daily bridge closure of 6 hours during weekdays and approximately 3.3 hours of daily closure during weekends, as compared to approximately 3.50 and 2.45 hours of daily closure during weekdays and weekends, respectively, under the Existing Conditions. Although the Proposed Action (2016 Passenger and upgraded infrastructure) will add to the total daily bridge closure time (about 2.92 hours during the weekdays and 3.12 hours during weekends), improvements to the rail infrastructure are expected to increase the speed of rail traffic, reducing the Proposed Action average time of single closures (11 minutes) by approximately 8 minutes when compared to Existing Conditions and No-Build Alternative (19 minutes). The Combined Effect (2016 Freight and Passenger) will correspond to an average of 6.9 hours of daily closure times during the weekdays and 5.23 hours of closure time during the weekends. The total bridge closure estimated for the No-Build 2016 Freight and the 2016 Improved Freight, (Combined Effect minus the Proposed Action; data presented in Appendix A) are very similar. However, the 2016 Improved Freight has a lower total daily closure time from Thursday to Saturday and a reduction of bridge closure that ranges between 2 and 30 minutes during active vessel traffic (6:00am to 6:00pm).

Under the Combined Effect some hours will experience longer periods of bridge closure time (above 30 minutes). Extended bridge closure time in a specific hour can be split into several short bridge closings periods (e.g., three 10 minutes closings) with bridge openings between each bridge closure, or they can happen as one bridge closure in that hour (Table 3.4-6). However, these single extended periods of closure time will occur mainly at night and early morning, which are characterized by a decreased vessel traffic compared to daytime hours (Appendix B). In addition these extended bridge closures are usually followed by long periods of bridge openings that should allow all queue vessels to cross without experiencing multiple bridge closures. Even the largest vessels (e.g., Jungle Queen) will not take more than 5 to 6 seconds to cross the bridge, thus shorter periods of bridge opening (e.g., 5 minutes) should be enough to clear queue vessels at both sides of the bridge.

Table 3.4-4. Bridge Operation Survey for New River Bridge Based on Live Feed Observations, February 2014

Day of Week	Time it takes Bridge to close	Time it takes Train to arrive	Time it takes Train to cross	Time it takes Bridge to start opening	Time it takes for Bridge to open	Total Time
Values Represent the Average Times Per Day (hh:mm:ss)						
Thursday	0:01:17	0:08:44	0:01:33	0:02:04	0:01:28	0:15:04
Friday	0:02:01	0:11:53	0:02:58	0:02:13	0:01:17	0:20:22
Saturday	0:01:31	0:20:45	0:02:16	0:00:44	0:01:41	0:26:57
Sunday	0:01:18	0:06:37	0:03:29	0:01:21	0:01:45	0:14:30
Statistics of Raw Data for the Bridge Operation Survey[a] (hh:mm:ss)						
Average	0:01:32	0:12:00	0:02:34	0:01:36	0:01:33	0:19:13
Minimum	0:01:17	0:06:37	0:01:33	0:00:44	0:01:17	0:14:30
Median	0:01:24	0:10:18	0:02:37	0:01:42	0:01:35	0:17:43
Maximum	0:02:01	0:20:45	0:03:29	0:02:13	0:01:45	0:26:57

Notes: [a] Average data based on 10 observations
Each day is an average of multiple observations per day that include both single and multiple trains crossing within the closures observed.

Table 3.4-5. Summary of Existing and Projected Bridge Operations for the New River Bridge

New River Bridge	Existing Conditions 2013 F	No-Build Alternative 2016 F[a]	Proposed Action 2016 P[b]	Combined Effect 2016 F+P [b]
Average Single Daily Closure Time (Minutes)				
Sunday	19	20	11	13
Monday	18	19	11	13
Tuesday	19	20	10	14
Wednesday	18	18	13	13
Thursday	19	19	11	13
Friday	19	19	12	13
Saturday	18	18	11	11
Average Single Weekly Closure Time (minutes) [c]	**19**	**19**	**11**	**13**
Total Number of Daily Closures	**10**	**16**	**16**	**30**
Total Daily Closure Time (Minutes)				
Sunday	148	179	182	319
Monday	231	395	175	447
Tuesday	189	362	134	402
Wednesday	221	348	188	433
Thursday	186	341	189	397
Friday	223	354	191	390
Saturday	146	215	192	308
Average of Total Weekday Closure Time (Minutes)	**210**	**360**	**175**	**414**
Average of Total Weekday Closure Time (Hours)	**3.50**	**6.0**	**2.92**	**6.90**
Average of Total Weekend Closure Time (Minutes)	**147**	**197**	**187**	**314**
Average of Total Weekend Closure Time (Hours)	**2.45**	**3.3**	**3.12**	**5.23**

Notes: [a]Results based on RTC modeling data of train and bridge operations with closure times verified with existing field conditions and under the assumption that infrastructure improvements planned under the Proposed Action do not occur.
[b]Results based on RTC modeling data of train and bridge operations for both freight and passenger rail with the planned infrastructure improvements planned under the Proposed Action.
[c]Multiple trains(freight and passenger) can cross under a single bridge closure.

Table 3.4-6. Extended Bridge Closures at New River due to Freight and Passenger Train Operations

Day	Bridge Closure Time (hh:mm) [a]	Total Number of Trains	Duration of Single Closure (Minutes)	Open Duration Before Next Bridge Closure (Minutes)
Tuesday	18:22	5	37	22
Tuesday	22:22	3	31	50
Thursday	17:22	3	30	29

Note: Extended bridge closures are characterized by single closures longer than 30 minutes
[a] Time of day when the extended bridge closure occurs

3.5 Model Simulation Results

No-Build Alternative (Case 2a) Compared to Combined Effect (Case 3)

Table 3.5.1 shows the model results for marine traffic wait times for total vessels (commercial plus recreational), commercial only vessels, and recreational only vessels at New River Bridge crossing for the four cases identified in Section 2.5.1. When comparing Case 2a (2016 No-Build Alternative) to Case 3 (2016 Freight and Passenger, Combined Effect) an increase in the percentage of vessels experiencing a wait from 23% under the No-Build Alternative to 36% under the Combined Effect is seen. There is a 90% probability that individual vessels that wait will not wait longer than 16.4 minutes under Case 2a, and will not wait longer than 12.2 minutes under Case 3. The average wait times for all vessels that experience a wait is expected to decrease under the Combined Effect as compared to the No-Build Alternative from 7.9 minutes to 6.3 minutes, respectively.

The effect on vessel wait times for commercial only vessels and recreational only vessels was similar to the effect on total vessels. For commercial vessels that wait, the average wait time is expected to decrease from 7.3 minutes under the No-Build Alternative to 6.3 minutes under the Combined Effect. For recreational vessels that wait, the average wait time is expected to decrease from 8.1 minutes under the No-Build Alternative to 6.3 minutes under the Combined Effect.

Based on vessel traffic characterized in the FECR Video Assessment for the New River Bridge (Table 3.3-4), the highest traffic period for commercial and recreational vessels occur from noon to 6:00 pm. Overall, under the No-Build Alternative (Case 2a) and for the Combined Effect (Case 3) there is a higher probability (>80%) that vessels will not have to experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 3.5-2. In general,

- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 3.5-2); while the maximum vessel queue length with a probability 0.1 to 2.2% of occurrence is over 10 vessels.
- Under the Combined Effect, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence; while the greatest vessel queue length with a probability ranging from 0.2 to 2.0% is over 10 vessels.

Existing Conditions (Case 1) Compared to No-Build Alternative (Case 2a)

When comparing Case 1 (2013 Existing Conditions) to Case 2a (2016 No-Build Alternative) for total vessel traffic, changes in vessel delays are projected. The percentage of vessels that experience a wait time increases from 14% under Existing Conditions to 23% for the No-Build Alternative There is a 90% probability that individual vessels that wait will not wait longer than 15 minutes under Case 1, and will not wait longer than 16.4 minutes under Case 2a. The average wait times for vessels that experience a wait increase under the No-Build Alternative as compared to the Existing Conditions, from 5.9 minutes to 7.9 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect of total vessels experiencing a wait. For commercial vessels that wait, the average wait time is expected to increase from 5.1 minutes under Existing Conditions to 7.3 minutes under the No-Build Alternative. For recreational vessels that wait, the average wait time is expected to increase from 6.3 minutes under Existing Conditions to 8.1 minutes under the No-Build Alternative.

Based on vessel traffic characterized in the FECR Video Assessment for the New River Bridge (Table 3.3-4), the highest traffic period for commercial and recreational vessels occur from noon to 6:00 pm. under Existing Conditions (Case 1) and for the No-Build Alternative (Case 2a) there is a higher probability that vessels will not experience a wait time. However, the number of vessels that

could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 3.5-2. In general,

- Under the Existing Conditions a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence; and the maximum vessel queue length with a 0.1 to 1.4% probability of occurrence is over 10 vessels.
- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 3.5-2); while the maximum vessel queue length with a probability 0.1 and 2.2% of occurrence is over 10 vessels.

No-Build Alternative (Case 2a) Compared to 2016 Improved Freight (Case 2b)

When comparing Case 2a (2016 No-Build Alternative) to Case 2b (2016 Freight, Improved) wait times decrease for total vessel traffic. The percentage of vessels that experience a wait time, decreases from 23% under 2016 No-Build Alternative to 18% for the 2016 Freight, Improved. There is a 90% probability that individual vessels that wait will not wait longer than 16.4 minutes under Case 2a, and will not wait longer than 11.2 minutes under Case 2b. The average wait times for vessels that experience a wait decrease under the 2016 Freight, Improved as compared to the 2016 No-Build Alternative from 7.9 minutes to 5 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect of total vessels experiencing a wait. For commercial vessels that wait the average wait time is expected to decrease from 7.3 minutes under the 2016 No-Build Alternative to 4.5 minutes under the 2016 Freight, Improved. For recreational vessels that wait, the average wait time is expected to decrease from 8.1 minutes under the 2016 No-Build Alternative to 5.2 minutes under the 2016 Freight, Improved.

Based on vessel traffic characterized in the FECR Video Assessment for the New River Bridge (Table 3.3-4), the highest traffic period for commercial and recreational vessels occur from noon to 6:00 pm under the No-Build Alternative (Case 2a) and for the 2016 Improved Freight (Case 2b) there is a higher probability that vessels will not experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 3.5-2. In general,

- Under the No-Build Alternative (Case 2a) a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence; and the maximum vessel queue length with a 0.1 to 2.2 % probability of occurrence is over 10 vessels.
- Under the 2016 Improved Freight (Case 2b), a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 3.5-2); while the maximum vessel queue length with a probability 0.1 and 0.3% of occurrence is over 10 vessels.

Table 3.5.1. Navigation Simulation Model Results for New River Bridge

Case Number		**1**	**2a**	**2b**	**3**
Train Traffic		**2013 F**	**2016 F**	**2016 F**	**2016 F+P**
Infrastructure		**2013 (No-Build)**	**2013 (No-Build)**	**2016 (Build)**	**2016 (Build)**
Marine Traffic	**Units**	**2013**	**2016 Projected**	**2016 Projected**	**2016 Projected**
Total Vessel Wait Times					
Vessel Arrivals	(#/day)	215	215	215	215
Vessels with Zero Wait Time	(#/day)	185	165	176	139
% Vessels with Zero Wait Time		86%	77%	82%	64%
Vessels With Wait Time	(#/day)	30	50	39	76
% Vessels With Wait Time		14%	23%	18%	36%
Avg. Wait Time (all) [a]	(min)	0.8	1.8	0.9	2.2
Avg. Wait Time [b]	(min)	5.9	7.9	5	6.3
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	≤15.0	≤16.4	≤11.2	≤12.2
Commercial Vessel Wait Times					
Vessel Arrivals	(#/day)	49	49	49	49
Vessels with Zero Wait Time	(#/day)	39	35	37	29
% Vessels with Zero Wait Time		79%	71%	76%	59%
Vessels with Wait Time	(#/day)	11	14	12	20
% Vessels With Wait Time		21%	29%	24%	41%
Avg. Wait Time (all) [a]	(min)	1.1	2.1	1.1	2.6
Avg. Wait Time [b]	(min)	5.1	7.3	4.5	6.3
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	≤14.9	≤17.0	≤11.6	≤12.9
Recreational Vessel Wait Times					
Vessel Arrivals	(#/day)	165	165	165	165
Vessels with Zero Wait Time	(#/day)	145	130	138	109
% Vessels with Zero Wait Time		88%	79%	84%	66%
Vessels With Wait Time	(#/day)	20	35	27	56
% Vessels With Wait Time		12%	21%	16%	34%
Avg. Wait Time (all) [a]	(min)	0.7	1.7	0.8	2.1
Avg. Wait Time [b]	(min)	6.3	8.1	5.2	6.3
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	≤15.1	≤16.3	≤11.1	≤12.0

Notes: [a] Average time all vessels will have to wait before crossing the bridge (average between vessels with wait time and vessels with no wait time)
[b] Average time queue vessels will have to wait before crossing the bridge

Table 3.5-2. Simulation Model Results for Vessel Queue Lengths at New River Bridge

Case	Time	Length of Queue (vessels)			
		Minimum Queue	Percent Chance	Maximum Queue	Percent Chance
Case Number: 1 **Train Traffic: 2013 F** **Infrastructure: 2013 (No-Build)** **Marine Traffic: 2013**	6-7 am	1	2.2	2	0.2
	7-8 am	1	1	2	0.2
	8-9 am	1	1.4	3	0.1
	9-10 am	1	6.5	7	0.1
	10-11 am	1	4.8	8	0.1
	11 am – 12 noon	1	4.1	8	0.2
	12 noon-1 pm	1	1.6	9	0.1
	1-2 pm	1	2.8	9	0.1
	2-3 pm	1	3.9	>10	0.9
	3-4 pm	1	1.3	>10	1.4
	4-5 pm	1	1.7	5	0.1
	5-6 pm	1	4.3	>10	0.1
	6-7 pm	1	2.9	>10	0.2
Case Number: 2a **Train Traffic: 2016 F** **Infrastructure: 2013 (No-Build)** **Marine Traffic: 2016 Projected**	6-7 am	1	2.2	2	0.3
	7-8 am	1	2.7	3	0.1
	8-9 am	1	0.5	1	0.1
	9-10 am	1	0.5	1	0.5
	10-11 am	1	4.9	7	0.1
	11 am – 12 noon	1	8.6	>10	0.8
	12 noon-1 pm	1	3.5	>10	0.3
	1-2 pm	1	1.2	2	0.1
	2-3 pm	1	5.4	>10	0.1
	3-4 pm	1	5.3	>10	2.2
	4-5 pm	1	5	>10	0.5
	5-6 pm	1	8.5	>10	1
	6-7 pm	1	8.2	>10	0.5
Case Number: 2b **Train Traffic: 2016 F** **Infrastructure: 2016** **Marine Traffic: 2016 Projected**	6-7 am	1	1.2	2	0.1
	7-8 am	1	1.7	2	0.3
	8-9 am	1	0.1	1	0.1
	9-10 am	1	0.5	1	0.5
	10-11 am	1	3.9	5	0.2
	11 am – 12 noon	1	8.4	>10	0.1
	12 noon-1 pm	1	3.7	9	0.1
	1-2 pm	1	1.2	2	0.1
	2-3 pm	1	4.4	8	0.1
	3-4 pm	1	5.7	>10	0.3
	4-5 pm	1	4.6	>10	0.1
	5-6 pm	1	7.1	>10	0.2
	6-7 pm	1	6.9	>10	0.1
Case Number: 3 **Train Traffic: 2016 F + P** **Infrastructure: 2016** **Marine Traffic: 2016 Projected**	6-7 am	1	3.6	2	0.2
	7-8 am	1	5.5	3	0.1
	8-9 am	1	5	4	0.1
	9-10 am	1	6.8	5	0.1
	10-11 am	1	6.8	6	0.2
	11 am – 12 noon	1	11.6	>10	0.2
	12 noon-1 pm	1	9	>10	0.6
	1-2 pm	1	7.3	>10	0.6
	2-3 pm	1	8.6	>10	1.3
	3-4 pm	1	7.8	>10	0.3
	4-5 pm	1	9.5	>10	2
	5-6 pm	1	8.8	>10	0.8
	6-7 pm	1	8.9	>10	0.3

4.0 Characterization of Loxahatchee River Bridge

4.1.1 Location of Loxahatchee River Waterway

The Loxahatchee River is located between Martin and Palm Beach Counties (Figure 4.1-1). Its headwater is located in River Bank on the south side of Indiana Road about 1.5 miles west of I-95 and Florida's Turnpike in Jupiter, and the mouth of the river is located at the Jupiter Inlet. The river has three main forks that flow to the central embayment area before heading out the Jupiter Inlet.

The primary bridges crossing the Loxahatchee River include two operable bridges and three stationary bridges. Operable bridges include the US 1 Jupiter Federal Bridge and the Loxahatchee River Bridge located at the confluence, 0.9 miles and 1.3 miles from the Loxahatchee River inlet, respectively. Stationary bridges include the A1A Route Bridge located 1.2 miles from the Loxahatchee inlet, the Tequesta Drive Bridge located at the North Fork 2.4 miles from the Loxahatchee River Bridge, and the Loxahatchee River Road Bridge located at the South Fork 1.9 miles from the Loxahatchee River Bridge. Characterization and location of these bridges, within the extent of waterfront development as defined in Figure 3.1-1 in the confluence and Northwest and Southwest Forks, can be found in Table 4.1-1.

Waterfront development on the North Fork extends for about 3.5 miles from the Loxahatchee River Bridge, for approximately 4.3 miles in the Northwest Fork and approximately 1.9 miles towards the South Fork, by the Loxahatchee River Road Bridge (Figure 4.1-1).

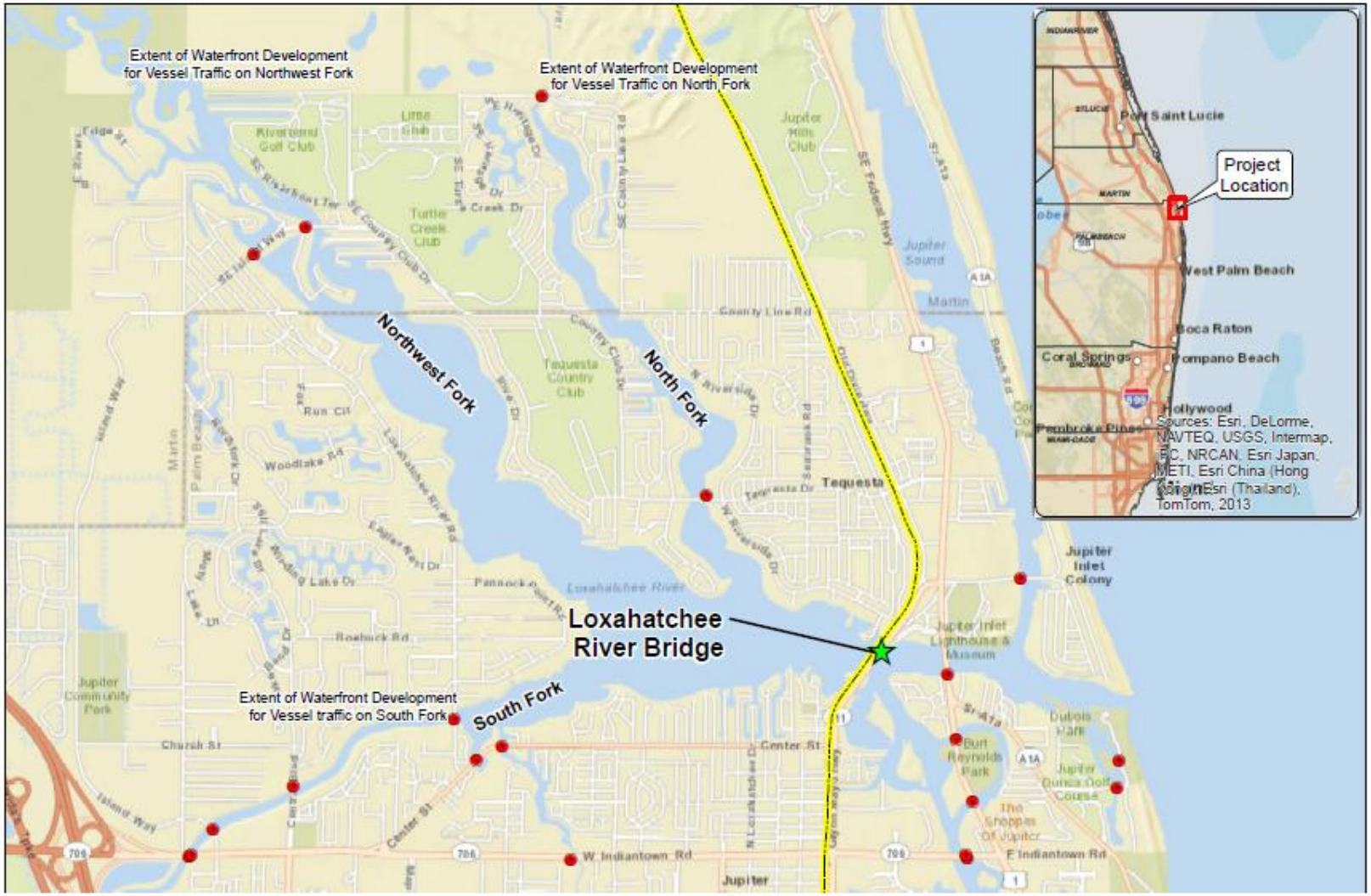
Table 4.1-1. Characterization of Bridges Traversing the Loxahatchee River

Bridge name	Type of bridge	Location where bridge crosses the river	Vertical clearance (feet)	Horizontal clearance (feet)
US 1 Bridge	Operable/Bascule	Confluence	26	91
State Hwy A1A	Fixed	Confluence	25	47
Loxahatchee River Bridge	Operable/Bascule	Confluence	4	40
US 1 Bridge	Fixed	Southeast Intracoastal Waterway	12	21
US1 Bridge	Fixed	Southeast Intracoastal Waterway	7	18
State Hwy 706	Operable/Bascule	Southeast Intracoastal Waterway	35	90
Tequesta Drive Bridge	Fixed	Northwest Fork	11	34
SE Island Way	Fixed	Northwest Fork	13	36
SE Island Way	Fixed	Northwest Fork	6	60
Center Street	Fixed	Southwest Fork	4.6	25
Center Street	Fixed	Southwest Fork	7	25
Loxahatchee River Road	Fixed	Southwest Fork	6	18

Source: NOAA website

4.1.2 Location of Loxahatchee River Bridge

The Loxahatchee River Bridge is located about 1.3 miles west of the Loxahatchee River's inlet (26°56'51.82"N, 80° 5'24.77"W) (Figure 4.1-1). This operable bridge has a vertical clearance of 4 feet and a horizontal clearance of 40 feet (Table 4.1-1). Although the bridge is typically open to the waterway to allow a continuous flow of vessel traffic, it currently closes an average of 10 times daily to accommodate freight rail service. While closed, most vessels (with the exception of small recreational vessels less than 5 feet in height) are unable to pass underneath the bridge deck, and queue while waiting for the bridge to re-open.



Explanation of Features

- Loxahatchee River Bridge
- Adjacent Bridges
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012

Loxahatchee River Bridge Location Map

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Ft

U.S. Department of Transportation Federal Railroad Administration

Figure 4.1-1

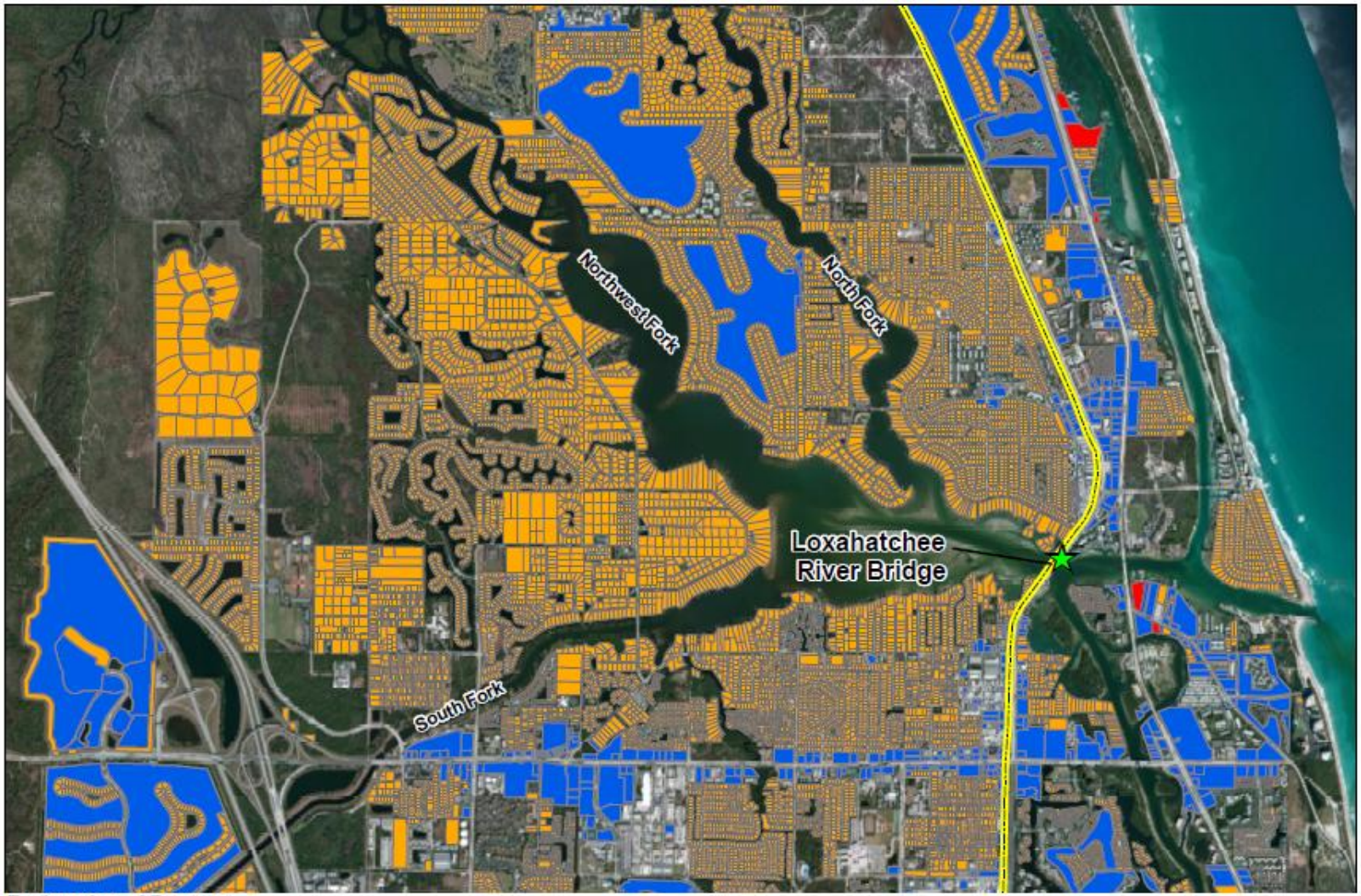
4.1.3 Land-use, Population Density

Land adjacent to the Loxahatchee River is mainly residential, with the exception of a commercial area and marine facilities near the Loxahatchee River inlet and west of the Loxahatchee River Bridge (Figure 4.1-2). The headwaters of the Loxahatchee River are one of the only two National Wild and Scenic Rivers in the State of Florida. This environmental preserve encompasses the three forks and central embayment of the Loxahatchee River, as well as Lake Worth Creek and is managed in two sections: Wilderness and Urban. While this designation ends approximately four miles west of the Loxahatchee River Bridge, this portion of the river is accessible to vessels traversing from the east. This river meanders through freshwater creeks from the west, down into a brackish estuary, and finally empties through the Jupiter Inlet into the Atlantic Ocean.

