Merritt Island National Wildlife Refuge

Transit Planning Study

July 2015

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John A. Volpe National Transportation Systems Center

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This study for the Fish and Wildlife Service (FWS) identifies and analyzes options for enhancing existing transit service at Merritt Island National Wildlife Refuge (the Refuge), a regional destination in Florida's Space Coast which serves approximately 1 million visitors annually. The Refuge, a popular destination for birders and tourists, experiences seasonal congestion at high-use visitor sites. Additionally, the Refuge acknowledges the opportunity to expand access to new user groups and serve visitors in a more sustainable manner through transit. The study team researched existing conditions on the Refuge and the surrounding community, safety, staff capacity, financial resources, and other considerations to develop a number of short- and long-term transit scenarios. The study presents specific considerations for FWS and its partners as they move to enhance transit service on the Refuge.

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The authors wish to thank the numerous individuals who graciously provided their time, knowledge and guidance in the development of this report. A full list of stakeholders involved in the development of this plan is available in Appendix G. Those of particular note are listed below:

Merritt Island National Wildlife Refuge

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Sandra Mickey, *Supervisory Refuge Ranger*

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Mike Legare, *Supervisory Wildlife Biologist*

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Canaveral National Seashore

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Shawn Harris, *Facility Manager*

All photos are by the Volpe Center or U.S. Fish and Wildlife Service unless otherwise noted.

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List of Acronyms

BPWD	Black Point Wildlife Drive
CCP	Comprehensive Conservation Plan
CDL	Commercial Driver's License
CGS	Contracting and General Services
CNS	Canaveral National Seashore
EEL	Brevard County Environmentally Endangered Lands
FDOT	Florida Department of Transportation
FTE	Full time employee
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U.S. Fish and Wildlife Service
ICW	Intracoastal Waterway
KSC	Kennedy Space Center
MINWR	Merritt Island National Wildlife Refuge
MIWA	Merritt Island Wildlife Association
NASA	National Aeronautics and Space Administration
NPS	National Park Service
NWR	National Wildlife Refuge
RAPP	Refuge Annual Performance Plan
REA	Federal Lands Recreation Enhancement Act
RFP	Request for Proposals
RSL	Remaining service life
SCAT	Space Coast Area Transit
SR	State Route
TPO	Transportation Planning Organization
TRIPTAC	Transit in Parks Technical Assistance Center
VIC	Visitor Information Center
VSP	Visitor Services Plan
WO	Wildlife Observation

Introduction

Merritt Island National Wildlife Refuge
Transit Planning Study

Merritt Island National Wildlife Refuge (MINWR or Refuge) encompasses 140,000 acres of habitat and wildlife on Merritt Island, located on Florida's east central coast approximately 60 miles east of Orlando and three miles east of the City of Titusville. With more than 1.1 million visitors annually, the Refuge is a flagship destination in the Space Coast region and one of the most popular units within the National Wildlife Refuge System (NWRS).

The combination of a large land area and a large visitor base results in management challenges for U.S. Fish and Wildlife Service (FWS) staff, especially related to transportation and public access. The MINWR Comprehensive Conservation Plan (CCP), completed in 2008, identified the development of transit or tram service and bicycle paths as options that could help reduce congestion and private vehicle use within the Refuge. The Refuge then pursued and was awarded grant funds from the Paul S. Sarbanes Transit in Parks (TRIP) program in 2012. Subsequently, the Refuge worked with the Transit in Parks Technical Assistance Center (TRIPTAC) to hire a Transportation Scholar to focus on alternative transportation options at the Refuge from June 2013 through April 2014. The U.S. Department of Transportation John A. Volpe National Transportation Systems Center (Volpe Center), and the Transportation Scholar (scholar) collaborated to produce this transit study.

Transportation Challenges

As identified in the CCP and in the TRIP application, several transportation challenges motivated the Refuge to pursue a transit plan. These challenges are summarized below and further documented in the Refuge Overview chapter.

1. The Refuge experiences congestion during peak season (December through March), especially on Black Point Wildlife Drive (BPWD). Congestion is becoming severe enough to threaten the safety of visitors and the Refuge's wildlife conservation mission.
2. The Refuge's visitor amenities are spread over great distances, and the Refuge manages numerous miles of roads and trails. The Refuge would like to better balance its law enforcement and maintenance capacity with the goal of offering the public high-quality, wildlife-based recreation opportunities and transportation choices.
3. The Refuge has an existing vehicle-based educational and interpretive program, which is very popular. The Refuge would like to expand the reach and scope of this program, but doing so would require additional time and resource investment that the Refuge does not currently have.
4. The Refuge would like to broaden its reach to new visitor groups, including local citizens and youth groups that may be underrepresented among current visitors.
5. The Refuge enjoys close relationships with the Kennedy Space Center (KSC), the Canaveral National Seashore (CNS), the City of Titusville, and other regional partners. Many regional partners would like to see the Refuge enhance its connectivity with other local attractions and help draw additional visitors to the region.

Scope and Organization

The MINWR Transit Planning Study is designed to address the transportation challenges listed above as well as a set of goals and objectives developed in the course of the planning effort. The Refuge worked closely with the Transportation Scholar and with Volpe Center staff from summer 2013 through winter 2015 to develop goals, collect data, identify short- and long-term strategies, and develop transportation alternatives. This plan documents those efforts and contains action-oriented guidance for current and future Refuge staff and partners to pursue alternative transportation on the Refuge.

The plan is organized into the following components:

1. **Introduction**. This section includes the plan background, scope, and goals and objectives.

2. **Chapter 1: Existing Conditions**. This section uses data to describe the Refuge's current operations, transportation network, transit system, and visitor demographics and activities.
3. **Chapter 2: Transit Partners and Audiences**. This section lists the Refuge's current partners and how they currently participate in Refuge transit or how they may do so in the future. It also lists potential transit audiences.
4. **Chapter 3: Short-Term Transit Plan**. The current transit tours are a successful foundation from which to pursue the transit study's goals in the short term (five years or less). This section contains strategies and actions to move the current transit service into the direction of pursuing Refuge goals without significant new financial or staff investment.
5. **Chapter 4: Long-Term Transit Plan**. This section contains scenarios for transit in the longer term, which may include more significant infrastructure investment and/or a partnership with a concessionaire to operate transit service.
6. **Appendices**. The appendices contain supplementary analyses related to the themes of the transit plan, including:
    a. Appendix A: Definitions of Surface Conditions,
    b. Appendix B: Public Programs Offered,
    c. Appendix C: Positions Supporting the Visitor Services Program,
    d. Appendix D: Transit Business Models,
    e. Appendix E: Refuge Signs,
    f. Appendix F: Access Control,
    g. Appendix G: Stakeholders Involved in Development of Plan,
    h. Appendix H: Refuge Bus Policy,
    i. Appendix I: Parking Needed at VIC, and
    j. Appendix J: Refuge Road Safety Audit.

The chapters are designed to be read sequentially but also independently. The planning team recognizes that each chapter's data, strategies, and recommendations cater to a unique audience or time frame, and each may be read and followed on its own.

Transit Planning Study Team and Participants

The Transit Planning Study team consists of Volpe Center staff, the Transportation Scholar, and MINWR senior staff. Layne Hamilton, Refuge Manager, and Sandy Mickey, Supervisory Park Ranger, led the Transit Planning Study scoping and development. The planning team met weekly or bi-weekly over the course of the Transit Planning Study development and participated in two site visits at the Refuge.

The planning team also engaged stakeholders to provide data and feedback to the Study. The Refuge's Federal agency partners at CNS and KSC met by phone or in person with the planning team approximately once per quarter to provide input and ideas. Additionally, the planning team convened a more informal Refuge Transit Working Group, consisting of local government, tourism, and transportation representatives from the Space Coast. The Working Group participated in occasional in-person interviews and meetings, reviewed selected draft sections, commented on long-term scenario concepts, and offered insights on implementation considerations. A complete list of stakeholders that participated in the Transit Planning Study is available in Appendix G.

Goals and Objectives

Considering the transportation-related challenges listed above, the planning team developed the following goals and objectives, which the planning team then vetted among MINWR staff. The planning team shared and discussed these goals with Refuge partners throughout the Transit Planning Study development.

- **Goal 1: Develop a transportation system that supports sustainable management practices at the Refuge, including reducing congestion to uphold the Refuge's resource conservation purpose.**
    - Objective: Enhance the visitor experience and reduce resource impacts along BPWD, focusing on peak seasonal use.
    - Objective**:** Institute a safe and cost-effective alternative to private vehicles for short-term visitor access through the Refuge.
    - Objective: Diversify visitor use spatially and seasonally, while concentrating use on the primary public use zone identified in the Comprehensive Conservation Plan (CCP).
    - Objective: Increase the number of convenient and accessible opportunities for visitors to access the Refuge without the use of a private vehicle.
    - Objective: Provide a financially-sustainable transit system that prioritizes the use of constrained financial resources through exploring multiple business models.

- **Goal 2: Expand access opportunities to the Refuge through multimodal transportation options for a diverse group of current and potential visitors.**
    - Objective: Provide new transportation choices for access and intermodal connections to the Refuge for local residents, including children, school groups, and retired persons.
    - Objective: Expand transportation modes and related educational and interpretive programs available to tourists that allow them to learn about and access the Refuge.
    - Objective: Ensure that transportation choices accommodate the needs of recreational users including anglers, hunters, and photographers.
    - Objective: Utilize transit to support wildlife observation.

- **Goal 3: Improve connectivity between the Refuge and the surrounding region.**
    - Objective: Provide new and/or improved connections to CNS, the City of Titusville, and other identified destinations of local or regional significance.
    - Objective: Establish a transit connection between the Refuge and the Space Coast Area Transit (SCAT) network, and consider future connections with inter-city transit (such as Amtrak passenger service).
    - Objective: Support the local and regional economy through connections between the Refuge and local businesses, events, and tourism groups.

In addition to the three primary study goals focusing on transportation outcomes, the Refuge also added two secondary considerations. First, the Refuge emphasized that the Transit Planning Study be connected with the Refuge's mission. The mission includes the protection of threatened Florida scrub jays and their habitat, waterfowl and wetlands, and other threatened and endangered species. By reducing private vehicle traffic in the Refuge, all transportation systems considered in this Transit Planning Study reinforce the Refuge's protection of these species and habitats.

Second, the Refuge recognizes the ongoing and anticipated budget and staff constraints within the FWS. Refuge management wants to ensure that the transit planning team evaluates all Transit Planning Study components for their fiscal and operational feasibility and (ideally) self-sustainability. In the event that circumstances change in the future, the Transit Planning Study can document options with higher costs or staffing needs. However, all transit components or scenarios considered in the Plan contain a realistic evaluation of costs and benefits.

Notably, the CCP includes an objective to "increase interpretive opportunities by providing a guided tour using an alternative transportation system, such as a tram or train." The CCP also contains indirect connections to these goals, including working with partners to develop an alternative transportation connection between the City of Titusville, the Refuge, and the Atlantic Ocean, and an assessment that motor vehicle tours would be a compatible use on the refuge, subject to certain conditions. [1]

These goals are foundational to this Transit Planning Study and are referenced throughout the Transit Planning Study.

[1] U.S. Fish and Wildlife Service, *Merritt Island National Wildlife Refuge Comprehensive Conservation Plan*, 2008, 122.

Chapter 1: Existing Conditions

Merritt Island National Wildlife Refuge
Transit Planning Study

Refuge Overview

Located on a 35 mile long barrier island on Florida's eastern coast, Merritt Island National Wildlife Refuge (MINWR or Refuge) protects hundreds of sensitive species and their habitat and attracts approximately a million visitors each year to enjoy wildlife-based recreation. The Refuge hosts the second largest population of the federal-threatened Florida Scrub Jay, serves as a resting location for more than 300 migratory bird species along with waterfowl and shore birds, and provides habitat for 93 federally- or state- listed endangered or threatened plant and animal species.[2] The Refuge uses a variety of management techniques to support the wildlife and its habitat including prescribed burns, water level manipulations in impoundments, mechanical or chemical treatment of non-native plans, and removal of non-native animals (e.g., feral hogs).

In 1963, the Refuge was established as an overlay of the National Aeronautics and Space Administration's (NASA) John F. Kennedy Space Center (KSC). A unique cooperative agreement, signed between the U.S. Department of the Interior and NASA, provided for NASA to retain land ownership while establishing a buffer for space-related activities as a wildlife refuge managed by U.S. Fish and Wildlife Service (FWS). Today, the Refuge is responsible for managing 140,000 acres of KSC's non-operational lands including secure and non-secure (public) areas. The Refuge also works closely with National Park Service's (NPS) Canaveral National Seashore (CNS), which is located along Merritt Island's eastern oceanic coastline. Approximately 34,000 acres of land is shared by CNS and the Refuge. In this shared area, the Refuge manages habitat and wildlife and CNS preserves cultural resources (see Figure 1 and Figure 2).