Population density maps developed through GIS analysis show lands adjacent to the Loxahatchee River have census blocks with population densities that extend from Class 1 to Class 3. Population density for all Classes can be found by the Loxahatchee River Inlet (Figure 4.1-3), while waterfront areas in the confluence and the Forks of the Loxahatchee River have population densities in the range of Class 1 to Class 3. About 28 square miles of land adjacent to the Loxahatchee River have waterfront access. The number of people in this area is approximately 49,077 to 54,569 people (Table 4.1-2).

Table 4.1-2. Land Area and Population Density with Waterfront Access at the Loxahatchee River

Class	Total Area (square miles)	Area with Waterfront Access (square miles)	Percent with Waterfront Access	Population within Waterfront Access Size Class
1	22.4	17.0	76	42,501
2	4.2	1.8	42	6,625
3	0.9	0.4	44	2,697



Explanation of Features

- N-S Corridor
- RESIDENTIAL
- COMMERCIAL
- MARINE FACILITIES

Data Sources: ESRI StreetMap, AAF 2012, FGDL

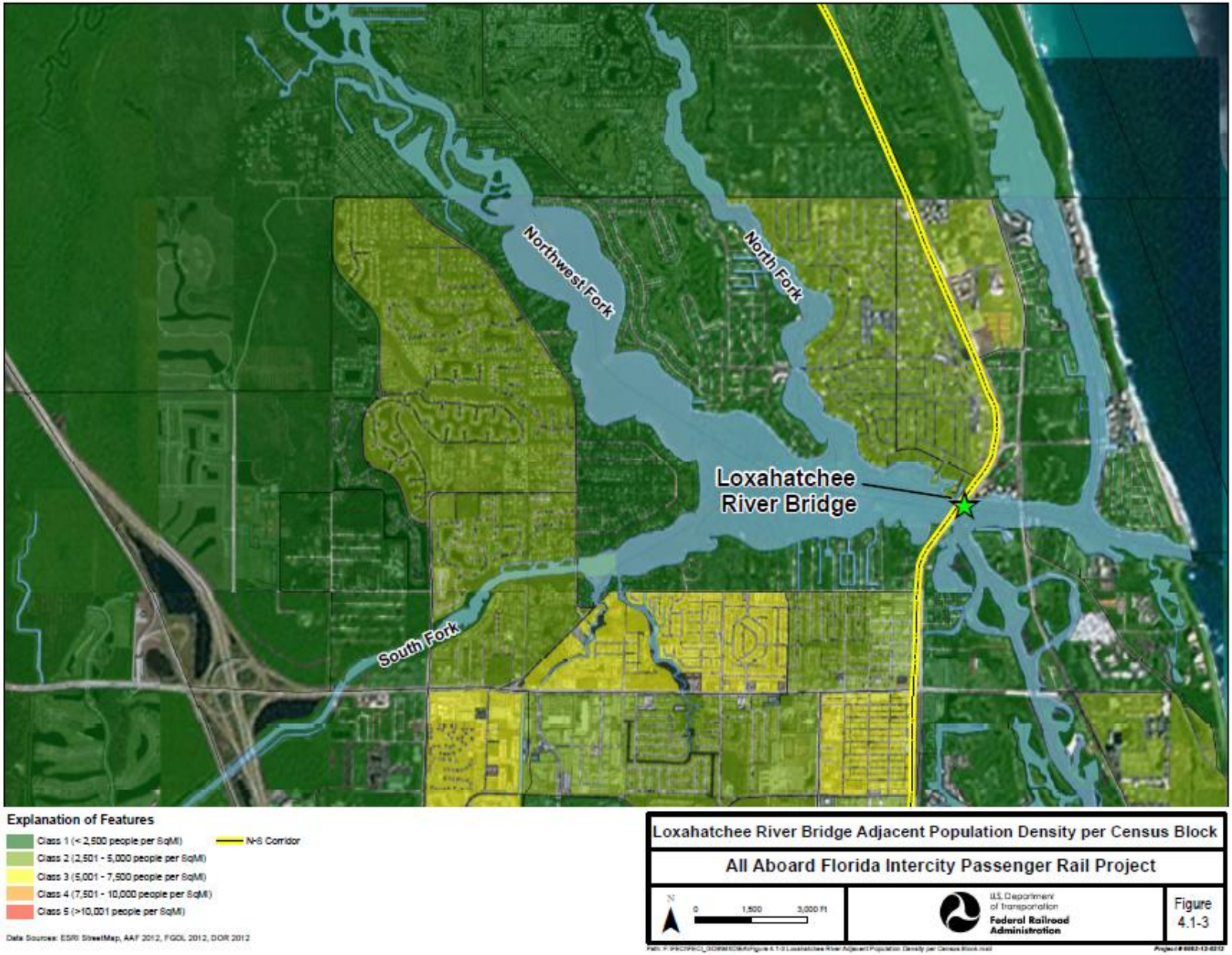
Loxahatchee River Bridge Adjacent Land Use

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Ft

U.S. Department of Transportation
Federal Railroad Administration

Figure 4.1-2


Northwest Fork
North Fork
Loxahatchee River Bridge
South Fork
Explanation of Features
Class 1 (< 2,500 people per SqMi)
Class 2 (2,501 - 5,000 people per SqMi)
Class 3 (5,001 - 7,500 people per SqMi)
Class 4 (7,501 - 10,000 people per SqMi)
Class 5 (>10,001 people per SqMi)
N-S Corridor
Data Sources: ESRI StreetMap, AAF 2012, FGDL 2012, DOR 2012
Loxahatchee River Bridge Adjacent Population Density per Census Block
All Aboard Florida Intercity Passenger Rail Project
N
0
1,500
3,000 Ft
U.S. Department of Transportation
Federal Railroad Administration
Figure 4.1-3

4.2 Marine Industry at Loxahatchee River Bridge

The Loxahatchee River supports a marine industry that primarily services smaller recreational vessels. Public and private marine facilities are concentrated in the eastern portions of the river and include seven marinas and three boat ramps (Figure 4.2-1). Boat/yacht clubs, waterfront restaurants and waterfront hotels that cater to mariners occur within Palm Beach and Martin counties; however, these waterway features are concentrated along the Intracoastal Waterway and are not located on the Loxahatchee River. With the exception of a commercial area and marine facilities near Jupiter Inlet, waterfront development is predominantly private residences, which provide approximate 135 private slips and 1,061 private docks.[5] While the Loxahatchee River is located in both Martin and Palm Beach counties, waterfront development and marine facilities are overwhelming concentrated in Palm Beach County. This is largely due to the Wild and Scenic River designation that applies to the Loxahatchee River for most of its reach in Martin County. This designation allows for abundant marine recreation opportunities, but limits the construction of waterfront and vessel service facilities. This waterway overview provides a description of the navigable extent of the Loxahatchee River and a characterization of the vessel traffic, waterway facilities, and the current and proposed use of the river.

4.2.1 Vessel Traffic Patterns

Navigational constraints and regional land use dictate vessel traffic patterns on the Loxahatchee River. The Loxahatchee River is used for recreational boating and as a travel corridor to and from residences to access the Atlantic Ocean via the Jupiter Inlet and the Intracoastal Waterway. Wild and Scenic River designated portions of the Loxahatchee River are accessible to smaller vessels only, and is a destination for wildlife viewing.

4.2.1.1 Vessel Registration and Population Trends

Palm Beach County has grown by approximately 11.6% from a population of 1.21 million people in 2003 to a population of 1.35 million people in 2013. The county's population is projected to grow to 1.39 million people by 2016 and to 1.54 million by 2025.[10] Approximately one third of the County's population lives in unincorporated areas. The remainder resides in the major coastal cities located in the central and southern portion of the County, including West Palm Beach, Boca Raton, and Boynton Beach. The City of Jupiter is anticipated to grow by 8.4% by 2025 to a population of 61,678.[14] Compared to Palm Beach County, Martin County tends to be less developed, with a population of 148,077 people in 2013. Population growth in Martin County has been robust, growing by approximately 10.1% over the last decade from a population of 134,491 people in 2003.

[14] Palm Beach County Planning, Zoning, and Building Department. 2013. 2013 Population Allocation Model. Available at: http://www.pbcgov.com/pzb/planning/population/populationproj.htm. Accessed 4 March.

Explanation of Features

- Marina
- Boat Ramp
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012, FWC

Marinas and Commercial Docks Along Loxahatchee River

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Ft

U.S. Department of Transportation
Federal Railroad Administration

Figure 4.2-1

Vessel registration information for Palm Beach and Martin counties from 2003 to 2013 were obtained from the Florida Department of Highway Safety and Motor Vehicles. Similar to other counties in Florida, vessel registration grew steadily between 2003 and 2008; however, during the recession from 2009 to 2013, vessel registration declined from peak vessel registration (2006). Overall, vessel registration declined by 14.1% between 2003 to 2013 in Palm Beach County, and 10.5% in Martin County.[10]

Based on County population and vessel registration data for 2003 to 2013, the 10-year average of registered vessels per capita is 3.31% for Palm Beach County, and 11.66% for Martin County. This per capita average of registered vessels was then compared to county population growth forecasts obtained from the Bureau of Economic and Business Research.5 Based on these population forecasts, it is anticipated that registered vessels in Palm Beach County will increase to 46,173 by 2016, and registered vessels in Martin County will increase to 17,956 by 2016. These data are provided in Table 4.2-1.

Table 4.2-1. Population and Vessel Registration in Palm Beach and Martin Counties (2003 and 2016)**Error! Bookmark not defined.**

Year	Palm Beach County			Martin County		
	Total Population	Total Vessel Registration	Percentage of Population with Registered Vessels	Total Population	Total Vessel Registration	Percentage of Population with Registered Vessels
2003	1,211,448	44,391	3.66%	134,491	17,446	12.97%
2004	1,242,270	44,560	3.59%	137,637	17,639	12.82%
2005	1,265,900	45,350	3.58%	141,059	17,661	12.52%
2006	1,287,987	44,964	3.49%	142,645	17,315	12.14%
2007	1,295,033	44,416	3.43%	143,737	16,772	11.67%
2008	1,294,654	45,294	3.50%	143,868	17,826	12.39%
2009	1,287,344	42,517	3.30%	143,856	15,932	11.07%
2010	1,320,134	41,158	3.12%	146,318	15,652	10.70%
2011	1,325,758	39,512	2.98%	146,689	15,745	10.73%
2012	1,335,415	38,363	2.87%	147,203	15,702	10.67%
2013	1,345,652	38,142	2.83%	148,077	15,606	10.54%
2016 (Projected)	**1,394,974**	**46,173**	**3.31%**	**153,999**	**17,956**	**11.66%**

Source: Florida Office of Economic and Demographic Research, 2013. Based on the results from the Florida Demographic Estimating Conference, February 2013 and UF, BEBR, Florida Population Studies, Volume 46, Bulletin 165, March 2013 medium county projections.

4.2.2 Inventory of Waterway Features

The Waterway Features Inventory of recreational and commercial boating access facilities includes boat ramps, marinas, dry storage facilities, anchorages, and commercial entities in both Martin and Palm Beach counties (Table 4.2-2). Waterfront residences with dockage or slips along the Loxahatchee River in both counties were also estimated. In order to estimate the number of waterfront residential properties that include wetslips and docks, a sampling procedure was used. For the purposes of this study, the Loxahatchee River was surveyed for the extent of its navigable area west of the operable bridge and to the Intracoastal Waterway to the east.

Table 4.2-2. Overview of Waterway Features in Palm Beach and Maritin Counties and the Loxahatchee River

Boating Facility	Palm Beach County	Loxahatchee River (within Palm Beach County)	Percent of Palm Beach County Inventory on Loxahatchee River	Martin County	Loxahatchee River (Within Martin County)	Percent of Martin County Inventory on Loxahatchee River
Marinas						
Marina	32	7	21.9%	24	0	0
Dockuminium	3	0	0%	0	0	0
Private Club	5	0	0%	3	0	0
Hotels/Restaurants	2	0	0%	10	0	0
Boat Ramps						
Private	1	0	0%	2	0	0
Public	34	3	8.8%	13	1	7.7

4.2.2.1 Marinas, Boat Ramps and Repair/ Support Facility Inventory

There are seven public and private marinas on the Loxahatchee River, all of which are located within Palm Beach County. The number of slips at these marinas ranges from 30 to 130, with a total of 534 slips and an average of approximately 72 slips per marina. Marinas on the Loxahatchee River comprise less than one fourth of all marinas in Palm Beach County (Table 4.2-3). The largest concentration of marinas on the Loxahatchee River is located along the Jupiter Inlet to the east of the Loxahatchee River Bridge, while the majority of the marinas in Palm Beach County are located along the Intracoastal Waterway. No waterfront hotels or restaurants that cater specifically to mariners are located on the Loxahatchee River.[5]

Table 4.2-3. Overview of Waterway Features in the Loxahatchee River

Boating Facility	Number	Slips	Location Relative to Loxahatchee River FEC Corridor Railway Bridge	
			East	West
Commercial Marina / Dockuminium	7	534	7	-
Private Club	0	-	-	-
Hotels / Restaurants	0	-	-	-
Total	**7**	**534**	**7**	**-**

Source: Florida Fish and Wildlife Research Institute, 2009**Error! Bookmark not defined.**

There are four boat ramps located on the Loxahatchee River, all of which are public (Table 4.2-4). Two of these ramps are located to the west of the Loxahatchee River Bridge - one on the North Fork of the Loxahatchee River and one on the South Fork. Three of the boat ramps are located in the Palm Beach County portion of the Loxahatchee River, while one, the Jonathan Dickinson State Park ramp, is located in Martin County on the North Fork of the Loxahatchee River. One waterfront vessel repair and service facility is located on the Loxahatchee River.

Table 4.2-4. Boat Ramps, Anchorages, and Vessel Repair Facilities on the Loxahatchee River

Boating Facility	Number	Location Relative to New River FEC Corridor Railway Bridge	
		East	West
Boat Ramp	4	3	1
Anchorage	0	-	-
Repair/ Support Facilities	1	1	-
Total	**5**	**4**	**1**

Source: Florida Fish and Wildlife Research Institute, 20094

4.2.2.2 Residential Boating Facility Inventory

The Loxahatchee River and nearby area islands in the Intracoastal Waterway have a high number of residential waterfront properties and numerous residential neighborhoods with waterway access to the river. Using the methodology provided in Section 2.1, the approximate number of docks and slips for single family, multi-family greater than 10, multi-family less than 10, and condominiums were counted or estimated (Table 4.2-5). Approximately, 81% of water front parcels for single family contain docks, and 10% contain slips. The majority of these small private waterfront housing developments on the Loxahatchee River only meets the boating needs of the residences and do not provide any public boating access.

Table 4.2-5. Overview of Residential Boating Features of Waterfront Properties on the Loxahatchee River

Land Use	Total Waterfront Properties	Estimated Properties with Docks	Estimated Properties with Slips	Estimated Properties with Docks or Slips
Single Family	1,304	1,057[a]	131[a]	1,188[a]
Multi Family <10 Units	7	3	2	5
Multi Family >10 Units	0	0	0	0
Condominiums	4	1	3	4
Total Waterfront Properties	**1,315**	**1,061**	**136**	**1,195**

Note: [a] Estimated based on a percent of parcels with docks or slips from a random sample of 100 WFP parcels on the Loxahatchee River

4.2.2.3 Purpose and Use of Navigation Infrastructure (Commercial versus Recreational)

Navigation on the Loxahatchee River is predominantly recreational, with limited commercial and marine industry vessel traffic.

4.2.3 Economic Analysis

The total economic value of the marine industry along the Loxahatchee River is based on all marine related sales along this river, including those directly related to marine services (e.g., vessel sales, vessel repairs, recreational equipment) and those that are outside the marine industry but related to marine activity (e.g., sales of food and ice for boating trips). The type of sales that were considered in the marine industry includes:

- Vessel and yacht sales;
- Vessel accessories and replacement parts (e.g., trailers, electronics);
- Vessel services (e.g., repair, maintenance, interior design);
- Vessel storage (e.g., marinas, onshore storage);
- Sales at businesses frequented during boating trips (e.g., hotels and restaurants);
- Recreational equipment and instruction (e.g., dive equipment, fishing tackle, water ski instruction);
- Inland waterway businesses (e.g., water taxis and charter boats); and
- Other miscellaneous costs (e.g., insurance, business/personal services).

This analysis estimates the direct, indirect, and induced benefits of the marine industry to the local economy. In order to determine the direct economic value of the marine industry along the Loxahatchee River, the total direct economic value of the marine industries in Palm Beach and Martin Counties were estimated and then the relative percentages of the marine industry that can be attributed to the portion of the Loxahatchee River that lies in each of these counties was applied. Because there are no wetslips at marinas, dockuminiums, clubs, and hotels/restaurants along the portion of the Loxahatchee River that lies in Martin County, the relative percentage for this county is

zero; therefore, the economic contribution of the marine industry in Martin County was not considered in the analysis for this river. After calculating the direct economic value of the marine industry for the portion of the Loxahatchee River that lies in Palm Beach County, this figure was used to determine the resulting indirect and induced benefits. This analysis also considers the number of jobs that are supported by the economic activity associated with the marine industry along the Loxahatchee River.

4.2.3.1 Economic Benefits of the Marine Industry in Palm Beach County

The direct economic value of the marine industry in Palm Beach County was determined by updating the economic analysis performed by the State of Florida in 2011. The state's study was updated from the base year of 2006, when the original study for Palm Beach County was performed, to reflect the total value of the industry in December 2013. The direct economic value of the marine industry associated with the Loxahatchee River includes all marine-related spending by the individuals and businesses utilizing the waterway.

The direct benefits of the marine industry in Palm Beach County were determined by escalating the values determined in the base year of 2006 in accordance with growth experienced between that time and December 2013. The gross sales in Kind Code 28 for Palm Beach County shrunk by 19.52% in that period while gross sales across all Kind Codes in the state of Florida grew by 9.27%. In accordance with the methodology described in Chapter 2, retail sales were escalated by -19.52% while port operations and non-marine benefits were escalated by 9.27%. As seen in Table 4.2-6, the resulting estimated total economic value of the marine industry (not including port tenants) in Palm Beach County in December 2013 was $943.1 million.

Table 4.2-6. Direct Benefits of the Marine Industry in Palm Beach County

Business Type	2006 Marine Business Volume [a]	Estimated 2013 Marine Business Volume
Total Direct Benefits (marine only)	$1,297,218,304	$904,169,935
Non-marine Benefits (gas, food, drink, ice)	$35,600,000	$38,901,606
Total Marine and Non-marine Direct Benefits	$1,332,818,304	$943,071,541

Source: Original 2006 marine business volume obtained from Appendix L of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

Notes: [a] Excludes receipts from port tenants since the port operations in Palm Beach County are not associated with the Loxahatchee River.

Due to indirect and induced effects of expenditures in the marine industry in Palm Beach County, the total economic value of the industry is greater than the initial direct spending. The resulting total economic value of the marine industry for Palm Beach County, including direct, indirect, and induced effects, was generated by using IMPLAN economic modeling software for the 2006 data. Because the distribution of economic value is similar to the distribution at the time of the original study, the relative indirect and induced effects would also be similar. Therefore, extrapolating from the data obtained for the 2006 model results, the estimated 2013 results show that the total value of the marine industry in Palm Beach County is $1.717 billion, with $943.1 million in direct sales, $219.4 million in indirect benefits, and $554.2 million in induced benefits (see Table 4.2-7).

The economic activity associated with Palm Beach County's marine industry also supports local area employment, including jobs associated with the direct effects of spending in the industry as well as jobs associated with indirect and induced economic activity. These benefits, including both the number of jobs and personal income, were estimated using the same methodology of applying the 2006 IMPLAN model run percentages to determine the total effects. The results show that direct spending in the marine industry supports 4,753 jobs and $182.7 million in personal income. Additionally, the total spending associated with the marine industry, including direct, indirect, and induced effects, supports 11,865 jobs and $494.8 million in personal income (see Table 4.2-7).

Table 4.2-7. Direct, Indirect, and Induced Benefits of the Marine Industry in Palm Beach County

	Original 2006 Model Results				Estimated 2013 Figures			
	Direct	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**
Business Volume (in millions)	$1,311.9	$305.2	$771.0	**$2,388.2**	$943.1	$219.4	$554.2	**$1,716.7**
Personal Income (in millions)	$254.2	$122.8	$311.3	**$688.3**	$182.7	$88.3	$223.8	**$494.8**
Employment	6,612	2,533	7,360	**16,505**	4,753	1,821	5,291	**11,865**

Source: Original 2006 model results obtained from Appendix L of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

4.2.3.2 Economic Benefits of the Marine Industry associated with the Loxahatchee River

The Loxahatchee River represents approximately 23.2% of the marine activity in Palm Beach County, excluding revenue from port activities. Because the economic activity associated with the Loxahatchee River is located in Palm Beach County, the total economic value of this river is equivalent to 23.2% of the economic value of the marine industry in Palm Beach County, or $398.6 million. This total value is comprised of $219.0 million in direct expenditures, $50.9 in indirect effects, and $128.7 million in induced effects. This activity supports a total of 2,755 jobs and $114.9 million in personal income (see Table 4.2-8).

Table 4.2-8. Direct, Indirect, and Induced Benefits of the Marine Industry along the Loxahatchee River

	Direct	**Indirect**	**Induced**	**Total**
Business Volume (in millions)	$219.0	$50.9	$128.7	$398.6
Personal Income (in millions)	$42.4	$20.5	$52.0	$114.9
Employment	1,104	423	1,228	2,755

Source: Original 2007 model results obtained from Appendix M of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011.6 Available at http://www.aicw.org/studies.jhtml?method=list

4.2.4 Public Outreach

Since AAF made the first public announcement of its proposed passenger rail Project in Florida, a comprehensive public engagement strategy has been employed. A series of meetings, briefings, speeches and telephone calls with stakeholders, community leaders, neighborhood leaders and elected officials have been ongoing and will continue indefinitely. AAF has participated in more than 300 meetings with residents, business and community leaders, and public agencies throughout the State. Further to these efforts that began in March 2012, AAF has undertaken earlier coordination efforts to work proactively with federal, state and local agencies [e.g., FRA, USACE, USCG, SFWMD, etc.]. Public outreach in Palm Beach and Martin counties, particularly in the vicinity of the Loxahatchee River, is provided in Tables 4.2-9 and 4.2-10. Public outreach in the region has predominantly occurred in the City of West Palm Beach; however, meetings in the Town of Jupiter have also occurred. Additionally, the EIS scoping meeting and meetings that specifically addressed navigation issues on the Loxahatchee River are outlined below.

Table 4.2-9. Community Outreach Data (page 1 of 2)

Presentation Made To	Type of Event
March 2012	
Community Development Department-Town of Lake Park	Meeting - Nadia Di Tommaso
April 2012	
City of West Palm Beach	Briefing - Jeri Muoio, Mayor Kim Briesemeister, CRA Director
City of West Palm Beach	Briefing - Commissioner Kimberly Mitchell
City of West Palm Beach Planning and Zoning Department	Briefing - Rick Green, Director
City of West Palm Beach CRA	Briefing - Kim Briesemeister, Director, & Staff
July 2012	
City of West Palm Beach	Briefing - Ed Mitchell, City Manager Rick Greene, Planning Manager Alex Hansen, Senior Planner
City of West Palm Beach	Briefing - Development and Traffic Team
September 2012	
North County Intergovernmental	Presentation – monthly board meeting (Palm Beach County business organization)
October 2012	
Marty Perry	Briefing – Palm Beach business leader and SFRTA board member
City of Boca Raton	Briefing – Deputy Mayor Susan Haynie
November 2012	
Chamber of Commerce of the Palm Beaches	Presentation – monthly meeting to membership
City of West Palm Beach Planning and Zoning Department	Briefing - Rick Green, Director
Business Development Board of Palm Beach County	Briefing – Kelly Smallridge, CEO
December 2012	
Sun Sentinel	Editorial board
January 2013	
Palm Beach County	Briefing – Commissioner Priscilla Taylor
Palm Beach County	Briefing – Commissioner Mary Lou Berger
Palm Beach County	Briefing – Commissioners Shelley Vana
City of West Palm Beach	Briefing – Mayor Jeri Muoio and Rick Greene
FONSI for intercity rail passenger service from Miami to West Palm Beach, FL published January 2013	
February 2013	
Palm Beach Post	Presentation – Editorial board
Business Development Board of Palm Beach County	Presentation – Economic Development stakeholders
City of West Palm Beach	Briefing – Commissioner Keith James
City of Palm Bay	Briefing – Councilwoman Kristine Isnardi
March 2013	
West Palm Beach	Briefing – Mayor Jeri Muoio and Rick Greene, Planning Director
City of North Palm Beach	Meeting – City Manager Ed Green, Village Planner Jodi Nentwick and Director of Community Development Chuck Huff
City of Riviera Beach	Meeting – City Manager Ruth C. Jones, Deputy City Manager Danny D. Jones, Fire Rescue Chief Troy F. Perry and Planning & Zoning Administrator Jeff Gagnon
City of West Palm Beach	Briefing – Commissioner Sharon Materio
April 2013	
Notice of Intent published April 15, 2013 initiated EIS scoping process	

Table 4.2-9. Community Outreach Data (page 2 of 2)

Presentation Made To	Type of Event
May 2013	
EIS Process scoping meeting/open house	Public meeting – West Palm Beach (Section 2.2.5)
Palm Beach County Tourist Development Council	Presentation – monthly board meeting
Martin County	Briefing – Commissioner Doug Smith
Martin County	Briefing – Commissioner Ed Fielding
Martin County	Briefing – Commissioner John Haddox
Town of Jupiter	Briefing – Councilor Wendy Harrison
Palm Beach Business Forum	Presentation – monthly meeting
Palm Beach County	Briefing – Kristine Frazell-Smith and county staff
Palm Beach MPO	Briefing – Nick Uhren, Executive Director
June 2013	
Mayor Steve Abrams' Roundtable District 4 Mayors/Managers meeting	Presentation to mayors and city managers from coastal cities in District 4 in Palm Beach County
City of West Palm Beach	Briefing – Commissioner Shanon Materio
City of West Palm Beach	Briefing – Commissioner Keith James
Port of Palm Beach	Briefing – Commissioner Ed Oppel
City of Lake Worth	Briefing – Vice Mayor Scott Maxwell
Palm Beach County	Briefing – Commissioner Mary Lou Berger
Palm Beach MPO	Presentation – monthly board meeting
September 2013	
TCRPC	Presentation to Council regarding Loxahatchee River Bridge
Palm Beach MPO	Public Meeting - AAF staff gave an update on the project. Discussed included questions on noise impacts, safety improvements, quiet zones and construction schedule.