This Refuge is located in the rapidly growing central Florida metropolitan region, which is within an hour's drive of Orlando and associated tourist attractions. A variety of visitors come to the Refuge due to its estuarine biodiversity, its world-class saltwater and freshwater fishing, and its designation as a globally-important bird area.

[2] U.S. Fish and Wildlife Service, *Merritt Island National Wildlife Refuge Comprehensive Conservation Plan*, 2008, 9.

Figure 1: Refuge and Federal Agency Boundaries

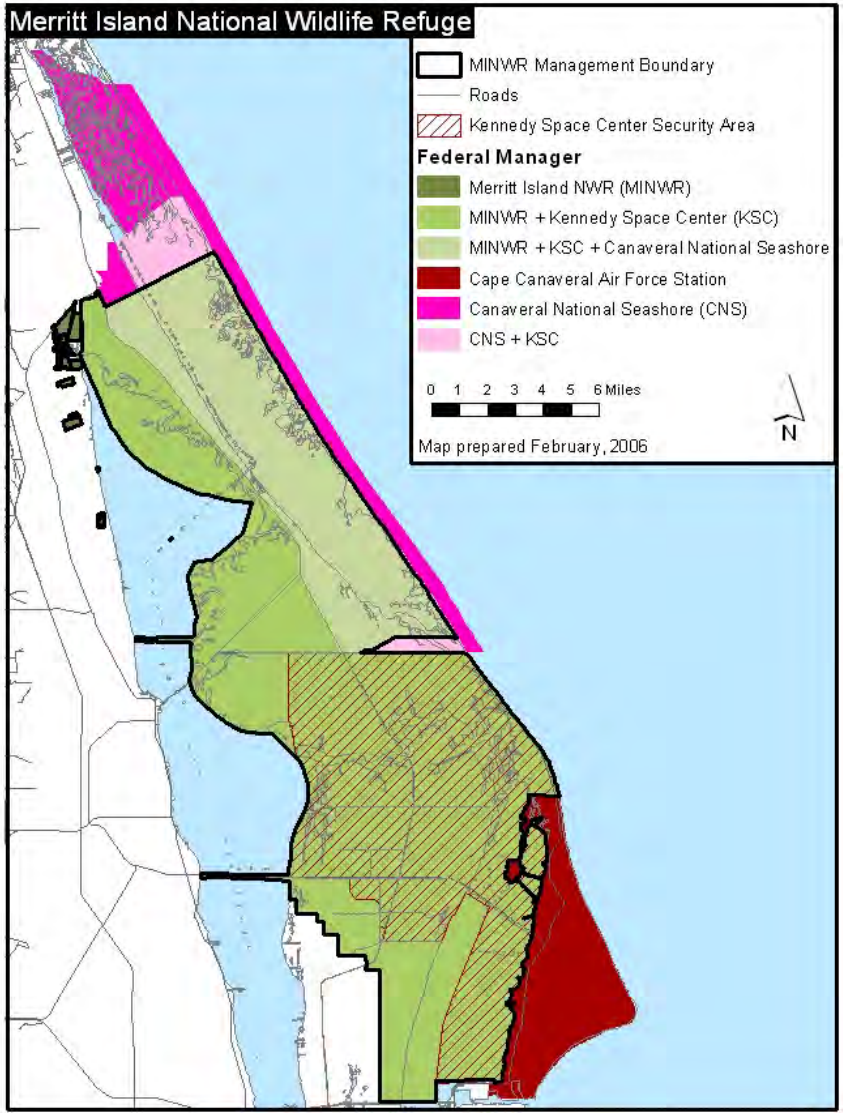
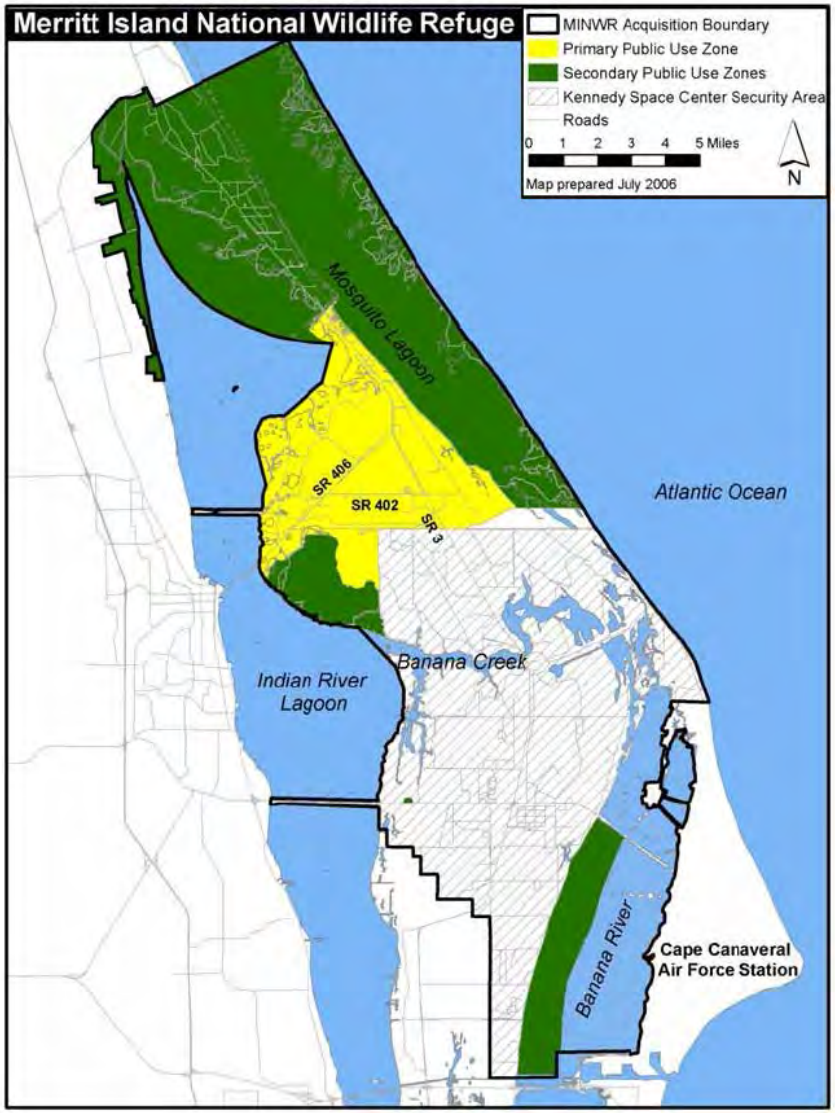


Figure 2: Refuge Public Use Zones



Physical Description and Regional Context

FWS manages seven distinct habitats on the Refuge, including freshwater impoundments, saltwater estuaries, marshes, hardwood hammocks, pine flatwoods, scrub, and costal dunes. Roughly 60 percent of the area within the management boundary is wetlands including two lagoons and over 70 impoundments. Many of the dikes built to create the impoundments are used today as roads to access various parts of the Refuge for fishing, birding, or biking. A series of ridges and swales forms the low-lying geography of the Refuge with ridges reaching no higher than ten feet above sea level. The Refuge sits at the dividing latitudinal line between temperate and sub-tropic climates, which creates a unique blend of plant and animal species.

The Intracoastal Waterway (ICW) includes the Haulover Canal, which connects the Mosquito Lagoon to the Indian River Lagoon, bisecting the Refuge. The narrow strip of land north of Haulover Canal has boat launches, a walking trail, and a variety of public roads but is designated as a secondary visitor use zone in the Refuge's Comprehensive Conservation Plan (CCP) (see Figure 2). This area is used more by boaters, fishermen, or hunters than by the casual day or tourist visitor. The area south of the canal, the primary visitor use zone, contains the Refuge's well-known auto-touring route, various walking trails, and their Manatee Observation Deck as well as the Visitor Information Center and the Refuge Headquarters. Numerous boat launches throughout the Refuge provides a connection to the ICW which traverses the waters within the Refuge's management boundary.

The Refuge has two public vehicle entry points. The primary entrance is along State Route (SR) 406 connecting the City of Titusville on the mainland to the Refuge via the A. Max Brewer Memorial Parkway Bridge; the Visitor Information Center is five miles from Titusville. A second entry point is located on the northern end of the Refuge along SR 3, Kennedy Parkway, connecting to the City of Oak Hill. These paved two lane highways are the primary roadways in the Refuge and also provide access to the CNS' Playalinda Beach and to KSC's secured area for badged employees.

While the very northern tip of the Refuge lies within Volusia County, the majority of the Refuge falls within the boundaries of Brevard County. Brevard County is a narrow county stretching 75 miles along Florida's eastern coastline from Titusville to Palm Bay. Known as the "Space Coast," Brevard County and the cities of Cocoa Beach, Satellite Beach, and Melbourne attract 3.5 million annual visitors from around the country.[3] Two significant tourist attractions in the Space Coast are KSC's Visitor Complex which has 1.5 million visitors annually[4] and Port Canaveral, which was the second busiest cruise port in the world in 2012.[5] KSC's Visitor Complex and the Port are located about twenty and forty minutes south, respectively, of the Refuge's Visitor Information Center. Major highways provide efficient access to Brevard County for tourism; I-95 traverses the county three miles west of downtown Titusville and the SR 528 high speed toll road, known as the Beach-Line, creates an easy link between Orlando, especially the Orlando International Airport, and the Space Coast.

Known as the Gateway to Nature and Space, Titusville and Brevard County have numerous other nature destinations and ecotourism locations attracting recreational tourism. Some examples include the St. John's River, 22 county sanctuaries for wildlife and wetlands, the Indian River Lagoon National Scenic Byway, and CNS. The Brevard Nature Alliance sponsors the annual Space Coast Birding and Wildlife

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[3] Rob Varley, Brevard County Tourism Development Council, phone interview, 8 November, 2013.
[4] Delaware North, "Kennedy Space Center Visitor Complex Quick Facts," accessed November 20 2014, http://media.kennedyspacecenter.com/kennedy/quick-facts/
[5] Canaveral Port Authority, *Port Canaveral 2013 Report/Directory*, 2013, 4.

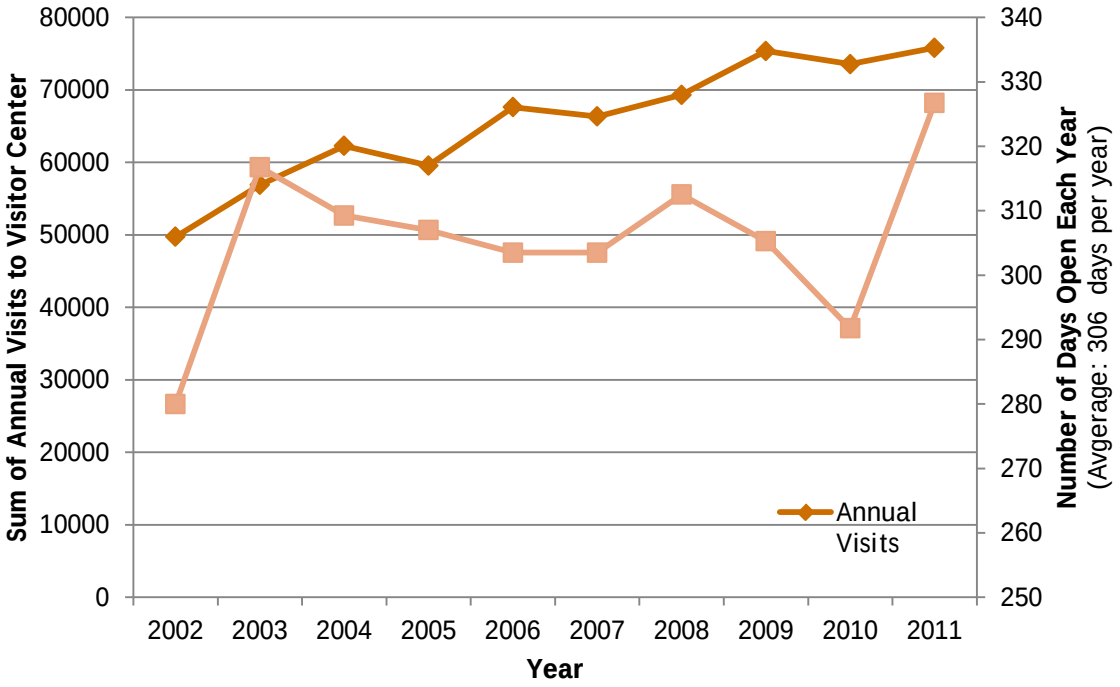
Festival held annually in January in Titusville, which attracts birders and wildlife enthusiasts from around the world.