Table 4.2-10. Letters and Agreements of Support

Date	Document; Entity	Signatory
July 24, 2012	Memorandum of Understanding; City of West Palm Beach	Geraldine Muoio, Mayor
July 24, 2012	Letter of Support; South Florida Regional Planning Council	James F. Murley, Executive Director
July 31, 2012	Letter of Support, Florida Chamber of Commerce	David A. Hart, Executive Vice President

4.2.4.1 West Palm Beach EIS Scoping

The public scoping meeting was held at the Gaines Park Community Center, 1505 N. Australian Ave., West Palm Beach from 3:30 to 7:00 pm on May 7, 2013. One-hundred-thirty-six (136) persons attended the meeting, and most of those indicated they were representing a local government agency, business, or non-governmental organization. Approximately 26 persons indicated they were not representing any organization. Sixty-six (66) attendees either submitted comments or completed a survey questionnaire. The topic of greatest concern to attendees at the West Palm meeting was noise and vibration, generating 19 comments. Concerns about emergency vehicle access at specific locations in West Palm Beach and Jupiter were raised by five attendees.

4.2.4.2 Loxahatchee River Railroad Bridge Meeting

A meeting concerning the Loxahatchee River Railroad Bridge was organized by the Treasure Coast Regional Planning Council (TCRPC) and took place on Thursday, September 26th, 2013, from 9:30am to 11:30am. The meeting was held at the Jupiter Community Center, at 200 Military Trail in Jupiter, Florida. The Vice President of FECI provided an overview of the AAF project and subsequently responded to questions and comments.

With relation to the elevation of the tracks and bridge, members of the public requested that AAF consider separating passenger and freight trains and a long-term plan to elevate the bridge span. It was noted that elevating the Loxahatchee Bridge would require closure of adjacent streets. The public also requested more information regarding bridge clearance, anticipated construction schedule and bridge closures during construction, and information regarding measures to reduce noise and vibrations. A request was made to post digital signage illustrating times until the next train crossing after concern over the schedule of closures, including the possibility of extended closures, was raised.

The public audience also expressed concern over impacts to emergency services such as police and fire response. Another request was made to provide access to GPS train location data to emergency responders. Also related to safety, members of the public expressed a desire for information regarding stopping distances for trains traveling at various speeds. In conclusion, the TCRPC committed to creating a Loxahatchee River Railroad Bridge Working Group and to continue correspondence with FECI to arrange follow-up meetings.

4.3 Summary of Vessel Traffic Survey at Loxahatchee River

Vessel traffic data was summarized at the Loxahatchee River Bridge and adjoining areas, byseason, month, day, and time of day; vertical clearance; and nearby bridges traversed within the Loxahatchee River. This summary includes a literature review of existing vessel traffic studies and 2014 FECR's video recordings. This combined data was used to analyze vessel activity within the Loxahatchee River and provides the information necessary to estimate impacts related to increased train traffic and associated closures of the Loxahatchee River Bridge. The information gathered from previous vessel studies along Loxahatchee River was summarized and used in conjunction with vessel traffic data collected from the video to evaluate changes in vessel traffic from 2004 to 2014, and to determine reliability of previous navigation studies to determine socioeconomic impacts of the Proposed Action.

4.3.1 Literature Review Vessel Traffic Surveys

Two independent vessel traffic studies along the Loxahatchee River were conducted in 2009 and 2012. These studies include aerial surveys, along with fixed point surveys and provide estimated morning and afternoon vessel trends as well as seasonal trends separated by weekdays and weekends. Figure 4.3-1 depicts the locations of each of these studies.

4.3.1.1 2009 Palm Beach County Vessel Traffic Survey

An Intracoastal Waterway vessel traffic study was conducted in Palm Beach County from the Martin County line south to the Boca Raton Inlet. The study focused on the Intracoastal Waterway, specifically four areas within Palm Beach County: Lake Work Inlet, South Lake Worth Inlet, Boca Raton Inlet and Jupiter Inlet.[15] The study area for the Jupiter Inlet included the section of the Intracoastal Waterway corresponding to the adjoining sections of Jupiter Inlet and the Loxahatchee River. Two types of surveys were conducted: aerial surveys of vessel traffic and video surveys of vessel traffic Figure 4.3-1.

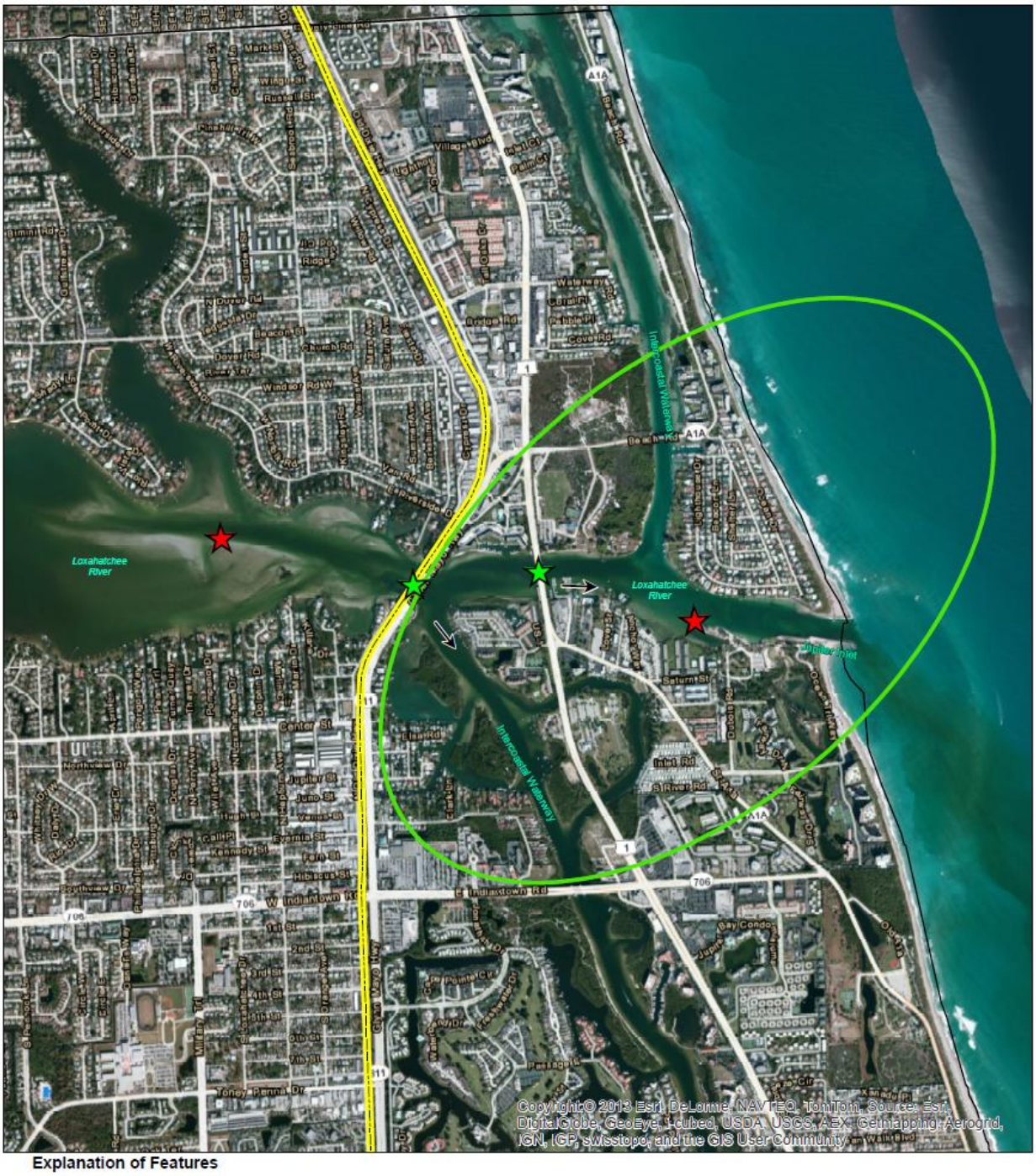
<u>Aerial Survey</u>

Aerial surveys conducted in 2007 (published in 2009) in this area captured snapshot imagery of vessels in Jupiter Inlet and in the Loxahatchee River west of the Jupiter SR 811/Alt A1A Bridge and Loxahatchee River Bridge. The Jupiter Inlet data only includes vessel counts east of the

[15] PBS&J. 2009. Palm Beach County Vessel Traffic Study. Prepared for Florida Fish and Wildlife Conservation Commission.

Loxahatchee River Bridge. A total of 16 flights capturing the entire Intracoastal Waterway were conducted and spaced evenly across season, day of week (weekend versus weekday) and time of day (morning versus afternoon) (Table 4.3-1). Data related to the Inlet aerial survey includes counts of vessel types and sizes. The data in this study is compiled into totals for the entire Intracoastal Waterway within Palm Beach and does not provide a breakdown for the Loxahatchee/Jupiter area or the railroad bridge.

The total number of vessels counted in the Intracoastal Waterway during this 16 trip period was 5,597 (Table 4.3-1). Only “in-use” vessels (i.e. excluding those docked at storage facilities, marinas or yacht clubs, or residential docks) were counted. Commercial vessels identified included tugs, barges, transport and “Other”. In this summary law enforcement vessels were included in the commercial count and accounted for 9% of the total commercial traffic. Recreational vessels made up 98% of the total vessel traffic. While afternoon counts of recreational vessels were more than two-fold higher than in the morning (3,924 versus 1,540), commercial traffic was evenly spaced across morning and afternoon periods. On average 8.3 commercial vessels were observed in the mornings and 7.9 were observed in the afternoon. On average 192.5 recreational vessels were observed in the mornings and 490.5 were observed in the afternoon.



Explanation of Features

- PBS&J Study
- Sea to Shore Alliance Study
- Flight Path PBS&J Study
- N-S Corridor
- Camera Direction

Data Sources: ESRI Imagery,PBS&J 2009, Sea to Shore Alliance Study 2010, AMEC 2013

Jupiter Inlet Vessel Study Locations

All Aboard Florida Intercity Passenger Rail Project

N

0 500 1,000 2,000 Feet

U.S. Department of Transportation
Federal Railroad Administration

Figure 4.3-1

Path: F:\FSC\FEC_GDB\MXD\EAI\Figure 4.3-1 Jupiter Inlet Vessel Study Location.mxd

Project # 6063-12-0212

Table 4.3-1. Summary of Commercial versus Recreational Vessel Traffic Observed throughout Intracoastal Waterway in Palm Beach County

Season	Week Day	Date	Morning (am)		Afternoon (pm)		Total	Percent of Commercial Vessels/day	Percent of Recreational Vessels/day
			Commercial	Recreation	Commercial	Recreation			
Winter	Friday	1/19/2007	5	123	7	165	300	4	96
Winter	Saturday	2/24/2007	10	358	11	578	957	2	98
Spring	Monday	4/2/2007	ND	ND	7	241	248	3	97
Spring	Tuesday	4/3/2007	5	136	ND	ND	141	4	96
Spring	Saturday	4/21/2007	13	269	ND	ND	282	5	95
Spring	Saturday	5/26/2007	ND	ND	0	747	747	0	100
Summer	Sunday	6/10/2007	ND	ND	6	1406	1412	0	100
Summer	Sunday	6/24/2007	2	288	ND	ND	290	1	99
Summer	Wednesday	7/18/2007	14	121	ND	ND	135	10	90
Summer	Thursday	8/23/2007	ND	ND	9	82	91	10	90
Fall	Monday	10/15/2007	13	45	15	55	128	22	78
Fall	Sunday	11/4/2007	2	206	8	650	866	1	99
		Total	64	1546	63	3924	5597	2	98

Source: Modified from Tables A3 from PBS&J 2009[15]
Note: ND = No Data

The data recorded during this period showed that for all seasons the average number of daily vessels was greater on the weekends than on weekdays. Weekend to weekday ratios ranged from 7.5 to 2.6 across seasons (Table 4.3-2). There were more vessels observed during the summer as compared to all other seasons, with an average of 113 vessels during weekdays and an average of 851 vessels observed during weekends. More vessels were observed on average in the afternoon as compared to the morning during all seasons and ranged from 752 in the summer to 364 in the fall.

Table 4.3-2. Summary of Vessel Traffic Observed throughout the Intracoastal Waterway in Palm Beach County. Summarized by Season and by Time of Day

Season	Weekday (Average)	Weekend (Average)	Ratio (WE/WD)	Morning (am)	Afternoon (pm)	Ratio (pm/am)
Winter	150	479	3.2	248	381	1.5
Spring	195	515	2.6	212	498	2.3
Summer	113	851	7.5	213	752	3.5
Fall	64	433	6.8	133	364	2.7

Source: Modified from Tables A3 from PBS&J 2009[15]
Notes: WD = Weekday; WE = Weekend

Vessel size was also recorded during aerial surveys (Table 4.3-3). In addition, this study compiled 2000 to 2007 vessel registration by size class for all of Palm Beach County (Table 4.3-4). These data were used in the Vessel Development Model to project vessel registrations in 2020. Both for small vessels (less than 16 feet) and large vessels, a greater number of vessels were recorded during aerial surveys conducted during weekend and afternoon observation periods. Aerial survey data showed that 90% of all vessels observed were greater than 16 feet in length. The 2007 registration data did not mirror aerial survey findings of the percentage of small vessels (less than16 feet). Vessel registrations show that more than 30% of the vessels registered were small vessels whereas the aerial survey found that only 10% of the vessels were less than 16 feet in length. However, registration data reflects vessels throughout Palm Beach County and not just those vessels residing near or traveling within the Intracoastal Waterway. Vessel registration projections for 2020 mirrored trends of 2007 vessel registration: more than two times the number of vessels are registered for recreational use as compared to commercial use and greater than 60% of the vessels are greater than sixteen feet in length.

Table 4.3-3. Summary of Vessel Size Observed throughout the Intracoastal Waterway in Palm Beach County.

Vessel Size	Weekday (Average)	Weekend (Average)	Morning (8:00 am to 11:59 am)	Afternoon (Noon to 3:00 pm)	Percentage of Total
< 16 ft	15	52	21	46	10%
> 16 ft	116	517	180	452	90%

Source: Modified from Tables A4 from PBSJ 2009[15]

Table 4.3-4. Vessel Registration and 2020 Projections for Palm Beach County. Summarized by Size Class and Year

Vessel Class	CANOES		CLASS A-1		CLASS A-2		CLASS 1 - 5		Percentage of Vessels < 16'	
Vessel Size			Less than 12'		12' - 15'11"		> 16'			
Year	Rec	Com	Rec	Com	Rec	Com	Rec	Com	Rec	Com
2007	264	2	8,550	67	5,535	154	28,619	836	33%	1%
2020 (projected)	641	5	10,137	97	3,704	120	37,648	1022	27%	2%

Source: Modified from Table 1-1 from PBSJ 2009[15]
Notes: Rec = Recreational; Com = Commercial

Video Survey

Video surveys were conducted at two locations within in the Jupiter Inlet area (Figure 4.3-1) from August 17, 2007 through August 19, 2007. Camera 1 was placed at the Jupiter SR 811/Alt A1A Bridge and directed southeast toward the Lake Worth Creek/Loxahatchee River confluence. A second camera (Camera 2) was placed on the U.S. Highway 1 Bridge and directed east toward Jupiter Inlet. Each monitoring period lasted 16 hours from 6 am to 9:59 pm. Data associated with the video survey included vessel direction as well as vessel counts at 15 minute increments. However, directional data was not provided in tabular form and it was not possible to interpolate the number or direction of the vessels from graphs provided in the report. Peak vessel traffic volumes as well as the total vessel count per 16 hour period (average daily traffic) were reported (Table 4.3-5). For both video survey locations, a greater number of vessels were recorded in the afternoon than in the morning). The total number of vessels during the Saturday survey period was similar at both locations (992 at Camera 1 versus 1113 at Camera 2). Forecasts out to 2020 show a 22% and 50% increase in traffic at the Lake Worth Creek/Loxahatchee River confluence and in Jupiter Inlet, respectively.

It should be noted that data from the video did not record vessels traveling under the Jupiter SR 811/Alt A1A Bridge or associated Loxahatchee Railroad Bridge. North bound vessels capture on Camera 1 could turn west toward the railroad bridge or turn east toward Jupiter Inlet (Figure 4.3-1). Similarly, west bound vessels captured on Camera 2 could continue to travel under the railroad bridge, turn south into the Intracoastal Waterway, or turn north into the Intracoastal Waterway.

Table 4.3-5. Vessel Traffic Daily and Peak Volume Totals by Video Recording at two Locations in Jupiter Inlet. Traffic Volume Projections through 2020

Location	Data Summary	Total Vessel Volumes and Projections			
		2007	2010	2015	2020
Jupiter Camera 1 (Saturday)	Large Vessels	2	3	3	3
	am Peak Volume	84	88	95	103
	pm Peak Volume	144	151	164	176
	Total Average Daily Traffic Volume	992	1042	1128	1213
Jupiter Camera 2 (Saturday)	Large Vessels	0	0	0	0
	am Peak Volume	84	88	95	104
	pm Peak Volume	189	199	215	231
	Total Average Daily Traffic Volume	1112	1169	1264	1659

Source: Modified from Table 2-4 from PBS&J 2009[15]

4.3.2 2014 Vessel Traffic Survey

This section summarizes vessel traffic data extracted from a three week video assessment of the Loxahatchee River Bridge, from December 31, 2013 to January 21, 2014.

4.3.2.1 Summary of Vessel Traffic Traversing Loxahatchee River Bridge

Data gathered through a three week video assessment of the Loxahatchee Bridge during winter, shows an average of 108 vessel crossings per day occurred (Min=5; Max=335) from Monday to Friday, compared to about 271 vessels (Min=119; Max=502) per day on a weekend (Table 4.3-6). High vessel activity was observed during four different weekday holidays (around New Years and Presidents day) with vessel counts in the range of 200 to 335. When vessel traffic data from holidays is not included in the average vessel count for the weekdays, this average value drops to an average of 65 vessels per day. Sundays had the highest vessel activity, with exception of the holidays, with a range of 119 to 502 vessel counts. The average vessel count for Monday appears high, but these

results include data from January 20, 2014 which was a holiday, and thus represents an unusual vessel count for Mondays as compared with data from Monday January 27, 2014.

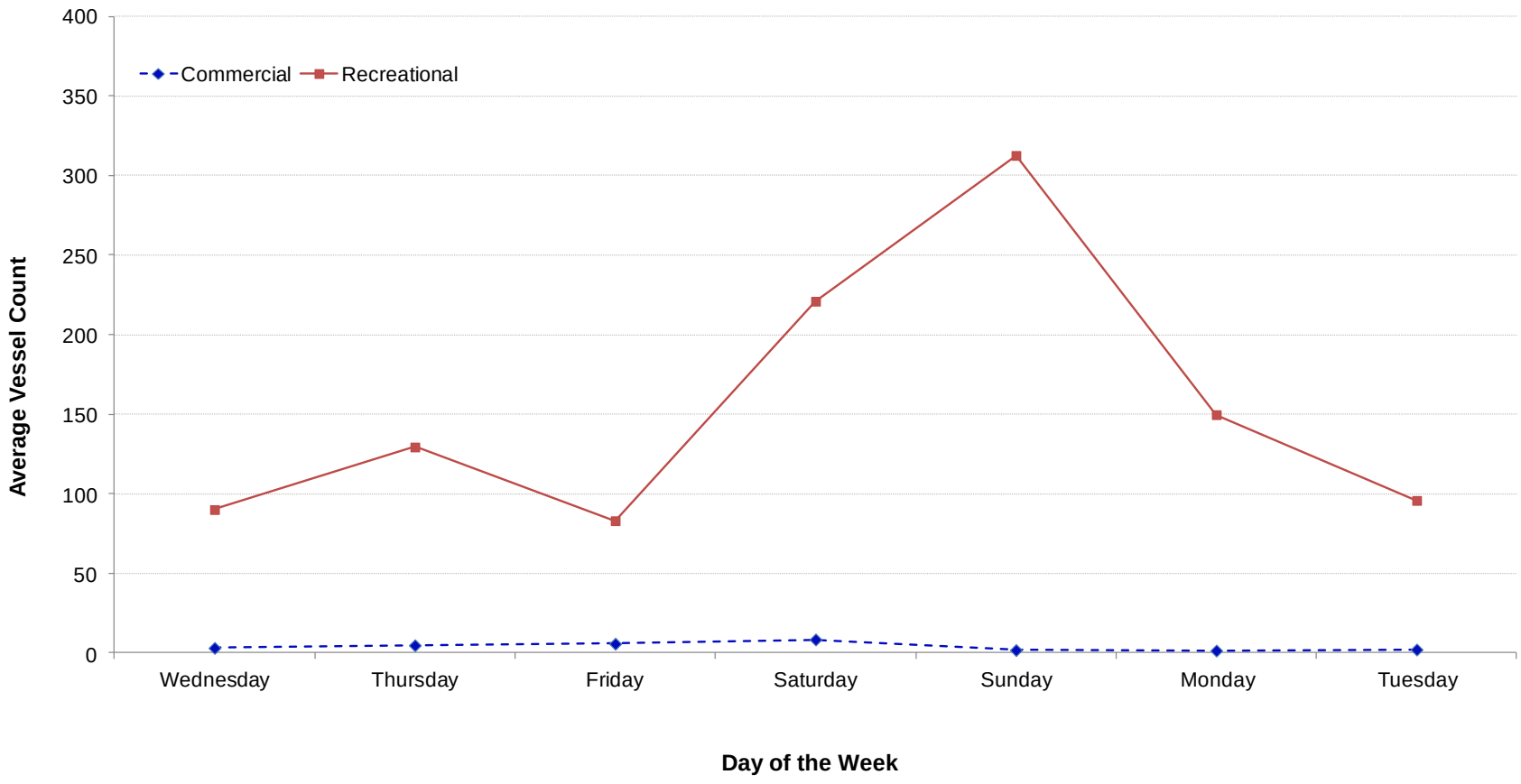
The average count of commercial vessels per day ranged from 0 to 14 (Figure 4.3-1). A slight difference in commercial traffic was observed between weekdays and the weekend (average of 3 and 5 vessels per day on weekday and weekend respectively). The average count of recreational vessels per day ranged from 5 to 500, with lower traffic from Tuesday, Wednesday and Friday and an increase in vessel traffic of about 60% during the weekend (Figure 4.3-2). Sunday had the most recreational vessel crossings with an average of 313 vessels.

Table 4.3-6. Vessel Traffic at Loxahatchee River Bridge Based on FECR Video Assessment from Tuesday December 31, 2013 to Tuesday January 21, 2014

Week Day	Date	Vessel Traffic at Loxahatchee River Bridge [a]						Total	Percent of Commercial Vessels/day	Percent of Recreational Vessels/day
		Morning (6:00 AM-9:59 AM)		Noon (10:00 AM-1:59 PM)		Afternoon to Overnight (2:00 PM-6:00 AM)				
		Commercial	Recreational	Commercial	Recreational	Commercial	Recreational			
Tuesday	12/31/2013	0	9	1	75	5	139	229	2.6%	97.4%
Wednesday	1/1/2014	0	13	4	90	1	122	230	2.2%	97.8%
Thursday	1/2/2014	2	14	2	128	2	187	335	1.8%	98.2%
Friday	1/3/2014	0	5	7	17	0	23	52	13.5%	86.5%
Saturday	1/4/2014	5	8	8	50	1	47	119	11.8%	88.2%
Sunday	1/5/2014	0	8	0	98	0	81	187	0.0%	100.0%
Monday	1/6/2014	0	13	0	72	0	68	153	0.0%	100.0%
Tuesday	1/7/2014	0	3	0	8	0	8	19	0.0%	100.0%
Wednesday	1/8/2014	0	0	0	3	0	2	5	0.0%	100.0%
Thursday	1/9/2014	0	5	4	7	0	10	26	15.4%	84.6%
Friday	1/10/2014	2	4	3	49	1	79	138	4.3%	95.7%
Saturday	1/11/2014	0	22	1	117	7	223	370	2.2%	97.8%
Sunday	1/12/2014	0	41	0	189	2	270	502	0.4%	99.6%
Monday	1/13/2014	0	11	0	39	2	48	100	2.0%	98.0%
Tuesday	1/14/2014	0	15	1	44	0	25	85	1.2%	98.8%
Wednesday	1/15/2014	0	12	3	9	1	6	31	12.9%	87.1%
Thursday	1/16/2014	2	3	2	9	0	25	41	9.8%	90.2%
Friday	1/17/2014	0	10	0	22	4	40	76	5.3%	94.7%
Saturday	1/18/2014	1	22	2	82	0	92	199	1.5%	98.5%
Sunday	1/19/2014	0	18	3	106	0	127	254	1.2%	98.8%
Monday	1/20/2014	0	19	0	91	2	88	200	1.0%	99.0%

Note: [a] Vessel traffic was assessed primarily during daylight hours (from 6:00am to 6:30pm), but casual observations were also recorded later at night.

Figure 4.3-2. Average Vessel Count Traversing the Loxahatchee River Bridge



4.4 Summary of Bridge Operation at Loxahatchee River

This section includes data gathered through existing bridge operation studies at and near the Loxahatchee River Bridge, and the current and projected operations schedule for freight and passenger traffic provided by AAF. These data are summarized herein and will be used to assess projected changes in maritime traffic.

4.4.1 Loxahatchee Bridge Operations Analysis

A bridge operation survey performed through the assessment of video recordings from the Loxahatchee River Bridge show that this operable bridge is closed for an average 19 minutes each time (Table 4.4-1). This value is comparable to the values obtained through RTC modeled bridge operations using the freight traffic data provided by AAF, which shows the Loxahatchee River Bridge is closed about 19 minutes per closure under Existing Conditions (Table 4.4-1).

Daily closures observed during the video assessment ranged from 0 to 4 closures. Observed number of closures is less than half of the daily closures reported by FECR (10 closures per day) (Existing Conditions).