Visitation

Visitation Trends

With 1.1 million visitors annually, FWS considers Merritt Island National Wildlife Refuge to be a flagship refuge in the southeastern United States.[6] Figure 3 below shows the sum of annual visits to the Visitor Information Center ("Visitor Center") compared to the number of days it was open. Visitation to the Visitor Center has increased in past ten years with an annual average increase of 5 percent. The Visitor Center is open an average of 306 days each year.[7] The Refuge does not charge fees for entrance, but it does charge fees for use of the following activities: driving on the auto tour route Black Point Wildlife Drive (BPWD), using four improved boat ramps and acquiring a hunting permit. Daily or annual passes may be purchased at the Visitor Information Center; daily passes for BPWD or the boat ramps can also be purchased at the site using unmanned fee collection boxes.

Figure 3: Annual Visits to Refuge Visitor Center and Number of Days Visitor Center was Open



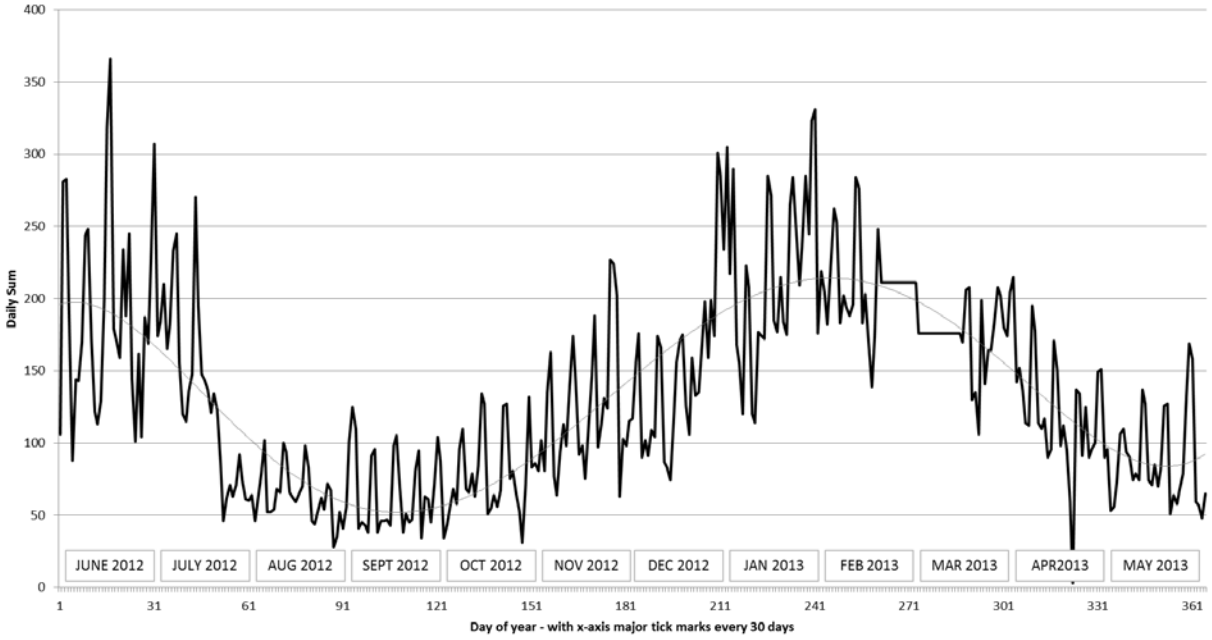
Seasonality

The Refuge is located along a prime migratory birding route and attracts many of its visitors for its birding opportunities. Therefore, the majority of visits to the Refuge take place during migratory bird season from December through March, with January experiencing the highest visitation counts. Figure 4 shows BPWD visitation trends in 2012, representing daily numbers of vehicles, with average vehicle

[6] U.S. Fish and Wildlife Service, *Merritt Island National Wildlife Refuge Comprehensive Conservation Plan*, 2008.
[7] Merritt Island National Wildlife Refuge, U.S. Fish and Wildlife Service, Refuge Annual Performance Plan, 2012.

occupancy of 2.5.[8] The Refuge also experiences a secondary peak on its auto tour route in early summer around June. Saturdays and Sundays are the most popular days to visit throughout the year, and the daily peak visitation is in the early afternoon from 1:00 PM to 3:00 PM. The Visitor Information Center, which provides information on resources and activities at the Refuge, welcomes an average of 266 visitors each day. Reflecting trends seen throughout the Refuge, the Visitor Information Center receives peak visitation during the winter months with increased visitation on weekends. For purposes of transit planning, the peak season is considered to be December through March, while April through November is the off-peak season.[9]

Figure 4: BPWD Visitation Trends in 2012 -2013[10]



Visitor Origins and Access

The Refuge attracts a large number of tourists from across Florida and across the U.S.; 37 percent of visitors live within 50 miles of the Refuge, and half of all visitors are Florida residents. Local visitors travel an average of 28 miles to get to the Refuge, while nonlocal visitors travel an average of 473 miles and come from nearly every state. The primary mode of access to the Refuge is by private vehicle.[11] Once in the Refuge, nearly all (94 percent) visitors use private vehicles to travel around the Refuge.

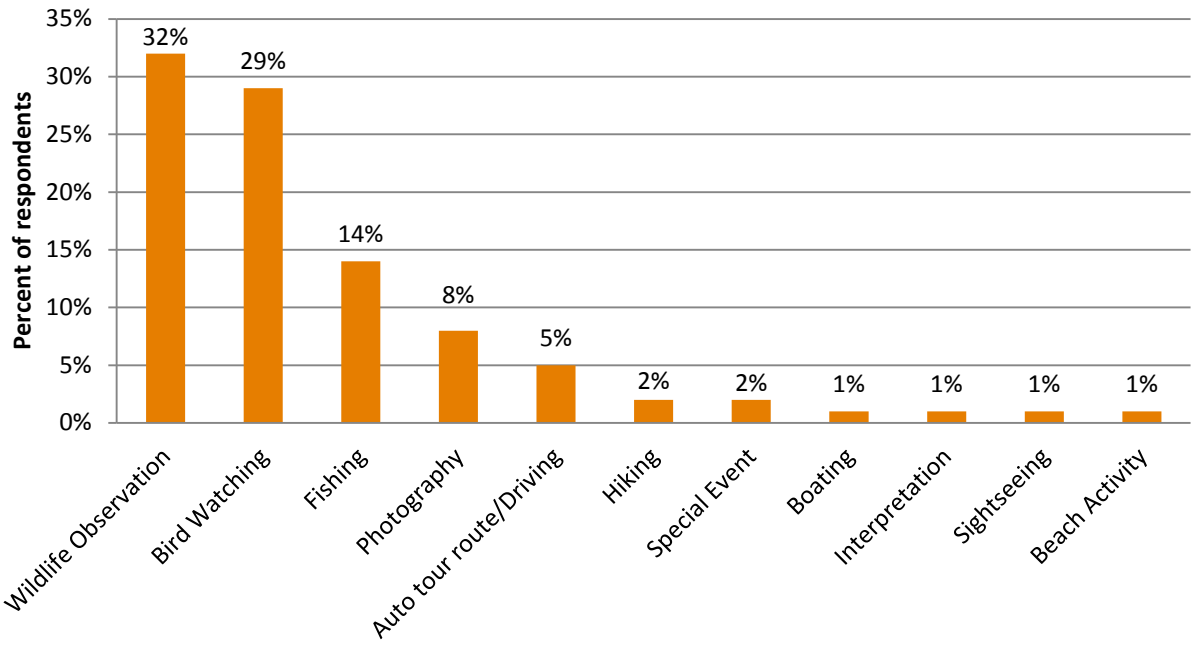
[8] Refuge management estimate.
[9] Some Refuge activities, such as fishing and hunting, experience different peaks or experience consistent visitation throughout the year. This report focuses on general visitation peaks for wildlife observation, photography, environmental education, and interpretation, as these visitors are more likely to be the audience for transit.
[10] FWS traffic counter data
[11] In the 2013 Region 4 Regional Alternative Transportation Evaluation (RATE) Questionnaire, the Refuge staff estimated that 82 percent of visitors use personal vehicles to access the Refuge.

Approximately 20 percent of visitors report using walking or hiking as their mode of transportation at some point during their visit, but the majority of these visitors also use a private vehicle for transport.[12]

Visitor Activities

Many visitors spend a full day at the Refuge, offering the opportunity to participate in several activities. Visitors report spending an average of five hours at the Refuge, although the most frequently reported length of visit during one day is eight hours (28 percent).[13] The most popular activities at the Refuge are wildlife observation and bird watching; more than half of visitors report one of these as the primary activity of their visit. Other popular activities include fishing, photography, and driving along the auto tour route BPWD (see Visitor Activities). Please note that the respondents that reported participating in beach activity were referring to the beach at CNS (see Figure 5). Refuge staff report that visitors may misunderstand that the Refuge and CNS are separate entities. FWS developed an exhibit on the Refuge, the wildlife, and their management practices, which is located at the KSC Visitor Complex and is included in the entrance fee to the KSC Visitor Center complex. A brief video about the Refuge is also played on the bus tour of KSC. The Refuge includes 24 percent of KSC's annual visitation into their annual visitation numbers since the Refuge's mission reaches KSC visitors through the exhibit and video.

Figure 5: Primary Visitor Activities (n=238)[14]



The following are descriptions of popular visitor activities.

Wildlife Observation

Most visitor wildlife observation occurs on driving routes, hiking trails, and non-motorized routes open to bicycles and pedestrians; these routes and trails are described under the Transportation Network and

[12] Sexton, N. et al., United States Geological Survey, *National Wildlife Refuge Visitor Survey 2010/2011: Individual Refuge Results for Merritt Island National Wildlife Refuge*, 2012.
[13] Ibid.
[14] Ibid. A small percentage of the Wildlife Observation visitation is from KSC visitors who participate in on-Refuge wildlife observation as part of their KSC visit.

Infrastructure section. According to Refuge staff, the most popular roads for wildlife observation are BPWD and Biolab Road, and the most popular trails are the Hammock Trails and Visitor Information Center Boardwalk, both of which are close to the Visitor Information Center. Additionally, the Refuge encourages visitation at Scrub Ridge Trail, a one-mile loop trail with opportunities to spot scrub jays.

The Refuge has a few additional visitor amenities that accommodate wildlife observation. These include:

1. The Visitor Information Center, located on the south side of SR 402, is designated as the eastern gateway for the Great Florida Birding Trail and is home to the Refuge's exhibits, educational movie, and Boardwalk. Hours of the Visitor Information Center can vary by time of year and can be subject to staffing availability however, general hours are from 9:00 AM to 4:00 PM daily, with Sunday closures during the off-peak season.[15] FWS volunteers and staff from the Merritt Island Wildlife Association, the official *Friends Group* [16] of the Refuge, staff the information desk and are the primary point of contact for the visitors. The volunteer program at the Refuge is managed by the Refuge Ranger.
2. Two observation towers, located at the Refuge entrance along SR 406 and along BPWD, provide wildlife viewing opportunities.
3. The Manatee Observation Deck, located on SR 3 on the north side of the canal, provides a land-based, accessible platform to view manatees in the Haulover Canal.
4. The Sendler Education Outpost, located on the west side of SR 3, accommodates school and youth groups by special permit. The facility includes a large, covered pavilion with a picnic area, restrooms, and limited facilities for educational activities.
5. There are two wildlife viewing blinds along the Cruickshank and Wild Bird trails accessed off of BPWD.

Fishing

Commercial and recreational fishing is a popular activity at the Refuge and experiences slightly different visitation trends than other visitor activities. Fishing occurs year round and does not see the same peaks as birding does in the winter months. The boat ramps, used mainly by recreational and commercial fishermen, experience two daily peaks beginning at sunrise and early afternoon while Refuge staff observe bank fishing peaks in the late afternoon to early evening. FWS and NPS jointly issue about 200 permits each year for harvesting and to boating and fishing guides (NPS assumes issuance responsibility on behalf of both agencies).

Hunting

Waterfowl hunting is permitted on 36,000 acres of the Refuge (representing approximately 25 percent of the total Refuge area). Hunting season is from mid-November through January with hunting permitted on Wednesdays, Saturdays, and Sundays as well as on Thanksgiving, Christmas, and New Year's Day. Hunters are allowed to enter the Refuge on hunt days at 4:00 AM, with hunting beginning one hour before sunrise until 12:00 PM. Permits through Florida Fish and Wildlife Conservation Commission (FWC) and the Refuge are required for hunting. Hunt areas include the majority of the secondary visitor use zone as well as the Mosquito Lagoon, L Pond Road, and Peacock's Pocket areas of the primary visitor use zone.