A summary of existing and projected bridge operations is provided in Table 4.4-2. Analysis of RTC model data suggests that projected freight increase with the No-Build Alternative without the infrastructure contemplated as part of the Proposed Action will increase the average time of each bridge closure by approximately 6 minutes. Furthermore, the projected freight traffic under the No-Build Alternative results in a total average daily bridge closure of 5.8 hours during weekdays and approximately 3.6 hours of daily closure during weekends, as compared to approximately 3.57 and 2.60 hours of daily closure during weekdays and weekends, respectively, under the Existing Conditions. Although the Proposed Action (2016 Passenger and upgraded infrastructure) will add to the total daily bridge closure time (about 5.53 hours during the weekdays and 5.41 hours during weekends), improvements to the rail infrastructure are expected to increase the speed of rail traffic, reducing the Proposed Action average time of single closures (11 minutes) by approximately 8 minutes when compared to Existing Conditions (19 minutes) or about 9 minutes when compared to the No-Build Alternative respectively (20 minutes). The Combined Effect (2016 Freight and Passenger) will correspond to an average of 8.59 hours of daily closure times during the weekdays and 7.23 hours of closure time during the weekends. The total bridge closure estimated for the 2016 Improved Freight, (Combined Effect minus the Proposed Action; data presented in Appendix A) is slightly shorter than the No-Build 2016 Freight. However, the 2016 Improved Freight has a lower total daily closure time throughout the week and a reduction of bridge closure that ranges between 3 and 24 minutes during active vessel traffic (6:00am and 6:00pm).

Under the Combined Effect, some specific hour periods can potentially show longer periods of bridge closure time (above 30 minutes). Extended bridge closure time in a specific hour can be split into several short bridge closings periods (e.g., three -10 minutes closings) with bridge openings between each bridge closure, or these can happen as one bridge closure in that hour (Table 4.4-3). These single extended periods of closure time however, will occur mainly late at night, during which there is a decreased vessel traffic compared to daytime hours (Appendix B). In addition these extended bridge closures are usually followed by long periods of bridge openings that should allow all queue vessels to cross without experiencing multiple bridge closures. Large vessels will not take more than 5 to 6 seconds to cross the bridge, thus shorter periods of bridge opening (e.g., 5 minutes) should be enough to clear queue vessels at both sides of the bridge.

Table 4.4-1. Bridge Operation Survey for Loxahatchee River Bridge Based on FECR Video Assessment

Day of Week	Time it takes bridge to close	Time it takes train to arrive	Time it takes train to cross	Time it takes Bridge to start opening	Time it takes for Bridge to open	Total Time
Values Represent the Average Times Per Day (hh:mm:ss)						
Sunday	0:01:05	0:02:20	0:01:02	0:12:07 [a]	0:01:44	0:18:18
Monday	0:01:51	0:07:23	0:02:03	0:00:54	0:01:37	0:14:22
Tuesday	0:01:39	0:14:48	0:01:20	0:01:05	0:01:29	0:20:22
Wednesday	0:02:02	0:08:59	0:02:57	0:02:22	0:01:51	0:17:52
Thursday	0:01:43	0:10:41	0:02:30	0:03:36	0:02:07	0:21:17
Friday	0:02:05	0:12:12	0:02:24	0:01:01	0:01:56	0:19:39
Saturday	0:01:29	0:13:35	0:03:24	0:02:09	0:01:27	0:22:42
Statistics of Raw Data for the Bridge Operation Survey [b] (hh:mm:ss)						
Average	0:01:46	0:10:47	0:02:30	0:02:21	0:01:45	0:19:27
Minimum	0:00:40	0:00:51	0:00:23	0:00:40	0:00:47	0:07:47
Median	0:01:53	0:12:11	0:01:53	0:01:08	0:01:54	0:20:24
Maximum	0:02:30	0:20:08	0:06:19	0:12:07	0:02:31	0:35:18

Notes: Each day is an average of multiple observations per day that include both single and multiple trains crossing within the closures observed.
[a] This number is the result of multiple train crossings.
[b] Average data based on 23 observations

Table 4.4-2. Summary of Existing and Projected Bridge Operations for the Loxahatchee River Bridge

Loxahatchee River Bridge	Existing Conditions 2013 F [a]	No-Build Alternative 2016 F [a]	Proposed Action 2016 P [b]	Combined Effect 2016 F+ P [b]
	Average Single Daily Closure Time (Minutes)			
Sunday	19	20	11	11
Monday	22	20	12	13
Tuesday	20	19	11	12
Wednesday	19	20	12	12
Thursday	18	20	11	12
Friday	20	20	11	12
Saturday	18	21	11	11
Average Single Daily Closure Time [c] (minutes)	**19**	**20**	**11**	**12**
Total Number of Daily Closures	**10**	**16**	**30**	**42**
	Total Daily Closure Time (Minutes)			
Sunday	148	183	322	437
Monday	190	315	345	515
Tuesday	199	370	318	510
Wednesday	231	394	347	535
Thursday	216	357	319	508
Friday	235	318	330	508
Saturday	164	249	327	430
Average of Total Weekday Closure Time (Minutes)	**214**	**350.8**	**332**	**515**
Average of Total Weekday Closure Time (Hours)	**3.57**	**5.8**	**5.53**	**8.59**
Average of Total Weekend Closure Time (Minutes)	**156**	**216**	**325**	**434**
Average of Total Weekend Closure Time (Hours)	**2.60**	**3.6**	**5.41**	**7.23**

Notes: [a]Results based on RTC modeling data of train and bridge operations with closure times verified with existing field conditions and under the assumption that infrastructure improvements planned under the Proposed Action do not occur.
[b]Results based on RTC modeling data of train and bridge operations for both freight and passenger rail with the planned infrastructure improvements planned under the Proposed Action.
[c]Multiple trains(freight and passenger) can cross under a single bridge closure.

Table 4.4-3. Extended Bridge Closures at Loxahatchee River due to Freight and Passenger Train Operations

Day	Bridge Closure Time (hh:mm) [a]	Total Number of Trains	Duration of Single Closure (Minutes)	Open Duration Before Next Bridge Closure (Minutes)
Monday	21:05	4	38	32
Wednesday	21:05	4	38	32

Note: Extended bridge closures are characterized by single closures longer than 30 minutes
[a] Time of day when the extended bridge closure occurs

4.5 Model Simulation Results

No-Build Alternative (Case 2a) Compared to Combined Effect (Case 3)

Table 4.5-1 shows the model results for marine traffic wait times for total vessels (commercial plus recreational), commercial only vessels, and recreational only vessels at Loxahatchee River Bridge crossing for the four cases identified in Section 2.5.1. When comparing Case 2a (2016 No-Build Alternative) to Case 3 (2016 Freight and Passenger, Combined Effect) an increase in the percentage of vessels experiencing a wait from 25% under the No-Build Alternative to 42% under the Combined Effect is observed. There is a 90% probability that individual vessels that wait will not wait longer than 16.7 minutes under Case 2a, and will not wait longer than 9.8 minutes under Case 3. The average wait times for vessels that experience a wait is expected to decreases under the Combined Effect as compared to the No-Build Alternative, from 9.4 minutes to 5.7 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect on total vessels. For commercial vessels that wait, average wait time is expected to decrease from 6.7 minutes under the No-Build Alternative to 5.4 minutes under the Combined Effect. For recreational vessels that wait, average wait time is expected to decrease from 9.5 minutes under the No-Build Alternative 5.7 minutes under the Combined Effect.

Based on vessel traffic characterized in the FECR Video Assessment for the Loxahatchee River Bridge (Table 4.3-7), the highest traffic periods for commercial and recreational vessels occur from 10:00 am to 6:00 pm. Overall, under the No-Build Alternative (Case 2a) and the Combined Effect (Case 3) there is a higher probability (> 80%) that vessels will not have to experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 4.5-2. In general,

- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 4.5-2); while the maximum vessel queue length with a probability 0.2 to 1.7% of occurrence is over 10 vessels. However, there are also blocks of time where vessels are expected to have a 0% of queue time (e.g., 6:00 am to 9:00am).
- Under the Combined Effect, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence; while the greatest vessel queue length with a probability ranging from 0.1 to 0.5% is over 10 vessels.

Existing Conditions (Case 1) Compared to No-Build Alternative (Case 2a)

When comparing Case 1 (2013 Existing Conditions) to Case 2a (2016 No-Build Alternative) for total vessel traffic, increases in vessel delays are projected. The percentage of vessels that experience a wait time increases from 7% under Existing Conditions to 25% for the No-Build Alternative. There is a 90% probability that individual vessels that wait will not wait longer than 15.9 minutes under Case 1, and will not wait longer than 16.7 minutes under Case 2a. The average wait times for vessels that experience a wait increases under the No-Build Alternative as compared to the Existing Conditions, from 8.3 minutes to 9.4 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect of total vessels experiencing a wait. For commercial vessels that wait, wait times are expected to increase on average from 5.9 minutes under Existing Conditions to 6.7 minutes under the No-Build Alternative. For recreational vessels that wait, wait times are expected to increase on average from 8.5 minutes under Existing Conditions to 9.5 minutes under the No-Build Alternative.

Based on vessel traffic characterized in the FECR Video Assessment for the Loxahatchee Bridge (Table 4.3-7), the highest traffic periods for commercial and recreational vessels occur from 10:00 am to 6:00 pm. under the Existing Condition (Case1) and the No-Build Alternative (Case 2a) there is a higher probability that vessels will not experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 4.5-2. In general,

- Under the Existing Conditions a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence; and the maximum vessel queue length with a 0.1 to 1.3 % probability of occurrence is over 10 vessels. e.g., 5:00 pm to 7:00 pm).
- However, there are also blocks of time where vessels are expected to have a 0% of queue time (e.g., 6:00 pm to 7:00 pm).
- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest

probability of occurrence (Table 4.5-2); while the maximum vessel queue length with a probability 0.2 to 1.7% of occurrence is over 10 vessels. However, there are also blocks of time where vessels are expected to have a 0% of queue time (6:00 am to 9:00am).

No-Build Alternative (Case 2a) Compared to 2016 Improve Freight (Case 2b)

When comparing Case 2a (2016 No-Build Alternative) to Case 2b (2016 Freight, Improved) wait times decrease for total vessel traffic. The percentage of vessels that experience a wait time, decreases from 25% under 2016 No-Build Alternative to 18% for the 2016 Freight, Improved. There is a 90% probability that individual vessels that wait will not wait longer than 16.7 minutes under Case 2a, and will not wait longer than 11.4 minutes under Case 2b. The average wait times for vessels that experience a wait decrease under the 2016 Freight, Improved as compared to the 2016 No-Build Alternative from 9.4 minutes to 6.3 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect of total vessels experiencing a wait. For commercial vessels that wait, wait times are expected to decrease on average from 6.7 minutes under the 2016 No-Build Alternative to 4.2 minutes under the 2016 Freight-Improved. For recreational vessels that wait, wait times are expected to decrease on average from 9.5 minutes under the 2016 No-Build Alternative to 6.4 minutes under the 2016 Freight-Improved.

Based on vessel traffic characterized in the FECR Video Assessment for the Loxahatchee River Bridge (Table 4.3-7), the highest traffic periods for commercial and recreational vessels occur from 10:00 am to 6:00 pm. Under the No-Build Alternative (Case 2a) and the 2016 Improved Freight (Case 2b) there is a higher probability that vessels will not experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 4.5-2. In general,

- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 4.5-2); while the maximum vessel queue length with a probability 0.2 to 1.7% of occurrence is over 10 vessels. However, there are also blocks of time where vessels are expected to have a 0% of queue time (e.g., 6:00 am to 9:00am).
- Under the 2016 Improved Freight (Case 2b), a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 4.5-2); while the maximum vessel queue length with a probability 0.4 of occurrence is over 10 vessels. However, there are also blocks of time where vessels are expected to have a 0% of queue time (e.g., 6:00 am to 9:00am).

Table 4.5-1. Simulation Model Results for Loxahatchee River Bridge

Case Number		**1**	**2a**	**2b**	**3**
Train Traffic		**2013 F**	**2016 F**	**2016 F**	**2016 F+P**
Infrastructure		**2013 (No-Build)**	**2013 (No-Build)**	**2016 (Build)**	**2016 (Build)**
Marine Traffic	**Units**	**2013**	**2016 Projected**	**2016 Projected**	**2016 Projected**
Total Vessel Wait Times					
Vessel Arrivals	(#/day)	121	121	121	121
Vessels With Zero Wait Time	(#/day)	112	105	110	74
% Vessels With Zero Wait Time		93%	87%	91%	61%
Vessels With Wait Time	(#/day)	9	16	11	47
% Vessels With Wait Time		7%	25%	18%	42%
Avg. Wait Time (all) [a]	(min)	0.6	1.2	0.6	2.2
Avg. Wait Time [b]	(min)	8.3	9.4	6.3	5.7
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	≤15.9	≤16.7	≤11.4	≤9.8
Commercial Vessel Wait Times					
Vessel Arrivals	(#/day)	4	4	4	4
Vessels With Zero Wait Time	(#/day)	4	4	4	2
% Vessels With Zero Wait Time		84%	84%	86%	56%
Vessels With Wait Time	(#/day)	1	1	1	2
% Vessels With Wait Time		16%	16%	14%	44%
Avg. Wait Time (all) [a]	(min)	0.9	1.2	0.6	2.4
Avg. Wait Time [b]	(min)	5.9	6.7	4.2	5.4
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	≤15.4	≤15.7	≤11.0	≤10.1
Recreational Vessel Wait Times					
Vessel Arrivals	(#/day)	116	116	116	116
Vessels With Zero Wait Time	(#/day)	108	101	106	71
% Vessels With Zero Wait Time		93%	87%	91%	61%
Vessels With Wait Time	(#/day)	8	15	11	45
% Vessels With Wait Time		7%	13%	9%	39%
Avg. Wait Time (all) [a]	(min)	0.6	1.2	0.6	2.2
Avg. Wait Time [b]	(min)	8.5	9.5	6.4	5.7
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	≤15.9	≤16.8	≤11.4	≤9.8

Notes: [a] Average time all vessels will have to wait before crossing the bridge (average between vessels with wait time and vessels with no wait time)
[b] Average time queue vessels will have to wait before crossing the bridge

Table 4.5-2. Simulation Model Results for Vessel Queue Lengths at Loxahatchee River Bridge

Case	Time	Length of Queue (vessels)			
		Minimum Queue	Percent Chance	Maximum Queue	Percent Chance
Case Number: 1 **Train Traffic: 2014 F** **Infrastructure: 2014 (No-Build)** **Marine Traffic: 2014**	6-7 am	1	0.2	1	0.2
	7-8 am	1	2.5	2	0.3
	8-9 am	1	3.2	3	0.3
	9-10 am	1	1.9	3	0.1
	10-11 am	1	3.6	4	0.1
	11 am – 12 noon	1	1.5	4	0.1
	12 noon-1pm	1	3.7	6	0.1
	1-2 pm	1	0.3	5	0.1
	2-3 pm	1	2.2	8	0.1
	3-4 pm	1	2.4	>10	0.1
	4-5 pm	1	2.4	>10	1.3
	5-6 pm	nq	na	nq	na
	6-7 pm	nq	na	nq	na
Case Number: 2a **Train Traffic: 2016 F** **Infrastructure: 2014 (No-Build)** **Marine Traffic: 2016 Projected**	6-7 am	nq	na	nq	na
	7-8 am	nq	na	nq	na
	8-9 am	nq	na	nq	na
	9-10 am	1	0.4	2	0.1
	10-11 am	1	6.4	7	0.2
	11 am – 12 noon	1	0.5	7	0.1
	12 noon-1pm	1	5.5	>10	0.2
	1-2 pm	1	1.3	7	0.1
	2-3 pm	1	0.1	1	0.1
	3-4 pm	1	3.3	6	0.1
	4-5 pm	1	8	>10	1.7
	5-6 pm	1	6.6	>10	1.5
	6-7 pm	nq	na	nq	na
Case Number: 2b **Train Traffic: 2016 F** **Infrastructure: 2016** **Marine Traffic: 2016 Projected**	6-7 am	nq	na	nq	na
	7-8 am	nq	na	nq	na
	8-9 am	nq	na	nq	na
	9-10 am	1	0.2	1	0.2
	10-11 am	1	4.2	5	0.1
	11 am – 12 noon	1	0.5	4	0.1
	12 noon-1pm	1	4	8	0.1
	1-2 pm	1	1.2	4	0.1
	2-3 pm	1	0.1	1	0.1
	3-4 pm	1	2.4	5	0.1
	4-5 pm	1	5.8	>10	0.4
	5-6 pm	1	4.8	>10	0.4
	6-7 pm	nq	na	nq	na
Case Number: 3 **Train Traffic: 2016 F + P** **Infrastructure: 2016** **Marine Traffic: 2016 Projected**	6-7 am	1	0.8	2	0.1
	7-8 am	1	4.2	2	0.5
	8-9 am	1	6.7	3	0.2
	9-10 am	1	6.8	4	0.1
	10-11 am	1	9	6	0.1
	11 am – 12 noon	1	10.8	>10	0.4
	12 noon-1pm	1	9.9	>10	0.1
	1-2 pm	1	10.1	>10	0.4
	2-3 pm	1	8.1	>10	0.1
	3-4 pm	1	9.2	>10	0.5
	4-5 pm	1	9.9	>10	0.2
	5-6 pm	1	12.9	>10	0.4
	6-7pm	1	0.6	>10	0.1

5.0 Characterization of St. Lucie River Bridge

5.1 Project Area description

5.1.1 Location of St. Lucie River Waterway

The St. Lucie River is located between St. Lucie and Martin Counties. The headwaters of the North Fork are located in St. Lucie County near I-95 and flows south into Martin County where it joins the north-flowing South Fork. The headwaters for the South Forks are located east of I-95 and northwest of Hobe Sound. The North Fork, passes through Port Saint Lucie and White City, The North and South Forks meet just south of the old Roosevelt Bridge in Stuart to form the main confluence of the St. Lucie River. From here, the River travels east, passing under the St. Lucie River Bridge and the Roosevelt Bridge until it reaches the northern end of Sewall's Point peninsula, where the river then runs south under the Evans Crary Bridge and then into the Indian River Lagoon, which goes into the Atlantic Ocean. The St. Lucie River connects to Lake Okeechobee by the St. Lucie Canal.

The primary bridges crossing the St. Lucie River within the extent of waterfront development, as defined in Figure 5.1-1, include three operable bridges and ten stationary bridges. Operable bridges include the St. Lucie River Bridge and the Dixie Highway Bridge, located at the confluence, approximately 5.92 miles and 5.97 miles from the St. Lucie River inlet, respectively and a railroad bridge located in the South Fork at the Okeechobee Waterway. Stationary bridges include the Roosevelt Highway Bridge, located 5.82 miles from the St. Lucie River inlet in the confluence of the River; the State Road 716 Bridge, located 7.22 miles from the St. Lucie River Bridge in the North Fork; the Prima Vista Boulevard Bridge, located 12.7 miles from the St. Lucie River Bridge in the North Fork; the County Road 712 Bridge, located 16.61 miles from the St. Lucie River Bridge in the North Fork; the State Road 714 Bridge, located 2.09 miles from the St. Lucie River Bridge in the South Fork; the I-95 Bridge, located 6.4 miles from the St. Lucie River Bridge in the South Fork; the Florida Turnpike Bridge, located 6.69 miles from the St. Lucie River Bridge in the South Fork; the SW 96th Street Bridge, located 9.43 miles from the St. Lucie River Bridge in the South Fork; the SR 710 Bridge, located 20.69 miles from the St. Lucie River Bridge in the South Fork; and the Conner's Highway Bridge, located 31.32 miles from the St. Lucie River Bridge, which thereafter enters Lake Okeechobee. Characterization and location of these bridges, within the extent of waterfront development as defined in Figure 5.1-1 in the confluence and North and South Forks, can be found in Table 5.1-1.

5.1.2 Location of St. Lucie River Bridge

The St. Lucie River Bridge is located about 5.92 miles from the St. Lucie River's inlet (27°12'12.84"N 80°15'36.41"W) (Figure 5.1-1). This operable bridge has a vertical clearance of 7 feet and a horizontal clearance of 50 feet (Table 5.1-1). Although this bridge remains open to the waterway to allow a continuous flow of vessel traffic, it closes an average of 10 times daily to accommodate freight rail service. While closed, most vessels (with the exception of small recreational vessels less than 16 feet size class) are unable to pass through the bridge, and queue while waiting for the bridge to re-open.

Table 5.1-1. Characterization of Bridges Crossing the St. Lucie River Bridge

Bridge name	Type of bridge	Location where bridge crosses the river	Vertical clearance (feet)	Horizontal clearance (feet)
State Highway A1A	fixed	Inlet	65	125
Roosevelt Highway	fixed	Confluence east of the rail bridge	65	90
St. Lucie River Bridge	operable/bascule	Confluence	7	50
Dixie Highway Bridge	operable/bascule	Confluence west of the rail bridge	14	58
State Road 714 Bridge	fixed	South Fork	54	90
I-95 Bridge	fixed	South Fork	56	110
Fl Turnpike Bridge	fixed	South Fork	56	90
SW 96th Street Bridge	fixed	South Fork	56	90
SW Warfield Boulevard Bridge	fixed	South Fork	55	90
CSX Railroad Bridge	operable/swing	South Fork	7	47
State Road 716 Bridge	fixed	North Fork	18.4	75.5
E Prima Vista Boulevard Bridge	fixed	North Fork	12.8	57.7
Country Road 712 Bridge	fixed	North Fork	ND	ND

Notes: ND = no data

Explanation of Features

- St. Lucie River Bridge
- Adjacent Bridges
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012

St Lucie River Bridge Location Map

All Aboard Florida Intercity Passenger Rail Project

N 0 2.5 5 Miles

U.S. Department of Transportation
Federal Railroad Administration

Figure 5.1-1

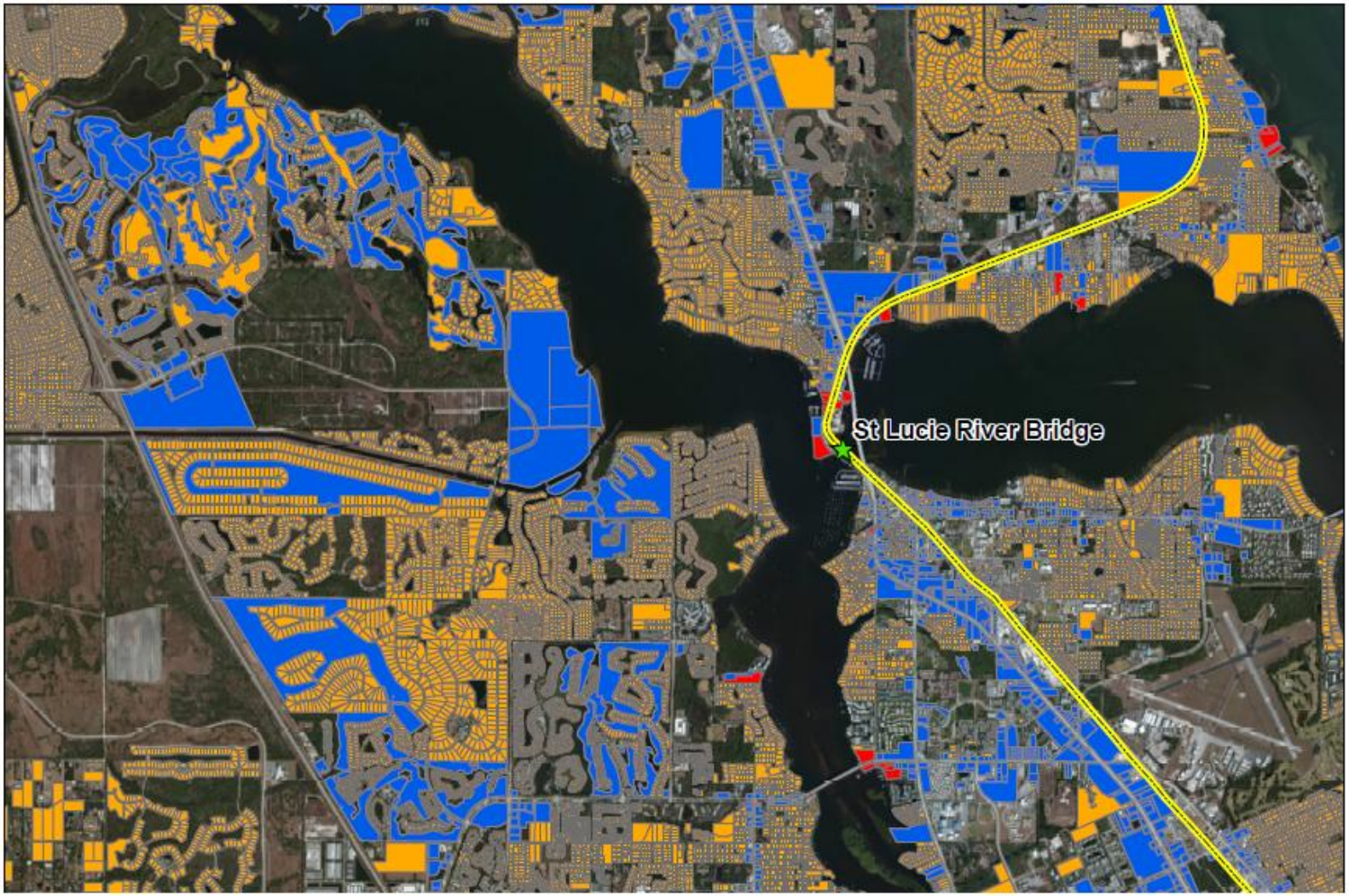
5.1.3 Land-use, Population Density

The upper North Fork of the St. Lucie River is primarily preserve land bordered by residential communities. South of Port St. Lucie, the North Fork widens and is surrounded by residences on the banks and golf courses until reaching the confluence (Figure 5.1-2). From Lake Okeechobee through much of the southwestern regions of the South Fork, the land use primarily consists of agricultural and some residential. After passing underneath the I-95 Bridge, the banks of the St. Lucie River are again dominated by residential land use and some marine facilities until reaching the confluence at the Dixie Highway Bridge, where more commercial land use and marine facilities can be found. A unique mixed land use of commercial and residential is found in this location; traveling east in the confluence the land use returns to primarily residential.

Population density maps developed through GIS analysis show adjacent lands to the St. Lucie River have census blocks with population densities that extend from Class 1 to Class 3. Land with waterfront access in only occupied by Class 1 and Class 2 population areas. Class 1 population density can be found east of the Loxahatchee River Bridge by the river Inlet (Figure 5.1-3), while waterfront areas in the confluence and the Forks of the Loxahatchee River have population densities in the range of Class 1, with the exception of the south Fork that includes an area of Class 2. About 28 square miles of land adjacent to the Loxahatchee River have waterfront access. The number of people in this area is approximately 70,323 to 76,396 people (Table 5.1-2).