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[15] VIC hours reflect historic patterns; hours subject to change in the future.

[16] Friends Groups are non-profit organizations sanctioned by USFWS that support their associated Refuge's mission through a variety of means and provides a connection to the local community. The friends groups at MINWR runs the nature shop at the visitor center and fundraises to support public programs and interns at the Refuge.

Transportation Network and Infrastructure

The Refuge is accessible by both land and water with an extensive road, trail, and boat launches. This section describes the infrastructure that allows visitors to access the Refuge and travel between its visitor use areas. The descriptions of infrastructure within the Refuge provide a menu of potential transit routes and illustrate how visitors currently drive, walk, bike, and boat around the Refuge. Figure 6 and Figure 7 and show maps of road names and locations.

Access to the Refuge

Land-Based Access

Vehicles can access the Refuge using two, unmanned, public entrances denoted by visitor information kiosks located at each entrance. The primary entrance (the southern entrance) is along SR 406/SR 402 connecting the Refuge to Titusville via the A. Max Brewer Memorial Parkway Bridge. Constructed in 2010, this fixed span bridge has become a recreational amenity for Titusville. The bridge supports multi-modal use with two 12-foot travel lanes restricted to a 30 mile per hour speed limit, 8-foot wide shoulders in both directions for bicyclists, and divided five-foot wide pedestrian walkways along both sides. City parks, fishing piers, boat launches, and a restaurant are located on both sides of the bridge. The northern entrance, immediately south of Oak Hill, is along SR 3 (Kennedy Parkway) and is accessed off of US 1, a major north-south highway. The Refuge's Visitor Information Center is located less than five miles from Titusville, making the southern entrance more heavily used. While the majority of roads on the Refuge are gravel or native surface, both road entry points are two-lane, paved highways with posted speed limits of 55 miles per hour. These highways are owned and maintained by KSC since they also serve badged employees traveling to and from work at the Space Center. The single entrance to CNS' Playalinda Beach is within the Refuge's boundaries, along SR 402. Therefore, these main roads accommodate through traffic in addition to Refuge visitors.

Figure 6: Merritt Island Roads and Place Names (North) (Source: MINWR)

Figure 7: Merritt Island Roads and Place Names (South) (Source: MINWR)

Water-Based Access

The Refuge has four designated boat ramps: Bairs Cove, Beacon 42, Biolab, and WSEG. Commercial and recreational anglers and recreational boaters use the boat ramps (permits are required for commercial guides and harvesters). Bairs Cove is the most improved ramp with a paved parking lot, a canoe/kayak launch area, and a boat ramp for boats on trailers. The other three ramps have gravel or native open areas for parking and a single boat ramp (see Table 5 for more information on the parking facilities). Use of the boat ramps, except for WSEG, requires a $5 daily fee or a $15 annual permit. Permits can be purchased at the Visitor Information Center or via fee collection boxes at each boat ramp.

The ICW traverses the Refuge through the Mosquito and Indian River Lagoons surrounding Merritt Island. Haulover Canal is part of the ICW connecting the two lagoons. It is a man-made canal running east-west and dividing the Refuge into northern and southern sections. Varieties of boats from kayaks to sailboats travel and recreate on the ICW. The Refuge's Bairs Cove Boat Ramp along the Haulover Canal provides direct access to the ICW.

Infrastructure within the Refuge

Roads

There are 258 miles of roads on the Refuge, including paved two lane highways, earthen dikes, and primitive roads. Roughly 83 miles are public roads with the remaining used by Refuge staff for fire breaks or to provide administrative or KSC staff access. Table 1 divides the Refuge roads by surface and shows respective mileage.

Table 1: Mileage of Refuge Roads by Surface[17]

Surface	Asphalt	Gravel	Native[18]	Primitive	Total
Mileage	31 miles[19]	50 miles	120 miles	57 miles	258 miles
Public Roads	29 miles	37 miles	15 miles	2 miles	83 miles

Black Point Wildlife Drive

BPWD is the Refuge's primary auto-touring route. BPWD is an improved dike that is resurfaced annually. The gravel, one-way, 6.29 mile driving route has restrooms, an observation tower, and wildlife blinds along its route as well as an associated self-guided tour. BPWD is the Refuge's most popular route, and it experiences high use during peak birding season.

Through the Federal Lands Recreation Enhancement Act (REA), the Refuge charges a daily enhanced amenity fee of $5 per car to access BPWD. Annual passes for the Refuge or CNS, and other REA passes can be used to access BPWD and other fee areas of the Refuge.

Congestion occurs on BPWD in the peak season. Over 250 vehicles on average visit the Drive daily during the months of January and February. The Drive is restricted to one-way traffic with one entrance and one exit. The dike is 14 feet wide and pull-outs are located periodically along the drive. In addition to the

[17] Federal Highway Administration, *Road Inventory of Merritt Island National Wildlife Refuge*, 2010.
[18] Native surface does not have a gravel base.
[19] These 31 miles of asphalt are comprised of 10 miles of Refuge-maintained paved roads, and 21 miles of KSC-maintained paved roads in the non-secure area.

high volume during peak season, Refuge staff perceived that congestion may also be due to the following:

- Visitors stop to observe wildlife at locations other than designated pull-offs and do not consistently pull far enough to the side to allow room for other vehicles to pass.
- Birders or photographers may stop along the Drive for long periods of time, which can cause partial road blocks.

Other Public Roads

Public roads on the Refuge include the paved highways (SR 402, SR 406, and SR 3), dikes, and access roads/driveways to various visitor use areas. Certain public roads are restricted to non-motorized traffic only. Gates and posted signs indicate the modes permitted on each road (see Table 4). Appendix E and Appendix F provide the foundation for future actions to improve the effectiveness of the Refuge's sign program and access control.

Of the 29 miles of public asphalt roads (Table 1), four miles are driveways to various visitor use areas and the remaining 25 miles are highways providing thoroughfare for Refuge and CNS visitors and KSC staff. KSC maintains 21 miles of the paved highways while the Refuge maintains a four mile stretch that provides access to BPWD. The speed limit on the highways ranges from 45 to 55 miles per hour and all have grass shoulders.