Table 5.1-2. Land Area and Population Density with Waterfront Access at the St. Lucie River

Class	Total Area (square miles)	Area with Waterfront Access (square miles)	Percent with Waterfront Access	Population within Waterfront Access Size Class
1	43.3	25.7	59%	64,245
2	5.7	2.4	43%	9,115
3	0.2		0%	



Explanation of Features

- N-S Corridor
- RESIDENTIAL
- COMMERCIAL
- MARINE FACILITIES

Data Sources: ESRI StreetMap, AAF 2012, FGDL

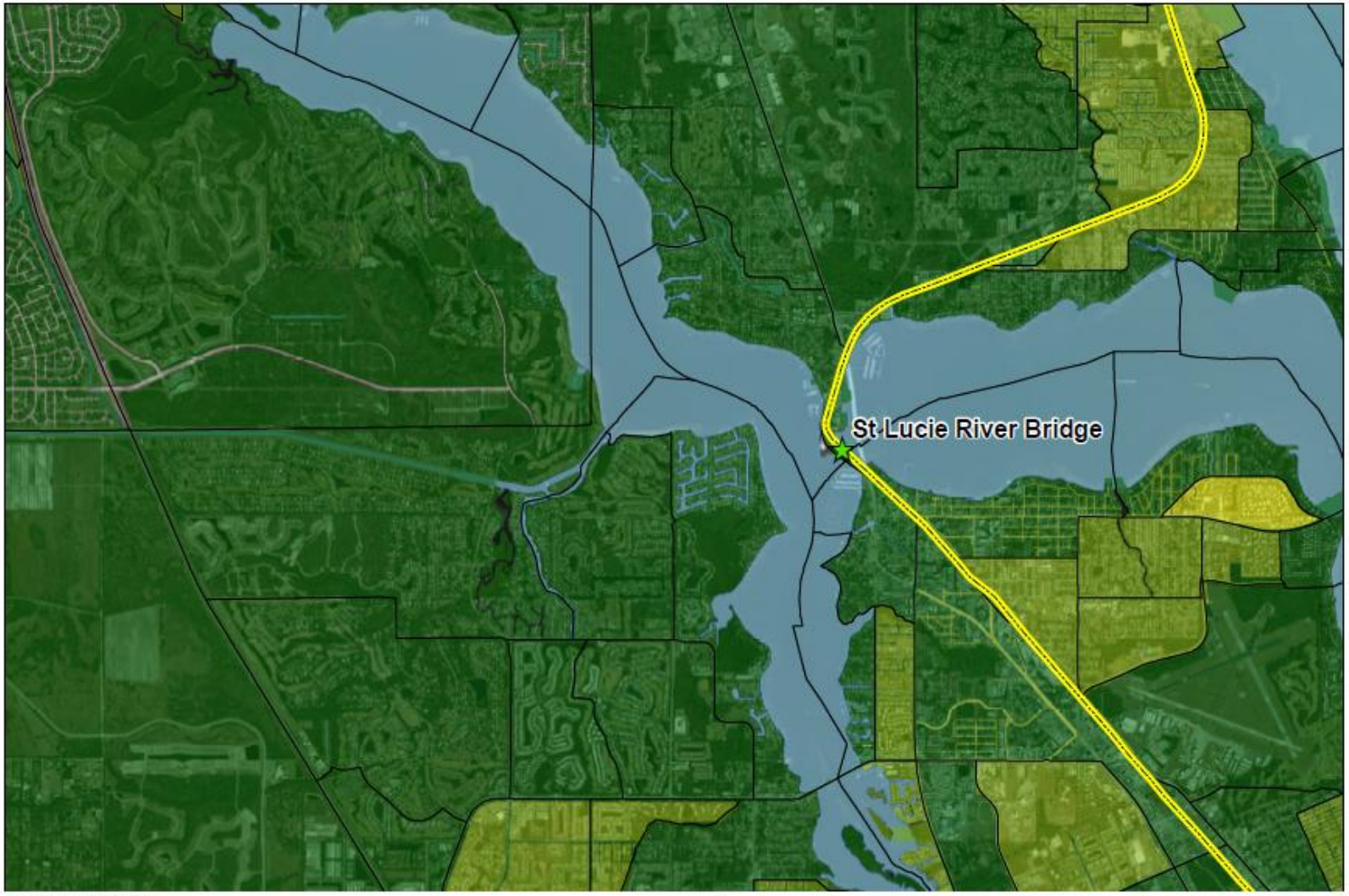
St Lucie River Bridge Adjacent Land Use

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Feet

U.S. Department of Transportation
Federal Railroad Administration

Figure 5.1-2



Explanation of Features

- Class 1 (< 2,500 people per SqMi)
- Class 2 (2,501 - 5,000 people per SqMi)
- Class 3 (5,001 - 7,500 people per SqMi)
- Class 4 (7,501 - 10,000 people per SqMi)
- Class 5 (>10,001 people per SqMi)
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012, FGDL 2012, DOR 2012

St. Lucie River Bridge Adjacent Population Density per Census Block

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Feet

U.S. Department of Transportation
Federal Railroad Administration

Figure 5.1-3

5.2 Marine Industry at St. Lucie River FEC Bridge

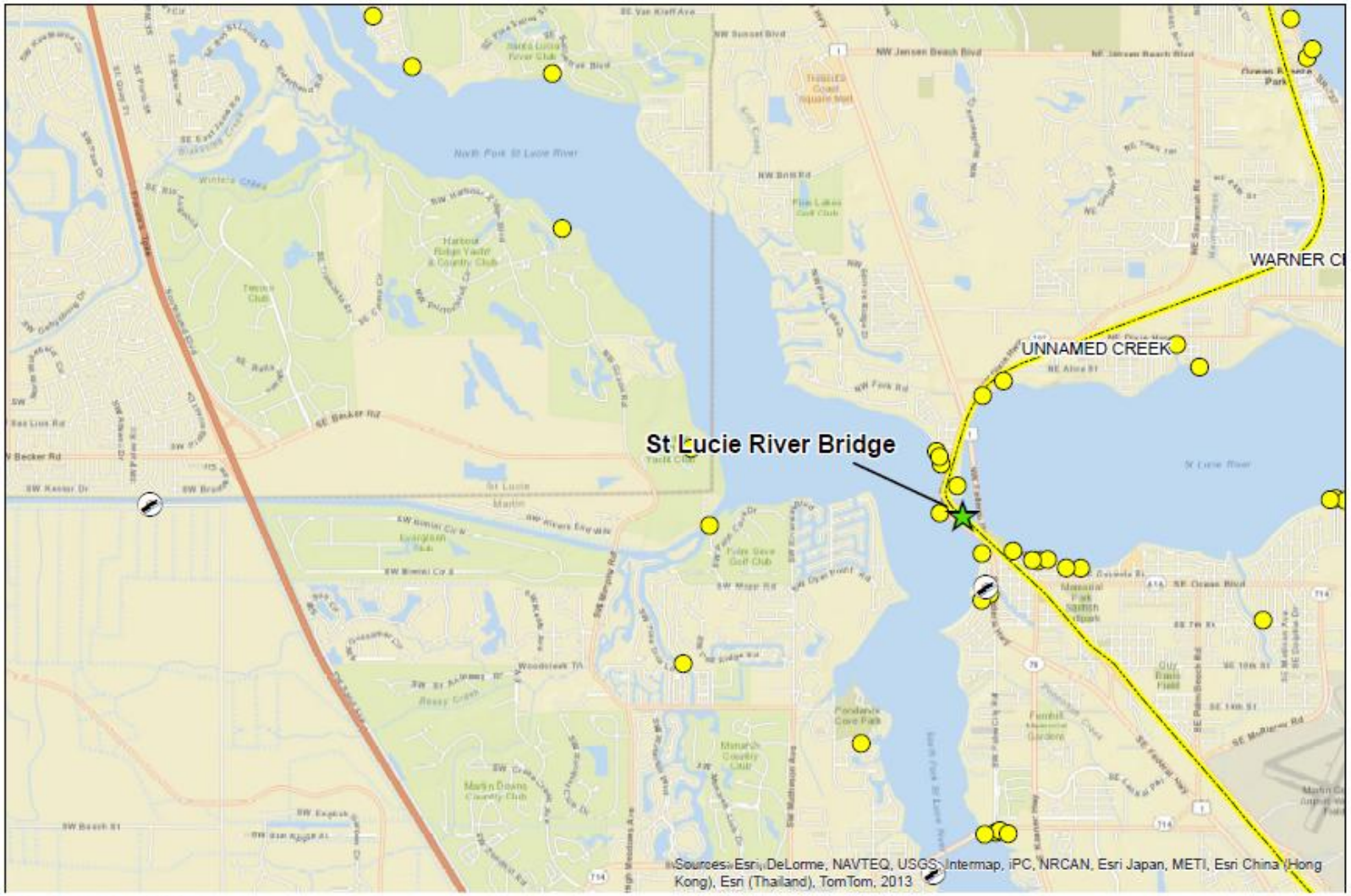
The St. Lucie River supports a marine industry that primarily services smaller recreational vessels. Public and private marine facilities are concentrated in the eastern portions of the river and include seven marinas and four boat ramps. Boat/yacht clubs, waterfront restaurants and waterfront hotels that cater to mariners occur within St. Lucie and Martin counties; however, these waterway features are concentrated along the Intracoastal Waterway and are not located on the St. Lucie River (Figure 5.2-1). With the exception of a large commercial area and marine facilities near Jupiter Inlet, waterfront development is predominantly private residences, which provide approximately 135 private slips and 1,061 private docks.4 While the St. Lucie River is located in both Martin and St. Lucie counties, waterfront development and marine facilities are overwhelmingly concentrated in St. Lucie County. This waterway overview provides a description of the navigable extent of the St. Lucie River and a characterization of the vessel traffic, waterway facilities, and the current and proposed use of the river.

5.2.1 Vessel Traffic Patterns

The St. Lucie River going up river has a broad river channel at its confluence with the Indian River Lagoon. The Indian River Lagoon provides mariners with access to the Atlantic Ocean and the Intracoastal Waterway. From the St. Lucie Bridge, the St. Lucie River travels inland southwestward to South Fork where it enters the St. Lucie Canal. After entering the St. Lucie Canal (Okeechobee Waterway), the waterway continues generally west southwestward to Port Mayaca where the canal enters Lake Okeechobee. The Okeechobee Waterway provides a route across the state a Florida from the St. Lucie River to Punta Rassa, approximately 90 miles south of the entrance to Tampa Bay on Florida's west coast.

5.2.2 Vessel Registration and Population Trends

St. Lucie County has grown by approximately 32.7% from a population of 211,898 people in 2003 to a population of 281,151 people in 2013. The county's population is projected to grow to 307,870 people by 2016 and to 387,701 by 2025.4 Martin County tends to be less developed than St. Lucie County, with a population of 148,077 people in 2013. Population growth in Martin County has grown more slowly than St. Lucie County over the last decade from a population of 134,491 people in 2003.



Explanation of Features

- Marina
- Boat Ramp
- N-S Corridor

Data Sources: ESRI StreetMap, AAF 2012, FWC

Marinas and Commercial Docks Along St. Lucie River

All Aboard Florida Intercity Passenger Rail Project

N 0 1,500 3,000 Feet

U.S. Department of Transportation Federal Railroad Administration

Figure 5.2-1

Vessel registration information for St. Lucie and Martin counties from 2003 to 2013 were obtained from the Florida Department of Highway Safety and Motor Vehicles. Similar to other counties in Florida, vessel registration grew between 2003 and 2008; however, during the recession from 2009 to 2013, vessel registration declined from peak vessel registration (2005 to 2006). Overall, vessel registration declined by approximately 10.5% between 2003 to 2013 in both St. Lucie County and Martin counties.[10]

Based on County population and vessel registration data for 2003 to 2013, the 10-year average of registered vessels per capita is 5.17% for St. Lucie County and 11.66% for Martin County. This per capita average of registered vessels was then compared to county population growth forecasts obtained from the Bureau of Economic and Business Research.5 Based on these population forecasts, it is anticipated that registered vessels will increase to 15,916 in St. Lucie County and will increase to 17,956 in Martin County by 2016. These data are provided in Table 5.2-1.

Table 5.2-1. Population and Vessel Registration in St. Lucie and Martin Counties (2003 and 2016**Error! Bookmark not defined.**

	St. Lucie County			Martin County		
Year	**Total Population**	**Total Vessel Registration**	**Percentage of Population with Registered Vessels**	**Total Population**	**Total Vessel Registration**	**Percentage of Population with Registered Vessels**
2003	211,898	13,154	6.21%	134,491	17,446	12.97%
2004	226,216	13,398	5.92%	137,637	17,639	12.82%
2005	240,039	13,999	5.83%	141,059	17,661	12.52%
2006	259,315	14,154	5.46%	142,645	17,315	12.14%
2007	271,961	14,053	5.17%	143,737	16,772	11.67%
2008	276,585	13,907	5.03%	143,868	17,826	12.39%
2009	272,864	13,621	4.99%	143,856	15,932	11.07%
2010	277,789	13,123	4.72%	146,318	15,652	10.70%
2011	279,696	12,857	4.60%	146,689	15,745	10.73%
2012	280,355	12,577	4.49%	147,203	15,702	10.67%
2013	281,151	12,564	4.47%	148,077	15,606	10.54%
2016 (Projected)	**307,870**	**15,916**	**5.17%**	**153,999**	**17,956**	**11.66%**

5.2.3 Inventory of Waterway Features

The Waterway Features Inventory of recreational and commercial boating access facilities includes boat ramps, marinas, dry storage facilities, anchorages, and commercial entities in both Martin and St. Lucie counties (Table 5.2-2). Waterfront residences with dockage or slips along the St. Lucie River in both counties were also estimated. In order to estimate the number of waterfront residential properties that include wetslips and docks, a sampling procedure was used. For the purposes of this study, the St. Lucie River was surveyed for the extent of its navigable area east of the operable bridge, including the Okeechobee Waterway to the west, and to the Intracoastal Waterway to the east.

5.2.3.1 Marinas, Boat Ramps and Repair/ Support Facility Inventory

There are 15 public and private marinas on the St. Lucie River. The number of slips at these marinas ranges from 8 to nearly 200, with a total of 439 slips and an average of approximately 35 slips per marina. Marinas occur throughout the St. Lucie River but many are concentrated in the vicinity of the St. Lucie River Bridge.**Error! Bookmark not defined.**

Table 5.2-2. Overview of Waterway Features on the St. Lucie River and Associated Waterways

Boating Facility	Number	Slips	Location Relative to St. Lucie River FEC Corridor Railway Bridge	
			East	West
Commercial Marina	9	439	4	5
Public Marina	6	78	2	4
Private Club	5	192	3	2
Hotel/ Restaurant	5	207	3	2
Total	**25**	**916**	**12**	**13**

Source: Florida Fish and Wildlife Research Institute, 20094

There are 15 boat ramps located on the St. Lucie River, all of which are public (Table 5.2-3). In addition, two anchorages, and five waterfront vessel repair and service facilities are located on the St. Lucie River.

Table 5.2-3. Boat Ramps, Anchorages, and Vessel Repair Facilities on the St. Lucie River

Boating Facility	Number	Location Relative to St. Lucie River FEC Corridor Railway Bridge	
		East	West
Boat Ramp	15	2	13
Anchorage	2	1	1
Repair/ Support Facilities	5	3	2
Total	**22**	**6**	**16**

Source: Florida Fish and Wildlife Research Institute, 20094

5.2.3.2 Residential Boating Facility Inventory

The St. Lucie River and nearby area islands in the Intracoastal Waterway have a high number of residential waterfront properties and numerous residential neighborhoods with waterway access to the river. These parcels contain a large number of docks, while approximately 12.3% contain a slip. Overall, approximately 82.8% of all waterfront properties contain either a dock or a slip (Table 5.2-4). The majority of these small private waterfront housing developments on the St. Lucie River meet the boating needs of the residences, but do not provide public boating access. While secondary to marinas and other public marine facilities, an inventory of the docks and slips at waterfront housing developments is important to provide an overall picture of the complete marine industry and recreational use of the St. Lucie River. Utilizing methodology provided in Section 2.1, the approximate number of docks and slips for single family, multi-family greater than 10, multi-family less than 10, and condominiums were counted or estimated (Table 5.2-4).

Table 5.2-4. Overview of Residential Boating Features of Waterfront Properties on the St. Lucie River

Land Use	Total Waterfront Properties	Estimated Properties with Docks	Estimated Properties with Slips	Estimated Properties with Docks or Slips
Single Family	2,847	2,021[a]	341[a]	2,362[a]
Multi Family <10 Units	32	17	2	19
Multi Family >10 Units	3	2	0	2
Condominiums	15	1	14	15
Total Waterfront Properties	**2,897**	**2,041**	**357**	**2,398**

Note: [a]Estimated based on a percent of parcels with docks or slips from a random sample of 100 WFP parcels on the St. Lucie River

5.2.3.3 Purpose and Use of Navigation Infrastructure (Commercial versus Recreational)

Navigation on the St. Lucie River is predominantly recreational, with limited commercial and marine industry vessel traffic. The size of the waterway for inland portions of the St. Lucie River limit the

extent of commercial marine activities. No commercial barge traffic occurs in the St. Lucie River. Inland commercial vessel activities are primarily associated with water taxi/bus, restaurant, and touring operations.

5.2.4 Economic Analysis

The total economic value of the marine industry along the St. Lucie River is based on all marine related sales along this river, including those directly related to marine services (e.g., vessel sales, vessel repairs, recreational equipment) and those that are outside the marine industry but related to marine activity (e.g., sales of food and ice for boating trips). The type of sales that were considered in the marine industry includes:

- Vessel and yacht sales;
- Vessel accessories and replacement parts (e.g., trailers, electronics);
- Vessel services (e.g., repair, maintenance, interior design);
- Vessel storage (e.g., marinas, onshore storage);
- Sales at businesses frequented during boating trips (e.g., hotels and restaurants);
- Recreational equipment and instruction (e.g., dive equipment, fishing tackle, water ski instruction);
- Inland waterway businesses (e.g., water taxis and charter boats); and
- Other miscellaneous costs (e.g., insurance, business/personal services).

This analysis estimates the direct, indirect, and induced benefits of the marine industry along the St. Lucie River to the local economy. In order to determine the direct economic value attributed to the St. Lucie River, the total direct economic value of the marine industries in Martin and St. Lucie Counties were estimated and then the relative percentages of the marine industry that can be attributed to the portion of the St. Lucie River that lies in each of these counties was applied. After calculating the direct economic value of the marine industry for the portion of the St. Lucie River that lies in each county, these figures were used to determine the resulting indirect and induced benefits. This analysis also considers the number of jobs that are supported by the economic activity associated with the marine industry along the St. Lucie River.

5.2.4.1 Economic Benefits of the Marine Industry in Martin County

The direct economic value of the marine industry in Martin County was determined by updating the economic analysis performed by the State of Florida in 2011. The state's study was updated from the base year of 1999, when the original study for Martin County was performed, to reflect the total value of the industry in December 2013. The direct economic value of the marine industry associated with the portion of the St. Lucie River that lies in Martin County includes all direct spending associated with the marine industry that occurred in the vicinity of this portion of the St. Lucie River. In other words, it includes all marine-related spending by the individuals utilizing this portion of the waterway.

The direct benefits of the marine industry in Martin County were determined by escalating the values determined in the base year of 1999 in accordance with growth experienced between that time and December 2013. The gross sales in Kind Code 28 for Martin County grew by 58.73% in that period, while the Consumer Price Index increased by 38.47%. In accordance with the methodology described in Chapter 2, retail sales were escalated by 58.73% while non-marine benefits were escalated by 38.47%. As seen in Table 5.2-5, the resulting estimated total economic value of the marine industry in Martin County in December 2013 was $523.7 million.

Table 5.2-5. Direct Benefits of the Marine Industry in Martin County

Business Type	1999 Marine Business Volume	Estimated 2013 Marine Business Volume
Total Direct Benefits (marine only)	$307,515,142	$488,116,321
Non-marine Benefits (gas, food, drink, ice)	$25,700,000	$35,587,399
Total Marine and Non-marine Direct Benefits	$333,215,142	$523,703,720

Source: Original 1999 marine business volume obtained from Appendix K of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

Due to indirect and induced effects of expenditures in the marine industry in Martin County, the total economic value of the industry is greater than the initial direct spending. The resulting total economic value of the marine industry for Martin County, including direct, indirect, and induced effects, was generated by using IMPLAN economic modeling software for the 1999 data. Because the distribution of economic value is similar to the distribution at the time of the original study, the relative indirect and induced effects would also be similar. Therefore, extrapolating from the data obtained for the 1999 model results, the estimated 2013 results show that the total value of the marine industry in Martin County is $705.0 million, with $523.7 million in direct sales, $86.0 million in indirect benefits, and $95.3 million in induced benefits (see Table 5.2-6).

The economic activity associated with Martin County's marine industry also supports local area employment, including jobs associated with the direct effects of spending in the industry as well as jobs associated with indirect and induced economic activity. These benefits, including both the number of jobs and personal income, were estimated using the same methodology of applying the 1999 IMPLAN model run percentages to determine the total effects. The results show that direct spending in the marine industry supports 4,588 jobs and $138.1 million in personal income. Additionally, the total spending associated with the marine industry, including direct, indirect, and induced effects, supports 7,049 jobs and $205.5 million in personal income (see Table 5.2-6).

Table 5.2-6. Direct, Indirect, and Induced Benefits of the Marine Industry in Martin County

	Original 1999 Model Results				Estimated 2013 Figures			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Business Volume (in millions)	$314.8	$51.7	$57.3	**$423.8**	$523.7	$86.0	$95.3	**$705.0**
Personal Income (in millions)	$83.0	$19.0	$21.5	**$123.5**	$138.1	$31.6	$35.8	**$205.5**
Employment	2,758	663	816	**4,237**	4,588	1,103	1,358	**7,049**

Source: Original 1999 model results obtained from Appendix K of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

5.2.4.2 Economic Benefits of the Marine Industry in St. Lucie County

The direct economic value of the marine industry in St. Lucie County was determined by updating the economic analysis performed by the State of Florida in 2011. Because the economic studies for the marine industry in Martin and St. Lucie Counties were both performed in 1999, the methodology for updating data to December 2013 values is the same for both counties. The direct economic value of the marine industry associated with the portion of the St. Lucie River that lies in St. Lucie County includes all direct spending associated with the marine industry that occurred in the vicinity of this portion of the St. Lucie River. In other words, it includes all marine-related spending by the individuals utilizing this portion of the waterway.

The direct benefits of the marine industry in St. Lucie County were determined by escalating the values determined in the base year of 1999 in accordance with growth experienced between that time and December 2013. The gross sales in Kind Code 28 for St. Lucie County grew by 49.32% in that period, while the Consumer Price Index increased by 38.47%. In accordance with the

methodology described in Chapter 2, retail sales were escalated by 49.32% while non-marine benefits were escalated by 38.47%; there is no revenue from port operations in this county. As seen in 5.2-7, he resulting estimated total economic value of the marine industry in St. Lucie County in December 2013 was $308.3 million.

Table 5.2-7. Direct Benefits of the Marine Industry in St. Lucie County

Business Type	1999 Marine Business Volume	Estimated 2013 Marine Business Volume
Total Direct Benefits (marine only)	$186,473,389	$278,438,465
Non-marine Benefits (gas, food, drink, ice)	$21,600,000	$29,910,032
Total Marine and Non-marine Direct Benefits	$208,073,389	$308,348,497

Source: Original 1999 marine business volume obtained from Appendix J of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

The resulting total economic value of the marine industry for St. Lucie County, including direct, indirect, and induced effects, was generated by using IMPLAN economic modeling software for the 1999 data. Because the distribution of economic value is similar to the distribution at the time of the original study, the relative indirect and induced effects would also be similar; this also applies for the calculation of personal income and employment. Therefore, extrapolating from the data obtained for the 1999 model results, the estimated 2013 results show that the total value of the marine industry in St. Lucie County is $420.85 million, with $308.35 million in direct sales, $53.17 million in indirect benefits, and $59.33 million in induced benefits. Additionally, the total personal income generated by the industry is $106.60 million and the total associated employment is 3,771 jobs (see Table 5.2-8).

Table 5.2-8. Direct, Indirect, and Induced Benefits of the Marine Industry in St. Lucie County

	Original 1999 Model Results				Estimated 2013 Figures			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Business Volume (in millions)	$192.87	$33.26	$37.11	$263.24	$308.35	$53.17	$59.33	$420.85
Personal Income (in millions)	$40.34	$12.46	$13.88	$66.68	$64.49	$19.92	$22.19	$106.60
Employment	1,377	441	541	2,359	2,201	705	865	3,771

Source: Original 1999 model results obtained from Appendix J of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

5.2.4.3 Economic Benefits of the Marine Industry associated with the St. Lucie River

The St. Lucie River represents approximately 82.9% of the marine activity in Martin County and 15.3% in St. Lucie County. Because the economic activity associated with the St. Lucie River is located in both Martin and St. Lucie Counties, the total economic value of this river is equivalent to 82.9% of the economic value of the marine industry in Martin County plus 15.3% of the economic value of the marine industry in St. Lucie County, resulting in a total economic value of $648.8 million. This total value is comprised of $481.3 million in direct expenditures, $79.4 million in indirect effects, and $88.1 million in indirect effects. This activity supports a total of 6,420 jobs and $186.6 million in personal income (see Table 5.2-9).

Table 5.2-9. Direct, Indirect, and Induced Benefits of the Marine Industry along the St. Lucie River

		Direct	Indirect	Induced	Total
Portion within Martin County	Business Volume (in millions)	$434.1	$71.3	$79.0	$584.4
	Personal Income (in millions)	$114.4	$26.2	$29.7	$170.3
	Employment	3,803	914	1,125	5,843
Portion within St. Lucie County	Business Volume (in millions)	$47.2	$8.1	$9.1	$64.4
	Personal Income (in millions)	$9.9	$3.0	$3.4	$16.3
	Employment	337	108	132	577
Total	Business Volume (in millions)	$481.3	$79.4	$88.1	$648.8
	Personal Income (in millions)	$124.3	$29.2	$33.1	$186.6
	Employment	4,140	1,022	1,258	6,420

Source: Original 2007 model results obtained from Appendix M of the Update of the Economic Benefits of the District's Waterways in Florida, Main Report by the Florida Inland Navigation District, December 2011. Available at http://www.aicw.org/studies.jhtml?method=list

5.2.5 Public Outreach

A summary of public participation initiatives and community outreach events, particularly related to navigation that occurred in the vicinity of the St. Lucie River, are presented in the Tables 5.2-10 and 5.2-11. Additionally, details regarding other meetings that specifically addressed navigation issues on the St. Lucie River are outlined below.

Table 5.2-10. St. Lucie River Community Outreach (page 1 of 3)

Presentation Made To	Type of Event
May 2012	
Central Florida Partnership	Presentation – Board Meeting
City of Orlando	Meeting - Mayor Buddy Dyer
Greater Orlando Aviation Authority (GOAA)	Briefing - Stan Thornton, Project Liaison Manager
GOAA	Briefing - Phil Brown, Executive Director
MetroPlan Orlando	Transit-Oriented Development Forum
Orange County	Meeting - Mayor Jacobs, Jim Harrison, Assistant County Administrator
SeaWorld	Meeting - Terry Prather
Transit Oriented Development	Briefing - Tony Brown, Executive Director Commissioner Lowe Scott Evans, Planning Director
Universal Florida	Meeting - John McReynolds
June 2012	
Orange County Environmental Protection Division	Briefing - Lori Cuniff
Osceola County	Briefing - Don Fisher, County Manager
GOAA	Meeting – Phil Brown and Staff
July 2012	
GOAA	Meeting – GOAA staff, United States Congressman John Mica
Orlando Sentinel	Meeting - Editorial Board
August 2012	
FDEP, USACE, SFWMD, SJRWMD and others	Tiger Team Meetings
FDEP, SFWMD and SJRWMD	Pre-application meeting/Bi-monthly conference calls
September 2012	
FDEP, USACE, SFWMD, SJRWMD and others	Tiger Team Meeting
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
MetroPlan Orlando	Presentation – monthly board meeting
TCRPC	Presentation – monthly board meeting

Table 5.2-10. St. Lucie River Community Outreach (page 2 of 3)

Presentation Made To	Type of Event
October 2012	
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
November 2012	
Universal Studios	Briefing – John McReynolds, SVP, External Affairs, and Alice Norsworthy, EVP, Marketing and Sales
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
FDEP, USACE, SFWMD, SJRWMD and others	Tiger Team Meeting
City of Titusville	Call – Mayor Jim Tulley
December 2012	
FDEP, USACE, SFWMD, SJRWMD and others	Tiger Team Meeting
USACE	Bi-monthly conference calls
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
Space Coast Transportation Planning Organization	Presentation – monthly board meeting
January 2013	
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
FDEP, USACE, SFWMD, SJRWMD and others	Tiger Team Meeting
City of Orlando	Briefing – Mayor Buddy Dyer
Central Florida Urban League	Briefing – Allie Braswell, Executive Director
February 2013	
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
FDEP, USACE, SFWMD, SJRWMD and others	Tiger Team Meeting
City of Titusville	Briefing – Mayor Jim Tulley
March 2013	
FDOT, District 4	Briefing – Amie Goddeau
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
April 2013	
Audubon Florida – Central Florida	Briefing - Charles Lee
NAIOP Central Florida Chapter	Presentation – monthly meeting
FDEP, USACE, SFWMD, SJRWMD and others	Tiger Team Meeting
FDEP, SFWMD and SJRWMD	Bi-monthly conference calls
SR 528 Land Manager Meeting	Environmental Coordination Meeting
GOAA	Environmental Coordination Meeting
Mayors Mean Business – Florida League of Mayors	Presentation – more than 50 mayors at annual Florida League of Mayors meeting
Women in Transportation – Central Florida chapter	Presentation – at annual scholarship dinner
Notice of Intent published April 15, 2013 initiated EIS scoping process	

Table 5.2-10. St. Lucie River Community Outreach (page 3 of 3)

Presentation Made To	Type of Event
May 2013	
USACE, USFWS, Federal Aviation Administration (FAA), FDEP, Florida Fish and Wildlife Conservation Commission (FFWCC), SJRWMD, and GOAA	Agency/tribal Coordination Meeting (Section 2.2.2)
EIS Process scoping meeting/open house	Public meeting – Orlando (Section 2.2.5)
FDEP, U USACE, SFWMD, SJRWMD and others	Tiger Team Meeting
City of Fort Pierce	Briefing – City Manager, Engineer and Planning Director
City of Fort Pierce	Briefing – Mayor Linda Hudson
City of Fort Pierce	Briefing – Commissioner Eddie Becht
City of Fort Pierce	Briefing – Commissioner Rufus Alexander
City of Fort Pierce	Briefing – Commissioner Reggie Sessions
City of Fort Pierce	Briefing – Commissioner Tom Perona
St. Lucie Transportation Planning Organization	Briefing – Peter Buchwald, Executive Director
Florida Transportation Commission	Presentation at public meeting
St. Lucie County	Briefing – Commissioner Chris Dzadovsky
St. Lucie County	Briefing – Commissioner Tod Mowery
St. Lucie County	Briefing – Commissioner Frannie Hutchinson
Economic Development Council of St. Lucie	Briefing – Larry Pelton, Executive Director
EIS Process scoping meeting/open house	Public meeting – Fort Pierce (Section 2.2.5)
City of Stuart	Briefing – City Manager
City of Stuart	Briefing – Mayor Eula Clarke
City of Stuart	Briefing – Commissioner James Christie
City of Stuart	Briefing – Commissioner Jeff Krauskopf
Martin County	Briefing – Commissioner Doug Smith
Martin County	Briefing – Commissioner Ed Fielding
Martin County	Briefing – Commissioner John Haddox
Visit Orlando	Briefing – George Aguel, President & CEO, and management team
MetroPlan Orlando	Briefing – Harry Barley, Executive Director
City of Orlando	Briefing – Mayor Buddy Dyer
June 2013	
FRA/GOAA /Federal Aviation Authority	Environmental coordination meeting
October 2013	
TCRPC	Presentation to Council regarding St. Lucie River Bridge

Table 5.2-11. Letters and Agreements of Support

Date	Document; Entity	Signatory
July 23, 2012	Letter of Support; Florida State Hispanic Chamber of Commerce	Julio Fuentes, President and CEO
July 24, 2012	Letter of Support; South Florida Regional Planning Council	James F. Murley, Executive Director
July 25, 2012	Letter of Support; TCRPC	Michael J. Busha, AICP, Executive Director
July 31, 2012	Letter of Support, Florida Chamber of Commerce	David A. Hart, Executive Vice President

5.2.5.1 St. Lucie River Railroad Bridge Meeting

A meeting concerning the St. Lucie River Railroad Bridge was organized by the TCRPC and took place on Thursday, October 3, 2013, from 9:30 am to 11:30 am. The meeting was held at Stuart City Hall, at 121 SW Flagler Avenue in Stuart, Florida. The Vice President of FECI provided an overview of the AAF project and subsequently responded to questions and comments.

Attendees expressed concern regarding the frequency of bridge closures and the resulting impacts to marine navigation and economy, including property values. There was also concern about the lack of awareness of the Project by residents who use the bridge for weekend recreational boating.

In relation to bridge closure, the public requested an estimate of expected total time of closure per hour, an investigation of improved mechanics and communications technology, and the coordination of bridge closures/openings with the bridge tender on Old Roosevelt Bridge. The discussion also focused on how the Martin County Metropolitan Planning Organization and FDOT would be involved in facilitating any bridge improvements. Members of the public also raised a concern regarding vessel safety related to the location of the two bridges and the existing currents in the channel noting that vessels have hit the bridge structure of Highway 1 (NW Federal Highway) before. A request for a taller, wider bridge was made for the purpose of increasing vessel safety. The public also requested a limited-service station in downtown Stuart. In conclusion, the TCRPC committed to coordinating with the FECR to arrange a follow-up meeting.

5.2.5.2 Waterways Plan for Martin and St. Lucie Counties

A meeting concerning the Waterways Plan for Martin and St. Lucie Counties was organized by the TCRPC and took place on Wednesday, January 29, 2014, at 2:00 pm. The meeting was held in the Stuart City Hall Commission Chambers, at 121 SW Flagler Avenue in Stuart, Florida. The meeting was the third forum in a six-forum series, and included participants from the SFWMD, Florida Fish and Wildlife Conservation Commission (FFWCC), USCG, Martin County, Martin County Sheriff's Office, St. Lucie County, St. Lucie County Sheriff's Office, and the City of Stuart.

The panel discussed the various possible ways in which the Waterways Plan could address regulation or management of the waterway. A brief discussion of the Project was prompted by a member of the Martin Municipal Planning Organization, and led to a conversation regarding USCG permitting requirements and environmental processes. During the conversation, concern for impacts to marine navigation was raised and the notion of including a bridge tender was suggested.

The same topics were discussed in a steering committee meeting for the Waterways Plan that took place on Wednesday, January 29, 2014, at 4:00 pm. The meeting was also held in the Stuart City Hall Commission Chambers, at 121 SW Flagler Avenue in Stuart, Florida.

5.3 Summary of Vessel Traffic Survey at St. Lucie River

Vessel traffic was summarized at the St. Lucie River Bridge and adjoining areas, including peak travel days and times. This summary includes a review of the 2014 FECR video recordings, used to analyze vessel activity within the St. Lucie River and provide the information necessary to estimate impacts related to increased train traffic and associated closures of the St. Lucie River Bridge. The information gathered from the video was then used to determine the socioeconomic impacts of the Proposed Action.

5.3.1 Literature Review Vessel Traffic Surveys

Previous vessel traffic studies along the St. Lucie River were not identified. Vessel trends for the St. Lucie River Bridge were identified through the 2014 Vessel Traffic Survey and modeling of bridge operations.

5.3.2 2014 Vessel Traffic Survey

This section summarizes vessel traffic data extracted from a two-week video assessment of the St. Lucie River Bridge, from January 3, 2014 to January 17, 2014.

5.3.2.1 Summary of Vessel Traffic Traversing St. Lucie River Bridge

Data gathered through a two-week video assessment of the St. Lucie River Bridge during winter shows an average of 102 vessel crossings per day occurred (Min=28; Max=263) from Monday to Friday, compared to about 315 vessels (Min=157; Max=413) per day on a weekend (Table 5.3-1). Sundays had the most vessel activity, with a range of 296 to 395 vessel counts.

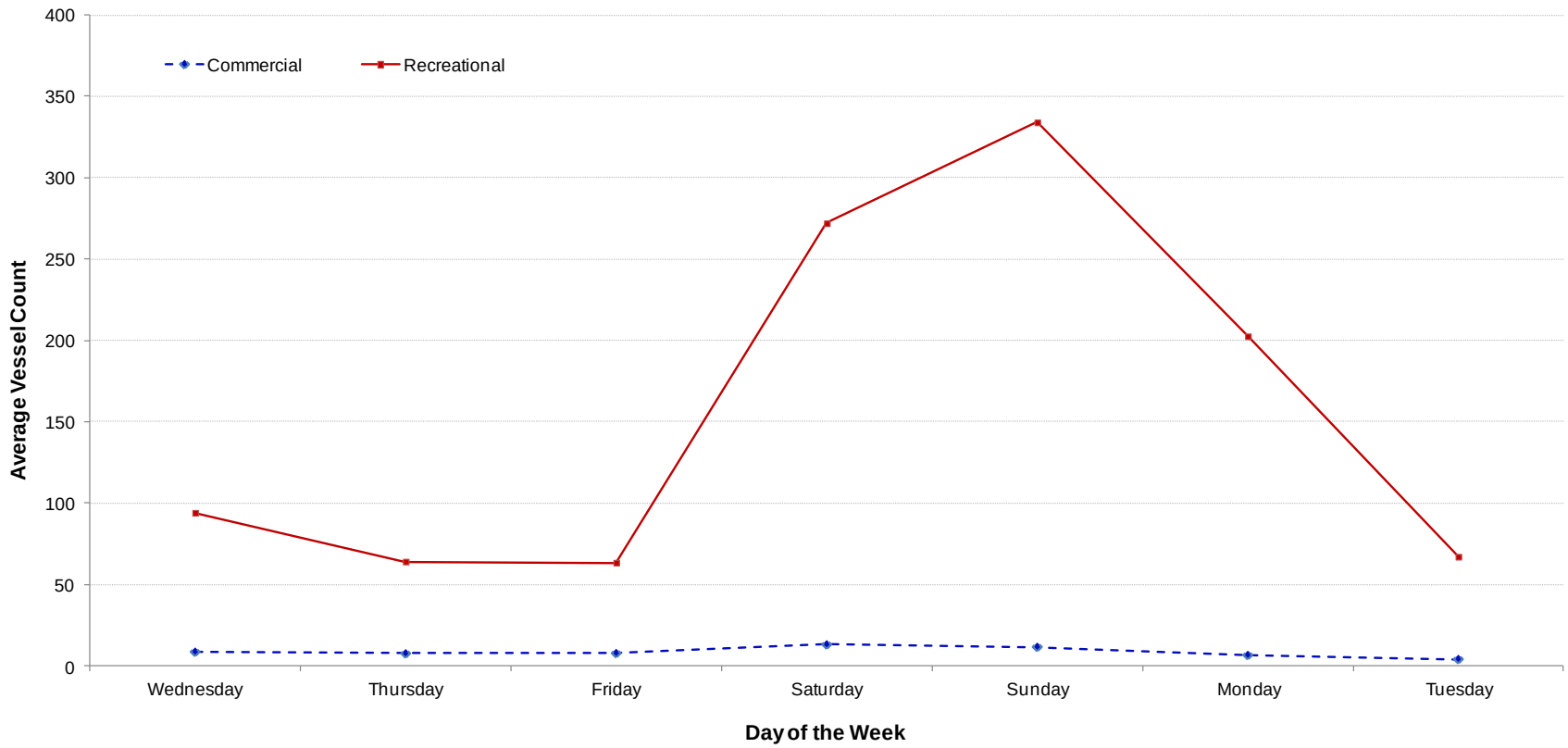
The average count of commercial vessels per day ranged from 2 to 21, with an average of 7 vessels and 12 vessels traversing the St. Lucie Bridge on weekdays and weekends respectively (Figure 5.3-1). An increase of 43% in commercial traffic during the weekend was observed during this two week assessment. The average count of recreational vessels per day ranged from 26 to 406 which represent a maximum increase in vessel traffic of about 69% during the weekend (Figure 5.3-1).

Table 5.3-1. Vessel Traffic at St. Lucie River Bridge Based on FECR Video Assessment from January 2014

Week Day	Date	Vessel Traffic at Stuart River Bridge [a]						Total	Percent of Commercial Vessels/day	Percent of Recreational Vessels/day
		Morning (6:00 AM-9:59 AM)		Noon (10:00 AM-1:59 PM)		Afternoon to Overnight (2:00 PM-6:00 AM)				
		Commercial	Recreational	Commercial	Recreational	Commercial	Recreational			
Friday	1/3/2014	2	6	7	17	4	8	44	29.5%	70.5%
Saturday	1/4/2014	6	22	8	77	5	39	157	12.1%	87.9%
Sunday	1/5/2014	0	25	1	264	1	104	395	0.5%	99.5%
Monday	1/6/2014	1	18	2	57	2	75	155	3.2%	96.8%
Tuesday	1/7/2014	0	10	1	8	1	8	28	7.1%	92.9%
Wednesday	1/8/2014	5	19	5	59	1	41	130	8.5%	91.5%
Thursday	1/9/2014	0	28	4	37	2	26	97	6.2%	93.8%
Friday	1/10/2014	0	22	3	43	4	51	123	5.7%	94.3%
Saturday	1/11/2014	1	37	2	183	4	186	413	1.7%	98.3%
Sunday	1/12/2014	4	33	9	123	8	119	296	7.1%	92.9%
Monday	1/13/2014	1	62	2	124	5	69	263	3.0%	97.0%
Tuesday	1/14/2014	1	31	2	45	3	32	114	5.3%	94.7%
Wednesday	1/15/2014	2	20	2	27	2	21	74	8.1%	91.9%
Thursday	1/16/2014	2	8	2	12	5	17	46	19.6%	80.4%
Friday	1/17/2014	0	16	3	27	0	0	46	6.5%	93.5%

Note: [a] Vessel traffic was assessed during January (high vessel traffic season) daylight hours (from 6:00am to 6:30pm), but casual observations were also recorded later at night.

Figure 5.3-1. Average Vessel Count Traversing the St Lucie River Bridge



5.4 Summary of Bridge Operation at St. Lucie River

This section includes data gathered through the current and projected operations schedule for freight and passenger traffic provided by AAF as modeled in the RTC simulation model. These data are summarized herein and will be used to assess projected changes in maritime traffic (Sections 6.0 and 7.0).

5.4.1 St. Lucie Bridge Operations Analysis

RTC model results for existing and projected bridge operations are provided in Table 5.4-1. Results shows the St. Lucie River Bridge is closed about 21 minutes per closure under Existing Conditions (Table 5.4-1). Analysis of data suggests the No-Build Alternative (without the infrastructure contemplated as part of the Proposed Action) will decrease the average time of each bridge closure by approximately 1 minute. The projected freight traffic under the 2016 No-Build Alternative results in a total average daily bridge closure of 6.6 hours during weekdays and approximately 3.6 hours of daily closure during weekends, as compared to approximately 4.01 and 2.74 hours of daily closure during weekdays and weekends, respectively, under the Existing Conditions. Although the Proposed Action (2016 Passenger and upgraded infrastructure) will add to the total daily bridge closure time (about 5.95 hours during the weekdays 5.89 hours during weekends), improvements to the rail infrastructure are expected to increase the speed of rail traffic, reducing the Proposed Action average time of single closures (15 minutes) by approximately 6 minutes, when compared to Existing Conditions (21 minutes) or about 5 minutes when compared to the No-Build Alternative respectively (20 minutes). The Combined Effect (2016 Freight and Passenger) will correspond to an average of 9.79 hours of daily closure times during the weekdays and 7.63 hours of closure time during the weekends. The total bridge closure estimated for the No-Build 2016 Freight and the 2016 Improved Freight, (Combined Effect minus the Proposed Action; data presented in Appendix A) are very similar. However, the 2016 Improved Freight has a lower total daily closure time throughout the week and a reduction of bridge closure that ranges between 4 and 53 minutes during active vessel traffic (6:00am and 6:00pm), except for Wednesday.

Under the Combined Effect, some specific hours could potentially experience longer periods of bridge closure time (above 30 minutes). Extended bridge closure time in a specific hour can be split into several short bridge closings periods (e.g., three -10 minutes closings) with bridge openings between each bridge closure, or they can happen as one bridge closure in that hour (Table 5.4-3). These single extended periods of closure time however, will occur mainly at night and early morning, during which there is decreased vessel traffic compared to daytime hours (Appendix B). In addition these extended bridge closures are usually followed by long periods of bridge openings that should allow all queue vessels to cross without experiencing multiple bridge closures. Even the largest vessels will not take more than 5 to 6 seconds to cross the bridge, thus shorter periods of bridge opening (e.g., 5 minutes) should be enough to clear queue vessels at both sides of the bridge.

Table 5.4-1. Bridge Operation Survey for St. Lucie River Bridge Based on FECR Video Assessment

Day of Week	Time it takes bridge to close	Time it takes train to arrive	Time it takes train to cross	Time it takes Bridge to start opening	Time it takes for Bridge to open	Total Time
Values Represent the Average Times Per Day (hh:mm:ss)						
Monday	0:00:59	0:18:37	0:00:34	0:02:27	0:00:25	0:23:02
Tuesday	0:00:40	0:11:47	0:11:01	0:01:21	0:01:09	0:25:41
Wednesday	0:00:23	0:23:16	0:01:22	0:02:52	0:00:27	0:28:20
Thursday	0:00:32	0:14:54	0:04:18	0:02:04	0:00:27	0:22:18
Friday	0:00:30	0:09:34	0:36:54	0:04:05	0:00:29	0:51:32
Statistics of Raw Data for the Bridge Operation Survey [a] (hh:mm:ss)						
Average	0:00:36	0:14:30	0:08:25	0:02:00	0:00:44	0:26:10
Minimum	0:00:14	0:02:03	0:00:06	0:00:34	0:00:22	0:06:07
Median	0:00:31	0:14:07	0:02:39	0:01:45	0:00:29	0:23:02
Maximum	0:01:26	0:24:11	0:58:02	0:04:05	0:02:57	1:22:15

Note: Each day is an average of multiple observations per day that include both single and multiple trains crossing within the closures observed.

[a] Average data based on 17 observations

Table 5.4-2. Summary of Existing and Projected Bridge Operations for the St. Lucie River Bridge

St Lucie River Bridge	Existing Conditions 2013 F [a]	No-Build Alternative 2016 F [a]	Proposed Action 2016 P [b]	Combined Effect 2016 F + P [b]
	Average Single Daily Closure Time (Minutes)			
Sunday	23	22	18	16
Monday	21	20	15	15
Tuesday	20	19	16	15
Wednesday	20	18	13	15
Thursday	21	20	14	14
Friday	20	19	16	16
Saturday	19	19	13	13
Average Single Daily Closure Time [c] (minutes)	**21**	**20**	**15**	**15**
Total Number of Daily Closures	**10**	**18**	**30**	**42**
	Total Daily Closure Time (Minutes)			
Sunday	158	179	348	458
Monday	227	358	385	583
Tuesday	234	407	372	580
Wednesday	245	411	316	594
Thursday	254	407	355	611
Friday	244	404	357	570
Saturday	171	247	359	457
Average of Total Weekday Closure Time (Minutes)	**241**	**397.4**	**357**	**588**
Average of Total Weekday Closure Time (Hours)	**4.01**	**6.6**	**5.95**	**9.79**
Average of Total Weekend Closure Time (Minutes)	**165**	**213**	**354**	**458**
Average of Total Weekend Closure Time (Hours)	**2.74**	**3.6**	**5.89**	**7.63**

Notes: [a]Results based on RTC modeling data of train and bridge operations with closure times verified with existing field conditions and under the assumption that infrastructure improvements planned under the Proposed Action do not occur.

[b]Results based on RTC modeling data of train and bridge operations for both freight and passenger rail with the planned infrastructure improvements planned under the Proposed Action.

[c]Multiple trains(freight and passenger) can cross under a single bridge closure.

Table 5.4-3. Extended Bridge Closures at St. Lucie River due to Freight and Passenger Train Operations

Day	Bridge Closure Time (hh:mm) [a]	Total Number of Trains	Bridge Closure Time (hh:mm)	Duration of Single Closure (Minutes)	Open Duration Before Next Bridge Closure (Minutes)
Monday	16:09	3	16:09	33	20
Monday	18:09	3	18:09	33	36
Tuesday	18:09	3	18:09	32	40
Tuesday	19:22	2	19:22	33	3
Tuesday	20:00	3	20:00	41	10
Wednesday	16:19	4	16:19	40	16
Wednesday	18:19	3	18:19	33	20
Thursday	14:10	3	14:10	30	35
Thursday	16:22	3	16:22	32	5
Thursday	20:07	3	20:07	34	17
Friday	13:09	3	13:09	32	35
Friday	19:13	4	19:13	33	32

Note: Extended bridge closures are characterized by single closures longer than 30 minutes
[a] Time of day when the extended bridge closure occurs

5.5 Model Simulation Results

No-Build Alternative (Case 2a) Compared to Combined Effect (Case 3)

Table 5.5.1 shows the model results for marine traffic wait times for total vessels (commercial plus recreational), commercial only vessels, and recreational only vessels at St. Lucie Bridge crossing for the four cases identified in Section 2.5.1. When comparing Case 2a (2016 No-Build Alternative) to Case 3 (2016 Freight and Passenger, Combined Effect) an increase in the percentage of vessels experiencing a wait from 14% under the No-Build Alternative to 42% under the Combined Effect is observed. There is a 90% probability that individual vessels that wait will not wait longer than 18.3 minutes under Case 2a, and will not wait longer than 17.6 minutes under Case 3. The average wait times for all vessels that experience a wait is expected to decrease under the Combined Effect as compared to the No-Build Alternative, from 9.9 minutes to 8.1 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect on total vessels. For commercial vessels that wait, wait time is expected to decrease on average from 8.1 minutes under the No-Build Alternative to 7.7 minutes under the Combined Effect. For recreational vessels that wait, wait time is expected to decrease on average from 10.1 minutes under the No-Build Alternative to 8.1 minutes under the Combined Effect.

Based on vessel traffic characterized in the FECR Video Assessment for the St. Lucie Bridge (Table 5.3-1), the highest traffic for commercial and recreational vessels occur from 10:00 am to 6:00 pm. Overall, under the No-Build Alternative (Case 2a) and for the Combined Effect (Case 3) there is a higher probability (>80%) that vessels will not have to experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 5.5-2. In general,

- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 3.5-2); while the maximum vessel queue length with a probability 0.1 to 2.1% of occurrence is over 10 vessels.
- Under the Combined Effect, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence; while the greatest vessel queue length with a probability ranging from 0.1 to 4.3% is over 10 vessels.

Existing Conditions (Case 1) Compared to No-Build Alternative (Case 2a)

When comparing Case 1 (2013 Existing Conditions) to Case 2a (2016 No-Build Alternative) for total vessel traffic, increases in vessel delays are projected. The percentage of vessels that experience a wait time increases from 7% under Existing Conditions to 14% for the No-Build Alternative. There is a 90% probability that individual vessels that wait will not wait longer than 16.5 minutes under Case 1, and will not wait longer than 18.3 minutes under Case 2a. The average wait times for vessels that experience a wait increase under the No-Build Alternative as compared to the Existing Conditions from 8.2 minutes to 9.9 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect of total vessels experiencing a wait. For commercial vessels that wait, wait time is expected to increase on average from 6.1 minutes under Existing Conditions to 8.1 minutes under the No-Build Alternative. For recreational vessels that wait, wait time is expected to increase on average from 8.5 minutes under Existing Conditions to 10.1 minutes under the No-Build Alternative.

Based on vessel traffic characterized in the FECR Video Assessment for the St. Lucie River Bridge (Table 5.3-1), the highest traffic for commercial and recreational vessels occur from 10:00 am to 6:00 pm. under the Existing Condition (Case1) and for the No-Build Alternative (Case 2a) there is a

higher probability that vessels will not experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 5.5-2. In general,

- Under the Existing Conditions a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence; and the maximum vessel queue length with a 0.1 to 0.2 % probability of occurrence is over 10 vessels.
- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 3.5-2); while the maximum vessel queue length with a probability 0.1 to 2.1% of occurrence is over 10 vessels.

No-Build Alternative (Case 2a) Compared to 2016 Improve Freight (Case 2b)

When comparing Case 2a (2016 No-Build Alternative) to Case 2b (2016 Freight, Improved) wait times decrease for total vessel traffic. The percentage of vessels that experience a wait time, decreases from 14% under 2016 No-Build Alternative to 11% for the 2016 Freight, Improved. There is a 90% probability that individual vessels that wait will not wait longer than 18.3 minutes under Case 2a, and will not wait longer than 13 minutes under Case 2b. The average wait times for vessels that experience a wait decrease under the 2016 Freight, Improved as compared to the 2016 No-Build Alternative from 9.9 minutes to 6.9 minutes, respectively.

The effect on vessel wait time for commercial only vessels and recreational only vessels was similar to the effect of total vessels experiencing a wait. For commercial vessels that wait, wait time is expected to decrease on average from 8.1 minutes under the 2016 No-Build Alternative to 5.3 minutes under the 2016 Freight-Improved. For recreational vessels that wait, wait time is expected to decrease on average from 10.1 minutes under the 2016 No-Build Alternative to 7.1 minutes under the 2016 Freight-Improved.

Based on vessel traffic characterized in the FECR Video Assessment for the St. Lucie River Bridge (Table 5.3-1), the highest traffic for commercial and recreational vessels occur from 10:00 am to 6:00 pm. under the No-Build Alternative (Case 2a) and for the 2016 Improved Freight (Case 2b) there is a higher probability that vessels will not experience a wait time. However, the number of vessels that could potentially experience being in a queue from 6:00 am to 6:00 pm is presented in Table 5.5-2. In general,

- Under the No-Build Alternative, a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 3.5-2); while the maximum vessel queue length with a probability 0.1 to 2.1% of occurrence is over 10 vessels.
- Under the 2016 Improved Freight (Case 2b), a vessel queue length (the number of vessels that are experiencing a wait) of 1 vessel for both directions (traveling east or west) has the highest probability of occurrence (Table 5.5-2); while the maximum vessel queue length with a probability 0.1 and 0.7% of occurrence is over 10 vessels.

Table 5.5-1. Simulation Model Results for St. Lucie River Bridge

Case Number		**1**	**2a**	**2b**	**3**
Train Traffic		**2013 F**	**2016 F**	**2016 F**	**2016 F+P**
Infrastructure		**2013 (No-Build)**	**2013 (No-Build)**	**2016 (Build)**	**2016 (Build)**
Marine Traffic	**Units**	**2013**	**2016 Projected**	**2016 Projected**	**2016 Projected**
Total Vessel Wait Times					
Vessel Arrivals	(#/day)	157	157	157	157
Vessels With Zero Wait Time	(#/day)	145	135	140	90
% Vessels With Zero Wait Time		93%	86%	89%	58%
Vessels With Wait Time	(#/day)	11.7	22.5	17	66.7
% Vessels With Wait Time		7%	14%	11%	42%
Avg. Wait Time (all) [a]	(min)	0.6	1.4	0.7	3.4
Avg. Wait Time [b]	(min)	8.2	9.9	6.9	8.1
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	16.5	18.3	13.0	17.6
Commercial Vessel Wait Times					
Vessel Arrivals	(#/day)	9	9	9	9
Vessels With Zero Wait Time	(#/day)	7	7	7	4
% Vessels With Zero Wait Time		83%	78%	81%	51%
Vessels With Wait Time	(#/day)	2	2	2	4
% Vessels With Wait Time		17%	22%	19%	49%
Avg. Wait Time (all) [a]	(min)	1.0	1.8	1.0	3.7
Avg. Wait Time [b]	(min)	6.1	8.1	5.3	7.7
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	16.4	18.3	12.9	16.6
Recreational Vessel Wait Times					
Vessel Arrivals	(#/day)	148	148	148	148
Vessels With Zero Wait Time	(#/day)	138	127	33	86
% Vessels With Zero Wait Time		93%	86%	22%	58%
Vessels With Wait Time	(#/day)	10	21	115	63
% Vessels With Wait Time		7%	14%	78%	42%
Avg. Wait Time (all) [a]	(min)	0.6	1.4	0.7	3.4
Avg. Wait Time [b]	(min)	8.5	10.1	7.1	8.1
Most Likely Vessel Wait Time; >90% Probability of Occurring	(min)	16.5	18.3	13.0	17.7

Notes: [a] Average time all vessels will have to wait before crossing the bridge (average between vessels with wait time and vessels with no wait time)
[b] Average time queue vessels will have to wait before crossing the bridge

Table 5.5-2. Simulation Model Results for Vessel Queue Lengths at St. Lucie River Bridge

Case	Time	Length of Queue (vessels)			
		Minimum Queue	Percent Chance	Maximum Queue	Percent Chance
Case Number: 1 **Train Traffic: 2013 F** **Infrastructure: 2013 (No-Build)** **Marine Traffic: 2013**	6-7 am	1	4.9	3	0.1
	7-8 am	1	3.4	3	0.3
	8-9 am	1	3.9	5	0.1
	9-10 am	1	3.2	7	0.1
	10-11 am	1	1.1	6	0.1
	11 am – 12 noon	1	4.9	6	0.1
	12 noon-1 pm	1	2.0	8	0.1
	1-2 pm	1	1.0	6	0.1
	2-3 pm	1	0.1	1	0.1
	3-4 pm	1	3.1	7	0.1
	4-5 pm	1	4.6	>10	0.2
	5-6 pm	1	0.7	>10	0.1
	6-7 pm	nq	na	nq	na
Case Number: 2a **Train Traffic: 2016 F** **Infrastructure: 2013 (No-Build)** **Marine Traffic: 2016 Projected**	6-7 am	1	4.6	2	0.8
	7-8 am	1	0.5	1	0.5
	8-9 am	nq	na	nq	na
	9-10 am	1	3.8	6	0.2
	10-11 am	1	4.2	>10	0.5
	11 am – 12 noon	1	0.2	1	0.2
	12 noon-1 pm	1	1.6	>10	0.1
	1-2 pm	1	5.2	>10	2.1
	2-3 pm	1	0.4	4	0.1
	3-4 pm	1	1.0	4	0.1
	4-5 pm	1	10.3	>10	1.1
	5-6 pm	1	8.0	>10	0.2
	6-7 pm	1	0.7	4	0.1
Case Number: 2b **Train Traffic: 2016 F** **Infrastructure: 2016** **Marine Traffic: 2016 Projected**	6-7 am	1	2.7	3	0.3
	7-8 am	1	0.3	1	0.3
	8-9 am	nq	na	nq	na
	9-10 am	1	2.8	6	0.1
	10-11 am	1	3.7	>10	0.1
	11 am – 12 noon	1	0.2	1	0.2
	12 noon-1 pm	1	1.0	7	0.1
	1-2 pm	1	4.7	>10	0.7
	2-3 pm	1	0.4	4	0.1
	3-4 pm	1	0.5	3	0.1
	4-5 pm	1	10.4	>10	0.3
	5-6 pm	1	5.8	8	0.1
	6-7 pm	1	0.6	2	0.2
Case Number: 3 **Train Traffic: 2016 F + P** **Infrastructure: 2016** **Marine Traffic: 2016 Projected**	6-7 am	1	5.9	2	0.4
	7-8 am	1	8.4	5	0.1
	8-9 am	1	9.1	7	0.1
	9-10 am	1	9.7	>10	0.1
	10-11 am	1	11.2	>10	1.3
	11 am – 12 noon	1	11.2	>10	0.3
	12 noon-1 pm	1	8.1	>10	1.5
	1-2 pm	1	9.9	>10	4.3
	2-3 pm	1	9.5	>10	0.7
	3-4 pm	1	9.3	>10	0.2
	4-5 pm	1	12.5	>10	1.5
	5-6 pm	1	13.4	>10	0.2
	6-7 pm	1	0.9	7	0.1

6.0 Effect Determination

Impacts to navigation for the New River, Loxahatchee River, and St Lucie River were evaluated based on the criteria described in Table 6.0-1. The following section details the effects of the Proposed Action at each bridge location. As shown in Table 6.0-1, multiple impacts were considered including:

- Percentage of vessels that will be required to wait;
- Vessel queue length and probability of queue to occur;
- Duration and frequency of bridge closure times; and
- Economic impacts to the marine industry.

These effect determinations are consistent with USCG guidance for this study.

Table 6.0-1. Description of Impacts to Navigation for the Effect Determinations

	Description of Impact to Navigation			
Impact	**% of Vessel that Wait**	**Queue Length and Probability**	**Extended Closure Times**	**Economic Impact**
No Impact	Alternative results in no change in vessels that experience a wait during peak traffic hours	Alternative results in no change in vessel queue length during peak traffic hours	Alternative results in no increase in bridge closure times during peak traffic hours	Alternative results in no economic impact to marine industry as a result of longer wait times during peak vessel traffic hours
Minimal	Alternative results in slight changes, not expected to be measureable, in vessels that experience a wait during peak traffic hours	Alternative results in slight changes not expected to be measureable in vessel queue length during peak traffic hours	Alternative results in slight changes not expected to be measureable for bridge closure times during peak traffic hours	Alternative results in slight changes (< 0.1% change) not expected to be measureable to marine industry as a result of longer wait times during peak vessel traffic hours
Minor	Alternative results in <25% of vessels that experience a wait during peak traffic hours	Alternative results in an increase in vessel queue lengths >10 vessels with a probability <2.5% during peak traffic hours	Alternative results in single bridge closure times that are < 30 minutes long during peak traffic hours	Alternative results in a > 0.1% but < 1% increase in the cost of waiting compared to the marine industry value
Moderate	Alternative results in >25% but <40% of vessels that experience a wait during peak traffic hours	Alternative results in an increase in vessel queue lengths >10 vessels with a probability >2.5% but <5% during peak traffic hours	Probability that Alternative result in single bridge closure times that are ≥30 and ≤45 minutes long during peak traffic is less than 1%	Alternative results in a > 1% but < 5% increase in the cost of waiting compared to the marine industry value
Major	Alternative results in >40% of vessels that experience a wait during peak traffic hours	Alternative results in an increase in vessel queue lengths >10 vessels with a probability >5% peak traffic hours	Probability that Alternative will result in single bridge closure times that are ≥30 and ≤45 minutes long during peak traffic is more than 1%	Alternative results in a > 5% increase in the cost of waiting compared to the marine industry value
Enhanced	Alternative results in a decrease in number of vessels that wait during peak traffic hours	Alternative results in a decrease in queue lengths during peak traffic hours	Alternative results in a decrease in bridge closures times during peak traffic hours	Alternative results in a decrease in cost of waiting as a result of longer wait times during peak vessel traffic hours

Based on analysis of modeling results for Existing Conditions and the No-Build and Combined Alternatives, extended closure times (single closure times greater than 30 minutes) create the greatest possible impact to navigation and obstruction of passage. Extended closure times during peak vessel traffic hours can present impacts associated with increased vessel wait times (for those

vessels that wait) as well as extended vessel queue lengths. Vessel wait times associated with extended closure times are limited, as the probability of vessels experiencing a wait time of 30 minutes or greater is less than 1% (Table 6.0-2). Specifically, there is a less than 1% probability that a single vessel will wait for 23.1 minutes at the New River Bridge, 20.2 minutes at the Loxahatchee River Bridge, and 30 minutes at the St. Lucie River Bridge. Furthermore, there is a less than 10% probability that a single vessel will wait for 12.2 minutes at the New River Bridge, 9.8 minutes at the Loxahatchee River Bridge, and 17.6 minutes at the St. Lucie River Bridge.

Those times when peak vessel traffic coincides with single closures greater than 30 minutes under the Combined Effect are described in Tables 6.0-3 through 6.0-5.

Table 6.0-2 Vessel Wait Time Probability per Vessel for the New River, Loxahatchee River, and St. Lucie River

Wait Time Probability per Vessel	New River Wait Time (minutes)	Loxahatchee River Wait Time (minutes)	St. Lucie River Wait Time (minutes)
< 10%	12.2	9.8	17.6
< 1%	23.1	20.2	30.0

Table 6.0-3. Intervals of Time When Peak Vessel Traffic Coincides with Single Closures Greater than 30 Minutes at the New River Bridge

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6-7 am							
7-8 am							
8-9 am							
9-10 am							
10-11 am							
11-noon							
noon-1 pm							
1-2 pm							
2-3 pm							
3-4 pm							
4-5 pm							
5-6 pm				Single Closure >30 min			
6-7 pm		Single Closure >30 min					
7-8 pm							
8-9 pm							
9-10 pm							
10-11 pm		Single Closure >30 min					

Notes: Shaded areas represent high vessel traffic time
Times when high vessel traffic coincide with single closures ≥30 minutes have a probability of occurrence of less than 1%, and are defined as a moderate impact

Table 6.0-4. Intervals of Time When Peak Vessel Traffic Coincides with Single Closures Greater than 30 Minutes at the Loxahatchee River Bridge

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6-7 am							
7-8 am							
8-9 am							
9-10 am							
10-11 am							
11-noon							
noon-1 pm							
1-2 pm							
2-3 pm							
3-4 pm							
4-5 pm							
5-6 pm							
6-7 pm							
7-8 pm							
8-9 pm							
9-10 pm	Single Closure >30 min		Single Closure >30 min				
10-11 pm							

Notes: Shaded areas represent high vessel traffic time
Times when high vessel traffic coincide with single closures ≥30 minutes have a probability of occurrence of less than 1%, and are defined as a moderate impact

Table 6.0-5. Intervals of Time When Peak Vessel Traffic Coincides with Single Closures Greater than 30 Minutes at the St. Lucie River Bridge

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6-7 am							
7-8 am							
8-9 am							
9-10 am							
10-11 am							
11-noon							
noon-1 pm							
1-2 pm					Single Closure >30 min		
2-3 pm				Single Closure >30 min			
3-4 pm							
4-5 pm	Single Closure >30 min		Single Closure >30 min	Single Closure >30 min			
5-6 pm							
6-7 pm	Single Closure >30 min	Single Closure >30 min	Single Closure >30 min				
7-8 pm		Single Closure >30 min			Single Closure >30 min		
8-9 pm		Single Closure >30 min		Single Closure >30 min			
9-10 pm							
10-11 pm							

Notes: Shaded areas represent high vessel traffic time
Times when high vessel traffic coincide with single closures ≥30 minutes have a probability of occurrence of less than 1%, and are defined as a moderate impact

6.1 Effect Determination of No-Build Alternative at the New River Bridge

The No-Build Alternative results in an increase in obstruction of passage compared to Existing Conditions, because of the greater number of bridge closures due to an increase in rail freight traffic. The number of vessels that wait is estimated to increase from 14% to 23%, which represents approximately 20 additional vessels per day. Of the additional number of vessels that wait, it is projected that 3 are commercial vessels and 15 are recreational vessels. In addition, the average wait time for vessels that wait will increase by approximately 2 minutes (Table 6.1-1). This results in a minor impact to the commercial and recreational vessels that wait. Although a measureable change/increase is expected in the percent of vessels that wait, this increase in wait time is not expected to occur during peak traffic hours.

With the exception of a few specific hour periods, the vessel queue length rarely exceeds 10 vessels (Table 6.1-1) and the probability of queue length greater than 10 vessels in any given hour is 2.2%, and queuing is projected to be 10 or fewer vessels for the other 97.8% of the time.

Table 6.1-1. Vessel Wait Times for the New River Bridge, Existing Conditions versus No-Build Alternative

Vessel Traffic Characterization	Units	Existing Conditions	No-Build Alternative
Commercial Vessel Traffic			
Commercial Vessels Experiencing Wait Time [a]	#/day	11	14
Percent Commercial Vessels Experiencing Wait Time	%	21	29
Recreational Vessel Traffic			
Recreational Vessels Experiencing Wait Time [a]	#/day	20	35
Percent Recreational Vessels Experiencing Wait Time	%	12	21
Total Vessel Traffic			
Percent Total Vessels Experiencing Wait Time	%	14	23
Average Wait Time for All Vessels that Wait	min	5.9	7.9
Maximum Probability of Queue Length >10	%	1.4	2.2

Note: [a] Number of vessels rounded to the closest integer

The vertical clearance of the New River Bridge is 4 feet at mean high water level (MHWL). Therefore, recreational vessels requiring a low vertical clearance (under 4 feet) may still traverse under the bridge when it is closed. Additionally, vessels with a higher vertical clearance may traverse under the closed bridge during low water conditions. Since vessels that can currently traverse under the closed bridge will do so under the No-Build Alternative, this is characterized as no impact.

Multiple overhead structures, such as bridges and power cables can obstruct the passage of vessels on the New River. However, the New River Bridge has the lowest vertical clearance (4 feet). The New River Bridge remains open most of the time, closing only to allow the passage of trains. The closed bridge limits vessel passage to the Intracoastal Waterway to the east and to marine facilities to the west. The Broward Boulevard Bridge, located at the North Fork, has a vertical clearance below 5 feet. This bridge limits the passage of vessels in the North Fork. However, the shallow depth of the North Fork limits the passage of larger vessels.

The anticipated increase in average vessel wait times associated with additional bridge closures and unimproved infrastructure would result in an increase in vessel queues of 18 vessels per day. These increased vessel wait times were considered when evaluating economic impacts to commercial developments along the New River. The increase in average vessel wait times for commercial and recreational vessels is estimated to result in an economic impact under the No-Build Alternative (Table 6.1-2) of $373.00 per day. This value is the difference between the estimated economic impacts from the No-Build Alternative compared to the impact of Existing Conditions. This represents less than a 0.1% increase in the total cost of vessel delays per day on the marine industry under the No-Build Alternative.

Table 6.1-2. Economic Model Results for the New River Bridge for Existing Conditions and No-Build Alternative

	Units	Existing Conditions	No-Build Alternative
Total Daily Wait Time for All Vessels	(min/day)	178	390
Commercial Industry			
Vessels Experiencing a Wait	(#/day)	11	14
Cost of Vessel Wait to Marine Industry	($/day)	101	196
Percent Cost Compared to Marine Industry Value	(%)	0.0016	0.0031
Recreational Industry			
Vessels Experiencing a Wait	(#/day)	20	35
Cost of Vessel Wait to Marine Industry	($/day)	215	493
Percent Cost Compared to Marine Industry Value	(%)	0.0040	0.0092
All Vessel Types			
Total Daily Cost of Waiting	($)	316	689
Total Annual Cost of Waiting	($)	115,340	251,485

Port Everglades is located east of the New River Bridge. However, cruise ships, commercial freighters, and other large oceangoing vessels do not access the New River. Therefore the No-Build Alternative would have no impact to existing or future commercial freighter or cruise ship operations at Port Everglades.

Commercial destinations on the New River are primarily boat/yacht repair and support facilities, which would not be anticipated to incur any decline in business as a result of impacts to navigation; therefore the No-Build Alternative is not expected to have impacts to such businesses.

6.2 Effect Determination of No-Build Alternative at the Loxahatchee River Bridge

The No-Build Alternative results in an increase in obstruction of passage compared to Existing Conditions because of the greater number of bridge closures due to an increase in rail freight traffic. The number of vessels that wait is estimated to increase from 7% to 25%, which represents approximately 7 additional vessels per day. At this location, only recreational vessels have an increase in the number of vessels experiencing wait time (no change in the number of commercial vessels that wait are expected under the No-Build Alternative compared to Existing Conditions). In addition, the average wait time for vessels that wait is expected to increase by approximately 1.1 minutes (Table 6.2-1). This results in a minor impact to the recreational vessels that wait. Although a measureable change/increase is expected in the percent of vessels that wait, this increase in wait time is not expected to occur during peak traffic hours.

With the exception of a few specific hour periods, the vessel queue length rarely exceeds 10 vessels (Table 6.2-1) and the probability of a queue length greater than 10 vessels in any given hour is 1.7% with little or no queuing for 98.3% of the time.

Table 6.2-1. Vessel Wait Times for the Loxahatchee River Bridge, Existing Conditions versus No-Build Alternative

Vessel Traffic Characterization	Units	Existing Conditions	No-Build Alternative
Commercial Vessel Traffic			
Commercial Vessels Experiencing Wait Time [a]	#/day	1	1
Percent Commercial Vessels Experiencing Wait Time	%	16	16
Recreational Vessel Traffic			
Recreational Vessels Experiencing Wait Time [a]	#/day	8	15
Percent Recreational Vessels Experiencing Wait Time	%	7	13
Total Vessel Traffic			
Percent Total Vessels Experiencing Wait Time	%	7	25
Average Wait Time for All Vessels that Wait	min	8.3	9.4
Maximum Probability of Queue Length >10	%	1.3	1.7

Note: [a] Number of vessels round to the closest integer

The vertical clearance of the Loxahatchee River Bridge is 4 feet at MHWL. Therefore, recreational vessels requiring a low vertical clearance (under 4 feet) may still traverse under the bridge when it is closed. Additionally, vessels with a higher vertical clearance may traverse under the closed bridge under low water conditions. Since vessels that can currently traverse under the closed bridge under low water conditions will do so under the No-Build Alternative, this is characterized as no impact.

Overhead structures, such as bridges and power cables, traverse the Loxahatchee River and thus obstruct the passage of vessels. Amongst these structures, the Loxahatchee River Bridge has the lowest vertical clearance (4 feet). Although the Loxahatchee River Bridge remains open most of the time, closing only to allow the passage of trains, the closed bridge limits passage to the Intracoastal Waterway to the east and to vessel docks on residential areas to the west. Several other fixed bridges on the South Fork have vertical clearances between approximately 7 feet and 4 feet. The Center Street fixed bridge traverses the Loxahatchee River in two different, but consecutive, locations (interrupted by a peninsula of land) with vertical clearances that are 4.6 and 6 feet high. These bridges limit vessel traffic in Sims Creek and North Jupiter River Estates residential areas located at the South Fork at the Loxahatchee River. The Loxahatchee River Road Bridge traverses the main waterway of the South Fork and has a vertical clearance of 7 feet. This fixed bridge greatly limits the vessel traffic on most of the South Fork.

The anticipated increase in average vessel wait times associated with additional bridge closures and unimproved infrastructure would result in an increase in vessel queues of 7 vessels per day. These increased vessel wait times were considered when evaluating economic impacts to commercial developments along the Loxahatchee River. The increase in average vessel wait times is estimated to result in an economic impact under the No-Build Alternative (Table 6.2-2), of $125 per day. This value is the difference between the estimated economic impacts from the No-Build Alternative compared to the impact of Existing Conditions. This represents less than a 0.1% increase in the total cost of vessel delays per day on the marine industry under the No-Build Alternative.

Table 6.2-2. Economic Model Results for the Loxahatchee River Bridge for Existing Conditions and No-Build Alternative

	Units	Existing Conditions	No-Build Alternative
Total Daily Wait Time for All Vessels	(min)	74	147
Commercial Industry			
Vessels Experiencing a Wait	(#/day)	1	1
Cost of Vessel Wait to Marine Industry	($/day)	7	9
Percent Cost Compared to Marine Industry Value	(%)	0.0005	0.0006
Recreational Industry			
Vessels Experiencing a Wait	(#/day)	8	15
Cost of Vessel Wait to Marine Industry	($/day)	118	241
Percent Cost Compared to Marine Industry Value	(%)	0.0089	0.0182
All Vessel Types			
Total Daily Cost of Waiting	($)	125	250
Total Annual Cost of Waiting	($)	45,625	91,250

There are no cruise ships, commercial freighters, or other large oceangoing vessels that access the Loxahatchee River; therefore, the No-Build Alternative is not expected to have an impact on operations of these types of vessels.

Individual commercial vessels could potentially experience an increase in vessel queue times at the Loxahatchee River Bridge. However, there are very few commercial destinations on the Loxahatchee River, and they would not be anticipated to incur any decline in business as a result of the bridge closures. Therefore, there is no impact under the No-Build Alternative.

6.3 Effect Determination of No-Build Alternative at the St. Lucie River Bridge

Under the No-Build Alternative, an increase in obstruction of passage compared to Existing Conditions is projected, and this is related to a greater number of bridge closures due to an increase in rail freight traffic. Only recreational vessels will have an increase in the number or vessels experiencing wait time (no change in the number of commercial vessels that wait are expected under the No-Build Alternative compared to Existing Conditions). The average wait time for vessels experiencing a wait will increase by approximately 1.7 minutes. This results in a minor impact to the vessels that wait; as there are measureable changes in the percent of vessels that wait, but not primarily during continuous periods of time during peak traffic hours.

With the exception of a few specific hour periods, the vessel queue length rarely exceeds 10 vessels (Table 6.3-1) and the probability of a queue length greater than 10 vessels in any given hour is 2.1%, with little or no queuing for 97.2% of the time.

Table 6.3-1. Vessel Wait Times for the St. Lucie River Bridge, Existing Conditions versus No-Build Alternative

Vessel Traffic Characterization	Units	Existing Conditions	No-Build Alternative
Commercial Vessel Traffic			
Commercial Vessels Experiencing Wait Time [a]	#/day	2	2
Percent Commercial Vessels Experiencing Wait Time	%	17	22
Recreational Vessel Traffic			
Recreational Vessels Experiencing Wait Time [a]	#/day	10	21
Percent Recreational Vessels Experiencing Wait Time	%	7	14
Total Vessel Traffic			
Percent Total Vessels Experiencing Wait Time	%	7	14
Average Wait Time for All Vessels that Wait	min	8.2	9.9
Maximum Probability of Queue Length >10	%	0.2	2.1

Note: [a] Number of vessels round to the closest integer

The vertical clearance of the St. Lucie River Bridge is 7 feet at MHWL. Therefore, recreational vessels requiring a low vertical clearance (under 7 feet) may still traverse under the bridge even when closed without obstruction. Additionally, vessels with a higher vertical clearance may traverse under the closed bridge under low water conditions without obstruction. Since vessels that can currently traverse under the closed bridge under low water conditions will do so under the No-Build Alternative, this is characterized as no impact.

Overhead structures, such as bridges and power cables, traverse the St. Lucie River and thus obstruct the passage of vessels. Amongst these structures, the St. Lucie River Bridge has the lowest vertical clearance in the confluence of the river (7 feet). Although the St. Lucie River Bridge remains open most of the time, closing only to allow the passage of freight, the closed bridge limits passage to the Intracoastal Waterway to the east and to vessel docks on residential areas to the west. Several other fixed bridges traverse the main waterway of the South Fork and the St. Lucie canal, some with vertical clearances lower than 7 feet. These bridges will limit the traffic of larger vessels in certain sections of the St. Lucie Canal.

The anticipated increase in average vessel wait times associated with additional bridge closures and unimproved infrastructure would result in an increase in vessel queues of 11 vessels per day. These increased vessel wait times were considered when evaluating economic impacts to commercial developments along the St Lucie River. The increase in average vessel wait times is estimated to result in an economic impact under the No-Build Alternative (Table 6.3-2), of $209 per day. This value is the difference between the estimated economic impacts from the No-Build Alternative compared to the impact of Existing Conditions. This represents less than a 0.1% increase in the total cost of vessel delays per day on the marine industry under the No-Build Alternative.

Table 6.3-2. Economic Model Results for the St. Lucie River Bridge for Existing Conditions and No-Build Alternative

	Units	Existing Conditions	No-Build Alternative
Average Wait Time for all Vessels	(min)	96	223
Commercial Industry			
Vessels Experiencing a Wait	(#/day)	2	2
Cost of Vessel Wait to Marine Industry	($/day)	15	26
Percent Cost Compared to Marine Industry Value	(%)	0.0006	0.0011
Recreational Industry			
Vessels Experiencing a Wait	(#/day)	10	21
Cost of Vessel Wait to Marine Industry	($/day)	143	341
Percent Cost Compared to Marine Industry Value	(%)	0.0065	0.0156
All Vessel Types			
Total Daily Cost of Waiting	($)	158	367
Total Annual Cost of Waiting	($)	57,670	133,955

There are no cruise ships, commercial freighters, or other large oceangoing vessels that access the St. Lucie River; therefore, the No-Build Alternative is not expected to impact the existing or future operations of these types of vessels.

Individual commercial vessels could potentially experience an increase in vessel queue times at the St. Lucie River Bridge. However, there are very few commercial destinations on the St. Lucie River, and they would not be anticipated to incur any decline in business as a result of the moderate impacts to navigation under the No-Build Alternative.

6.4 Combined Effect Determination at the New River Bridge

Under the Combined Effect (2016 Freight + Passenger), an increase in obstruction of passage compared to the No-Build Alternative is projected, creating a minor to moderate impact before mitigation. This increase in obstruction of passage results from an increase in the number of bridge closures and the frequency of closures. This increases the number of vessels that experience a wait time from 23% to 36%, which represents approximately 27 additional vessels per day (6 commercial vessels and 21 recreational vessels). However, the average wait time for vessels experiencing a wait will decrease approximately 1.6 minutes (from 7.9 to 6.3 minutes), when compared to the No-Build Alternative (Table 6.4-1). This results in a minor impact to vessels that wait before mitigation.

With the exception of a few specific hour periods, the vessel queue length rarely exceeds 10 vessels (Table 6.4-1). However, the likelihood of a queue length greater than 10 in any given hour is only 2.0% (a decrease of 0.2% when compared to the No-Build Alternative). Therefore, under the Combined Effect, there is a minor impact to vessel queue length.

Impacts to the percent of vessels that wait, the queue length and the probability these impacts occur, may be reduced or eliminated through mitigation (see Section 7.0).

Table 6.4-1. Vessel Wait Times for the New River Bridge, No-Build Alternative versus Combined Effect

Vessel Traffic Characterization	Units	No-Build Alternative	Combined Effect	Proposed Action[a]
Commercial Vessel Traffic				
Commercial Vessels Experiencing Wait Time[b]	#/day	14	20	6
Percent Commercial Vessels With Wait Time	%	29	41	12
Recreational Vessel Traffic				
Recreational Vessels Experiencing Wait Time[b]	#/day	35	56	21
Percent Recreational Vessels With Wait Time	%	21	34	13
Total Vessel Traffic				
Percent Total Vessels Experiencing Wait Time	%	23	36	12
Average Wait Time for All Vessels that Wait	min	7.9	6.3	-1.6
Number of Hours with Queue Length >10		7	8	1
Maximum Probability of Queue Length >10	%	2.2	2.0	-0.2

Notes: [a] Proposed Action = Combined effects − No-Build Alternative effects; values show increase and decrease compared to the No-Build Alternative
[b] Number of vessels round to the closest integer

Impacts due to extended closure times are expected to be moderate under the Combined Effect before mitigation. Moderate impacts are defined as the probability that an alternative will result in single bridge closure times that are greater than 30 and less than 45 minutes long during peak traffic is less than 1%. Based on modeling, extended closure times at the New River Bridge are limited to Thursday between 5 pm and 6 pm. (Table 3.4-6). Since other extended closures do not occur during peak vessel traffic hours, these closures are considered a moderate impact. Due to the variability of freight train arrival times in the RTC model, there is an associated level of uncertainty with freight arrival times. As explained in Section 7, the moderate impacts due to increased closure times associated with the Combined Effect may be reduced, or eliminated, through mitigation.

The vertical clearance of the New River Bridge is 4 feet at MHWL. Vessels requiring a low vertical clearance (under 4 feet) may still traverse under the bridge when it is closed. Therefore, vessels that only require this clearance to pass under the bridge will not be affected by changes in operations.

The increase in average vessel wait times results in minor economic impact under the Combined Effect (Table 6.4-2), which is estimated at $161 per day (a decrease in loss of $212 per day when compared to the No-Build Alternative versus Existing Conditions). This is the cost of the total vessel delay per day on the marine industry under the Combined Effect, and creates a minimal impact as there is a less than 0.1% increase in the percent cost of waiting compared to the marine industry value at the New River, when compared to the No-Build Alternative.

Table 6.4-2. Economic Model Results for the New River Bridge No-Build Alternative and Combined Effect

	Units	No-Build Alternative	Combined Effect	Proposed Action
Average Wait Time for all Vessels	(min)	390	481	91
Commercial Industry				
Vessels Experiencing a Wait	(#/day)	14	20	6
Cost of Vessel Wait to Marine Industry	($/day)	196	239	43
Percent Cost Compared to Marine Industry Value	(%)	0.0031	0.0038	0.0007
Recreational Industry				
Vessels Experiencing a Wait	(#/day)	35	56	21
Cost of Vessel Wait to Marine Industry	($/day)	493	611	118
Percent Cost Compared to Marine Industry Value	(%)	0.0092	0.0114	0.0022
All Vessel Types				
Total Daily Cost of Waiting	($)	689	850	161
Total Annual Cost of Waiting	($)	251,485	310,250	58,765

Commercial destinations on the New River are primarily boat/yacht repair and support facilities. These facilities are anticipated to incur minor impacts to their business as a result of the moderate impacts of the Combined Effect on vessel wait times and queue lengths.

Port Everglades is located east of the New River Bridge. Cruise ships, commercial freighters, and other large oceangoing vessels do not access the New River, and implementation of the Combined Effect would therefore have no impact to existing or future operations at Port Everglades.

6.5 Combined Effect Determination at the Loxahatchee River Bridge

Under the Combined Effect (2016 Freight + Passenger), an increase in obstruction of passage compared to the No-Build Alternative is projected, creating a moderate impact before mitigation. This increase in obstruction of passage is related to an increase in the number of vessels that experience a wait due to an overall increase in the number of bridge closures. The number of vessels that experience a wait increases from 25% to 42%, which represents approximately 31 additional vessels per day (1 commercial vessel and 30 recreational vessels). However, average wait time is reduced under the Combined Effect. The average wait time for vessels experiencing a wait is estimated to decrease 3.7 minutes, when compared to the No-Build Alternative (Table 6.5-1). This results in a minor impact to the vessels that wait, when compared to the No-Build Alternative.

With the exception of a few specific hour periods, the vessel queue length rarely exceeds 10 vessels (Table 6.5-1). The likelihood of a queue length greater than 10 vessels in any given hour is 0.5% (a decrease of 1.2% when compared to the No-Build Alternative).

Impacts to the percent of vessels that wait, the queue length, and the probability these impacts occur, may be reduced or eliminated through mitigation (see Section 6.7).

Table 6.5-1. Vessel Wait Times for the Loxahatchee River Bridge, No-Build Alternative versus Combined Effect

Vessel Traffic Characterization	Units	No-Build Alternative	Combined Effect	Proposed Action[a]
Commercial Vessel Traffic				
Commercial Vessels Experiencing Wait Time [b]	#/day	1	2	1
Percent Commercial Vessels With Wait Time	%	16	44	28
Recreational Vessel Traffic				
Recreational Vessels Experiencing Wait Time [b]	#/day	15	45	31
Percent Recreational Vessels With Wait Time	%	13	39	26
Total Vessel Traffic				
Percent Total Vessels Experiencing Wait Time	%	25	42	17
Average Wait Time for All Vessels that Wait	min	9.4	5.7	-3.7
Maximum Probability of Queue Length >10	%	1.7	0.5	-1.2

Notes: [a] Proposed Action = Combined effects − No-Build Alternative effects; values show increase and decrease compared to the No-Build Alternative
[b] Number of vessels round to the closest integer

Impacts to extended closure times are expected to be minor under the Combined Effect before mitigation. For the Loxahatchee River Bridge, these extended closure times are limited to non-peak hours of Monday and Wednesday from 9:00 pm to 10:00 pm (Table 4.4-3). Since the single extended closures do not occur during peak vessel traffic hours, these closures are considered a minor impact. Due to the variability of freight train arrival times in the RTC model, there is an associated level of uncertainty with freight arrival times. Under the Combined Effect, no extended closure times occur on weekends when vessel traffic is the highest, and therefore, there is an overall minor impact on navigation. Furthermore, as explained in Section 7, these impacts may be reduced, or eliminated, through mitigation.

The vertical clearance of the Loxahatchee Bridge is 4 feet at MHWL. Vessels requiring a low vertical clearance (under 4 feet) may still traverse under the bridge when it is closed. Therefore, vessels that only require this clearance to pass under the bridge will not be affected by changes in operations.

The estimated economic impact under the Combined Effect (Table 6.5-2) is $208 per day (an increase of $83 per day when compared to the No-Build Alternative). This is the impact of the increased total vessel delay per day on the marine industry under the Combined Effect and represents less than a 0.1% increase. This is considered a minor effect.

Table 6.5-2. Economic Model Results for the Loxahatchee River FECR Bridge No-Build Alternative and Combined Effect

	Units	No-Build Alternative	Combined Effect	Proposed Action
Average Wait Time for all Vessels	(min)	147	269	122
Commercial Industry				
Vessels Experiencing a Wait	(#/day)	1	2	1
Cost of Vessel Wait to Marine Industry	($/day)	9	18	9
Percent Cost Compared to Marine Industry Value	(%)	0.0006	0.0012	0.0006
Recreational Industry				
Vessels Experiencing a Wait	(#/day)	15	45	30
Cost of Vessel Wait to Marine Industry	($/day)	241	440	199
Percent Cost Compared to Marine Industry Value	(%)	0.0182	0.0331	0.0150
All Vessel Types				
Total Daily Cost of Waiting	($)	250	458	208
Total Annual Cost of Waiting	($)	91,250	167,170	75,920

There are very few commercial destinations on the Loxahatchee River, as most of the waterfront development is residential. The few commercial destinations are not expected to incur any decline in business as a result of the Combined Alternative's effect on navigation.

There are no cruise ships, commercial freighters, or other large oceangoing vessels that access the Loxahatchee River; therefore, the Combined Effect would have no impact to existing or future operations of these types of vessels.

6.6 Combined Effect Determination at the St. Lucie River Bridge

Under the Combined Effect (2016 Freight + Passenger), an increase in obstruction of passage compared to the No-Build Alternative is projected, creating a moderate impact before mitigation. This increase in obstruction of passage is related to an increase in the number of vessels that experience a wait due to an overall increase in the number of bridge closures. The number of vessels that experience a wait time increases from 14% to 42%, which represents approximately 44 additional vessels per day (2 commercial vessels and 42 recreational vessels); however, a decrease average wait time is observed. Accordingly, under the Combined Effect, the average wait time for vessels experiencing a wait will decrease approximately 1.8 minutes when compared to the No-Build Alternative (Table 6.6-1). This results in a moderate impact before mitigation to the percent of vessels that wait, when compared to the No-Build Alternative.

With the exception of a few specific hour periods, the vessel queue length rarely exceeds 10 vessels (Table 6.6-1). The likelihood of a queue length greater than 10 vessels in any given hour is 4.3%.

Impacts to the percent of vessels that wait, the queue length, and the probability these impacts occur, may be reduced or eliminated through mitigation (see Section 6.7).

Table 6.6-1. Vessel Wait Times for the St. Lucie River Bridge, No-Build Alternative versus Combined Effect

Vessel Traffic Characterization	Units	No-Build Alternative	Combined Effect	Proposed Action[a]
Commercial Vessel Traffic				
Commercial Vessels Experiencing Wait Time [b]	#/day	2	4	2
Percent Commercial Vessels With Wait Time	%	22	49	27
Recreational Vessel Traffic				
Recreational Vessels Experiencing Wait Time [b]	#/day	21	63	42
Percent Recreational Vessels With Wait Time	%	14	42	28
Total Vessel Traffic				
Percent Total Vessels Experiencing Wait Time	%	14	42	28
Average Wait Time for All Vessels that Wait	min	9.9	8.1	-1.8
Maximum Probability of Queue Length >10	%	0.2	4.3	4.1

Notes: [a] Proposed Action = Combined effects − No-Build Alternative effects; values show increase and decrease compared to the No-Build Alternative
[b] Number of vessels round to the closest integer

The Combined Effect Alternative will result in moderate impacts to vessel navigation before mitigation due to the projected duration and frequency of bridge closures. Moderate impacts are defined as a single bridge closure time that is greater than 30 minutes, but less than 45 minutes, and occurs less than 10 percent of the time during peak vessel traffic. For the St. Lucie River Bridge, these extended closure times occur Monday, Wednesday, and Thursday between 4 pm and 5 pm, Thursday between 2 pm and 3 pm, and Friday between 1 pm and 2 pm (Table 5.4-3). The hours listed between noon and 6 pm have the potential to result in moderate impacts to navigation as these hours occur during the peak vessel traffic time. Due to the variability of freight train arrival times in the RTC model, there is an associated level of uncertainty with freight arrival times. Under the Combined Effect, no extended closure times occur on weekends, when vessel traffic is the highest. As explained in Section 7.0, these impacts may be reduced, or eliminated, through mitigation.

The vertical clearance of the St. Lucie River Bridge is 7 feet at MHWL. Vessels requiring a low vertical clearance (under 7 feet) may still traverse under the bridge when it is closed. Therefore, vessels that only require this clearance to pass under the bridge will not be affected by changes in operations.

The estimated economic impact under the Combined Effect (Table 6.6-2) is $520 per day (an increase of $311 per day when compared to the No-Build Alternative). This is the impact of the increased total vessel delay per day on the marine industry under the Combined Effect and represents less than a 0.1% increase in the percent cost of waiting compared to the marine industry value at the St. Lucie River. This is considered a minor effect.

Table 6.6-2. Economic Model Results for the St. Lucie River Bridge No-Build Alternative and Combined Effect

	Units	No-Build Alternative	Combined Effect	Proposed Action
Average Wait Time for all Vessels	(min)	223	239	315.5
Commercial Industry Wait Times				
Vessels Experiencing Wait Time	(#/day)	9	4	-4
Cost of Vessel Delay to Marine Industry	($/day)	26	55	29
Percent Cost Compared to Marine Industry Value	(%)	0.0011	0.0023	0.0012
Recreational Industry Wait Times				
Vessels Experiencing Wait Time	(#/day)	148	165	17
Cost of Vessel Delay to Marine Industry	($/day)	341	832	491
Percent Cost Compared to Marine Industry Value	(%)	0.0156	0.0381	0.0225
All Vessel Types				
Total Daily Cost of Waiting	($)	367	887	520
Total Annual Cost of Waiting	($)	133,955	323,755	189,800

Commercial destinations on the St. Lucie River are primarily vessel/yacht repair and support facilities, which would not be anticipated to incur any decline in business as a result of the impacts of the Combined Effect on navigation and, therefore, the Combined Effect would have minimal impact to such businesses.

There are no cruise ships, commercial freighters, or other large oceangoing vessels that access the St. Lucie River and the Combined Effect would therefore have minimal impact on existing or future operations of these types of vessels.

6.7 Mitigation

Mitigation options are being considered by AAF to improve operations at the New River Bridge, Loxahatchee River Bridge, and St. Lucie River Bridge. These include:

- **Develop a set schedule for the down times of the bridge for passenger rail service**. Passenger rail service is anticipated to operate on consistent daily schedules that are both predictable and reliable with minimal deviations. Once local mariners are familiar with the passenger rail schedule, they should be able to predict approximate crossing times on a given day without having to look up the schedule because it will be consistent and unchanging from week to week. Developing a predictable schedule for passenger train crossing times will allow mariners, especially day to day commercial vessels, to plan their travel times accordingly and avoid unnecessary wait times. Local recreational mariners will also have access to the bridge schedules to plan accordingly and every effort should be made to inform non-local mariners of the bridge down times to avoid wait times and vessel stacking in the bridge vicinity.
- **Provide public access to the bridge closure schedules in an internet-accessible format updated daily with anticipated crossing times for each bridge**. Schedules for each bridge may be posted on the AAF website and/or the USCG website. Internet sites will provide estimated bridge crossing times so mariners may access real-time data from the water and plan appropriate travel times. This will also help the boating community to plan their trips to avoid wait times and related costs associated with the Proposed Action. Schedules and/or information on how to get up to date bridge down times may also be made available at local marinas and tackle shops.
- **Implement a notification sign/signal/horn at each bridge location with countdowns to indicate the times at which the bridge will begin to close and open**. Similar to a road crossing, the notification system will alert mariners within the vicinity that a train is approaching and provide a countdown for bridge closings and openings. The countdown will make mariners

aware of the time available to get through the bridge crossing before closing as well as the time to wait for it to re-open. This notification system will provide information to mariners associated with the opening and closing of the bridges to allow for planning of trips for those in the vicinity of the bridge.

- **Develop formal contact with first responders and emergency personnel**. A point of contact will be established to ensure that emergency personnel can coordinate with the dispatch center when access is necessary to respond to waterway emergencies.
- **Develop coordination plans between AAF and local authorities during peak vessel travel times on holidays and major public events**. Local authorities will have the ability to contact AAF in order to coordinate plans for certain special events and occasions in an effort to establish adjustments to train schedules that would allow the bridge to be open for specified periods of time.
- **Develop a coordination plan between AAF and the USCG to promote with commercial and recreational boating communities**. Such a plan would allow for updates to the bridge operating schedules to be disseminated through the USCG and local marinas as well as on the official website used for scheduling information.
- **Addition of a tender at the New River Bridge**. The New River has the greatest amount of commercial traffic (as compared to the Loxahatchee River Bridge and St. Lucie River Bridge). The addition of a bridge tender would allow better communication with commercial vessels in that the tender could be contacted directly by mariners with a need for information for planning purposes in order to minimize wait times.

In order for mitigation to reduce the effect determination by at least one level (i.e., reduce the impact from moderate to minor), each criterion was evaluated to determine the required percent reduction in impact to navigation to meet the threshold limit to be classified as minimal, minor, or no impact (Table 6.0-1). These percentages and the reduction in impacts with mitigation are reported in Tables 6.7-1, 6-7.2, and 6.7-3 for the New River, Loxahatchee River, and St Lucie River, respectively.

Table 6.7-1. Impacts to Navigation Before and After Mitigation for the New River Bridge

Effect Determination Criteria [a]	No-Build Alternative	Combined Effect (Proposed Action)	Reduction to Impacts to Meet Mitigation Goal	Combined with Mitigation
Obstruction of passage *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	30%	Minor
Most navigationally limiting structure *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	30%	Minor
Impacts to jobs, economic growth and development *Economic Impacts*	Minimal	Minimal	0.015%	No Impact (N/A)
Economic impacts to existing or planned commercial/industrial developments *Economic Impact*	Minimal	Minimal	0.015%	No Impact (N/A)
Impacts to unique or critical infrastructure	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to USACE transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	30%	Minor
Impacts to USCG transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	30%	Minor
Impacts to existing and future cruise ship ports-of-call/terminals	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to commercial freighters	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to ports supporting post-panamax vessels	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to vessels that produce unique products for the region	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to vessels that require tug boats *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	30%	Minor
Impacts to proposed commercial vessels as a result of proposed development *Economic Impact* *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	30%	Minimal
Ability of vessels to adjust operations without significant economic loss in order to transit the Proposed Action	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Availability of alternative routes for vessel passage	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Ability of vessels to transit at typical lower water stages	No impact (N/A)	No impact (N/A)	-	No impact (N/A)

Notes: [a] Effect determination for factors to be considered by the USCG was determined based on the identified criteria in italics of either % of vessels that wait, queue length, economic impacts and extended bridge closures or a combination of these criteria. The overall effect determination reflects the highest impact of the combined impact determination criteria of each Category.

Table 6.7-2. Impacts to Navigation Before and After Mitigation for the Loxahatchee River Bridge

Effect Determination Criteria [a]	No-Build Alternative	Combined Effect (Proposed Action)	Reduction to Impacts to Meet Mitigation Goal	Combined with Mitigation
Obstruction of passage *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	36%	Minimal
Most navigationally limiting structure *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	36%	Minimal
Impacts to jobs, economic growth and development *Economic Impacts*	Minimal	Minimal	0.034%	No Impact
Economic impacts to existing or planned commercial/industrial developments *Economic Impact*	Minimal	Minimal	0.034%	No Impact
Impacts to unique or critical infrastructure	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to USACE transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	36%	Minimal
Impacts to USCG transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	36%	Minimal
Impacts to existing and future cruise ship ports-of-call/terminals	No impact	No impact	-	No impact
Impacts to commercial freighters	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to ports supporting post-panamax vessels	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to vessels that produce unique products for the region	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to vessels that require tug boats *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	36%	Minimal
Impacts to proposed commercial vessels as a result of proposed development *Economic Impact* *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	36%	Minimal
Ability of vessels to adjust operations without significant economic loss in order to transit the Proposed Action	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Availability of alternative routes for vessel passage	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Ability of vessels to transit at typical lower water stages	No Impact	No Impact	-	No Impact

Notes: [a] Effect determination for factors to be considered by the USCG was determined based on the identified criteria in italics of either % of vessels that wait, queue length, economic impacts and extended bridge closures or a combination of these criteria. The overall effect determination reflects the highest impact of the combined impact determination criteria of each Category.

Table 6.7-3. Impacts to Navigation Before and After Mitigation for the St. Lucie River Bridge

Effect Determination Criteria [a]	No-Build Alternative	Combined Effect (Proposed Action)	Reduction to Impacts to Meet Mitigation Goal	Combined with Mitigation
Obstruction of passage *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	41%	Minor
Most navigationally limiting structure *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	41%	Minor
Impacts to jobs, economic growth and development *Economic Impacts*	Minimal	Minimal	0.040%	No Impact
Economic impacts to existing or planned commercial/industrial developments *Economic Impact*	Minimal	Minimal	0.040%	No Impact
Impacts to unique or critical infrastructure	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to USACE transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	41%	Minor
Impacts to USCG transit ability *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	41%	Minor
Impacts to existing and future cruise ship ports-of-call/terminals	No impact	No impact	-	No impact
Impacts to commercial freighters	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to ports supporting post-panamax vessels	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to vessels that produce unique products for the region	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Impacts to vessels that require tug boats *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Moderate	41%	Minor
Impacts to proposed commercial vessels as a result of proposed development *Economic Impact* *% of vessels that wait* *Queue length* *Extended closure times*	Minor	Minor	41%	Minimal
Ability of vessels to adjust operations without significant economic loss in order to transit the Proposed Action	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Availability of alternative routes for vessel passage	No impact (N/A)	No impact (N/A)	-	No impact (N/A)
Ability of vessels to transit at typical lower water stages	No Impact	No Impact	-	No Impact

Notes: [a] Effect determination for factors to be considered by the USCG was determined based on the identified criteria in italics of either % of vessels that wait, queue length, economic impacts and extended bridge closures or a combination of these criteria. The overall effect determination reflects the highest impact of the combined impact determination criteria of each Category.

7.0 Conclusions

The purpose of this Navigation Discipline Report is to provide navigational information for consideration by the USCG to allow an informed decision-making on the Proposed Action. This study evaluated the potential for environmental, economic and navigational impacts associated with the Proposed Action. More specifically, this study estimates the extent to which the projected increase in bridge closure times will effect commercial and recreational vessels traversing under each of FECR's operable bridges at the New River, Loxahatchee River, and the St. Lucie River. The USCG, in its June 2, 2014 letter, supports including the NDR as "an attachment to the DEIS as it informs the choice of alternatives for analysis."

7.1 Key Findings

Based on the areas of required evaluation by the USCG, the findings of this study indicate that the Proposed Action does not have a major socioeconomic, navigational or maritime delay impact on any of the three operable bridges. Furthermore, applying the proposed mitigation measures enables any identified impacts to be reduced. This mitigation will enable the impacts to be improved to be equal to or better than the No-Build Alternative conditions.

There is a less than 1% probability that a single vessel will wait for 23.1 minutes at the New River Bridge, 20.2 minutes at the Loxahatchee River Bridge, and 30 minutes at the St. Lucie River Bridge. Furthermore, there is a 90% probability that a single vessel will not have to wait for more than 12.2 minutes at the New River Bridge, 9.8 minutes at the Loxahatchee River Bridge, and 17.6 minutes at the St. Lucie River Bridge.

Passenger trains will operate under a set schedule and therefore were modeled as such. However, due to the variability of freight train arrival times (±10 minutes) in the RTC model, there is an associated level of uncertainty with freight arrival times. Therefore, the likelihood of a 30+ minute bridge closure at any of the three operable bridges is unlikely, with less than 1% probability of such a closure occurring. Table 7.1-1 provides a summary of total economic impact to the total marine industry resulting from recreational and commercial vessels delays at each of the three operable bridges. As shown, the total daily economic impacts due to vessel delays range from $483.20 for the Loxahatchee River to $924.52 for the St. Lucie River, and represent 0.034% and 0.040% of the daily total marine industry values for each of the rivers. These vessel delays associated with the Proposed Action have a minimal impact on the total marine industry and have the potential for no impact after mitigation.

Table 7.1-1. Total Economic Impact (before mitigation) to Total Marine Industry Value Resulting from Vessel Delays

Location	Economic Impact Due to Vessel Delays (Daily)	Marine Industry Value (Daily)	Percent of Total Marine Industry Value
New River	$881.55	$5,786,301.37	0.015%
Loxahatchee River	$483.20	$1,406,849.32	0.034%
St. Lucie River	$924.52	$2,288,767.12	0.040%

7.1.1 New River Bridge

The following observations, and effects to marine navigation and the marine industry, related to proposed bridge operational changes are reported:

- Peak usage times for maritime use were observed to generally be in winter months (January and February) and on weekends.
- Based on video surveillance, the average number of recreational vessels and commercial vessels traversing through the New River Bridge opening per day were 166 and 49, respectively in January 2014.

- Under the No-Build Alternative, an estimated 77% of vessels traversing through the New River Bridge experience no wait time due to bridge closures. This is projected to decrease to 64% with the Proposed Action (before mitigation). During peak vessel traffic times, the estimated average wait times for vessels that queue on either side of the bridge is 7.9 minutes under the No-Build Alternative. However, the wait time for vessels that queue is projected to decrease by 1.6 minutes with the Proposed Action (before mitigation). Under the No-Build Alternative, the estimated cost of recreational and commercial vessels delays due to queue is 0.0123% of the total value of the marine industry in the New River. Under the Proposed Action, this is projected to decrease to 0.0029% (before mitigation).

7.1.2 Loxahatchee River Bridge

The following observations, and effects to marine navigation and the marine industry, related to proposed bridge operational changes are reported:

- Based on video surveillance, the average number of recreational vessels and commercial vessels traversing through the Loxahatchee River Bridge opening per day were 117 and 4, respectively in January 2014.
- Under the No-Build Alternative, an estimated 87% of vessels traversing through the Loxahatchee River Bridge experience no wait time due to bridge closures. This is projected to decrease to 61% with the Proposed Action (before mitigation). During peak vessel traffic, the estimated average wait times for vessels that queue on either side of the bridge is 9.4 minutes under the No-Build Alternative. However, the wait time for vessels that queue is projected to decrease by 3.7 minutes under the Proposed Action (before mitigation). Under the No-Build Alternative, the estimated cost of recreational and commercial vessels delays due to queue is 0.0188% of the total value of the marine industry in the Loxahatchee River. Under the Proposed Action, this is projected to decrease to 0.0156% (before mitigation).

7.1.3 St. Lucie River Bridge

The following observations, and effects to marine navigation and the marine industry, related to proposed bridge operational changes are reported:

- Based on video surveillance, the average number of recreational vessels and commercial vessels traversing through the St. Lucie River Bridge opening per day were 148 and 9, respectively, in January 2014.
- Under the No-Build Alternative, an estimated 86% of vessels traversing through the St. Lucie River Bridge experience no wait time due to bridge closures. This is projected to decrease to 57% with the Proposed Action (before mitigation). During peak vessel traffic volumes, the estimated average wait times for vessels that queue on either side of the bridge is 9.9 minutes under the No-Build Alternative. However, the wait time for vessels that queue is projected to *decrease* by 1.8 minutes under the Proposed Action (before mitigation). Under the No-Build Alternative, the estimated cost of recreational and commercial vessels delays due to queue is 0.0167% of the total value of the marine industry in the St. Lucie River. Under the Proposed Action, this is projected to increase to 0.0237% (before mitigation).

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9.0 Appendices