Earthen dikes were constructed during the mid-20th century to form impoundments used for mosquito control. While the gravel roads on the dikes were not designed for heavy vehicular use, today many are open to the public and essentially serve as the driving routes throughout the Refuge to observe wildlife and to fish. While most native and primitive roads are administrative roads or fire breaks, there are a few miles of primitive roads open to the public for fishing access.

Degraded roadway conditions, especially potholes, are prevalent on many of the gravel and native surface routes as the Refuge's budget does not allow for continual maintenance and the dikes were not designed for the current vehicular use levels. While all roads are accessible for non-four wheel drive vehicles, a heavier-duty vehicle is often better suited for the roadway conditions. All public roads except for BPWD allow two-way traffic and do not have designated vehicle pull off areas, which can cause conflicts when vehicles must pass each other. Table 2 shows the characteristics of each of the Refuge's public roads including the roadway length in miles, its surface and conditions rated by the FHWA Road Inventory Report (see Appendix A for definitions of the condition), any adjoining or access roads, as well as individual comments including if the Refuge staff designates the road as a primary wildlife observation (WO) point shown in the table by "Primary WO point."

Table 2: Primary Motorized Public Roads[20]

Road Name	Length (mi.)	Surface	Condition[21]	Adjoining Roads	Notes
KSC Maintained Roads					
SR 402, Beach Road	6.00	Paved	Good	--	Two lanes striped
SR 3 Kennedy Parkway	15.00	Paved	Excellent	--	Two lanes striped
Refuge Maintained Roads – Fee Required					
Black Point Wildlife Drive	6.29	Gravel, Asphalt	Good, Excellent	SR 406	One-Way Primary WO[22] point
Refuge Maintained Roads – No Fee Required					
SR 406, A. Max Brewer Memorial Parkway	4.19	Paved	Excellent, Fair	SR 402, SR 3	Two lane striped
Biolab Road	5.57	Gravel	Good, Fair	SR 3, Beach Rd	Primary WO point; Beach Rd access located at CNS
Catfish Creek Loop	3.08	Gravel Native	Good, Fair	Peacock's Pocket, Gator Creek	--
East Gator Creek	1.53	Gravel	Good	SR 402, SR 406	--
Patillo Creek	1.00	Native	Good, Fair	SR 3	--
Peacock's Pocket	7.53	Gravel	Good, Excellent, Fair	SR 402, Catfish Creek Loop	Primary WO point
Shiloh 3	1.26	Native	Good	SR 3, Shiloh Marsh	Open periodically
Weather Tower	0.67	Native	Good	SR 3, Shiloh Marsh	Open periodically
W. Gator Creek	1.34	Gravel	Good	Southern Entrance, East Gator Creek	Primary WO point
Total	***53.46***				

[20] Data in the length, surface, and condition columns is from *The Road Inventory of Merritt Island National Wildlife Refuge,* conducted in June 2010 by the Federal Highway Administration. Roads are divided into segments with each segment characterized by mileage, surface, and condition. Many of the roads are comprised of multiple segments with varying surface types and conditions.

[21] The FWS Road Inventory Program assigns a condition assessment based on observed surface condition. The Office of Federal Lands Highway (part of the Federal Highway Administration) maintains visual standards for asphalt, concrete, grave and native roads based on defined factors such as structural condition, cracks, drainage, and crown. Roads may be assessed as excellent, good, fair, poor, or failed. See Appendix A of this report for definitions of the conditions used here.

[22] Refuge staff highlighted areas of the Refuge that are primary wildlife observation sites, indicating that these areas are popular with visitors and may be a logical stop on a transit route. Further analysis on these roads and their suitability for transit is examined in a later section.

Pedestrian Facilities

There are seven designated hiking trails on the Refuge, six of which are located in the primary visitor use zone (see Figure 2). These facilities allow walking only while other facilities may allow pedestrians and other modes such as bicycling (see the Bicycling Facilities section for further information). Surfaces of hiking trails include gravel, native, and a constructed boardwalk. Lengths range from one-quarter mile to over five miles and all have trailhead parking. Hiking trails are not subject to regular seasonal closures but could be subject to closure due to hunting or KSC needs. Table 3 below provides more detail on each of these hiking trails.

Table 3: Hiking Trails

Trail Name	Length (mi.)	Surface	Access	Amenities	Notes
Cruickshank	4.73	Native	BPWD	Restrooms	Primary WO point
Oak Hammock	2.00	Native, Boardwalk	SR 402	Benches	Crosses railroad tracks; Primary WO point
Palm Hammock	0.50	Native, Boardwalk	SR 402	Benches	Nature information plaques along trail; Primary WO point
Pine Flatwoods	1.00	Native	SR 3	-	Located in secondary visitor use zone
Scrub Ridge	1.00	Native	SR 3	-	Primary WO point
Visitor Center Boardwalk	0.25	Boardwalk	Visitor Center	Indoor, drinking fountain, restroom	ADA accessible; Part of nature tours; Primary WO point
Wild Birds Unlimited	0.50	Gravel	BPWD	-	Primary WO point
Total	***9.98***				

Bicycling Facilities

Bicycling is permitted on the Refuge with certain restrictions. Bicyclists are not allowed on designated hiking trails (see Table 3 for list of hiking trails) and KSC restricts bicycling along the main highways (SR 402 and SR 3) during peak commuting times (between 6:00 AM and 9:00 AM and between 3:00 PM and 6:00 PM). These facilities are not subject to regular seasonal closures but could be subject to closure due to hunting or KSC needs. There are no designated biking trails on the Refuge, but some dike roads have been designated as "non-motorized traffic only" (see Table 4). The Refuge has restricted some dike roads to non-motorized use to reduce wear from private motor vehicles. The Refuge does not have bicycle infrastructure such as bike racks, bike lanes, or bike crossings, but despite this lack of infrastructure, bicyclists frequently ride on the Refuge. Bicyclists include a range of ages, including children bicycling with scouting groups. Bicycling is most popular along BPWD, where it can create frequent conflicts with vehicles. Bicyclists sometimes ride the wrong way on the one-way road so as to make sure vehicles can see them. Refuge staff recognize the user conflicts and are working to improve bicycle safety through new designated bike routes.

Two regional bicycle paths (Titusville to Edgewater and Coast to Coast Connector) have been proposed by Florida Department of Transportation (FDOT). These trails would pass through the Refuge and connect to other existing regional and state-wide paths. The Refuge supports the development of these bicycle paths as they will provide a connection to the surrounding community and provide better and safer bicycling opportunities on the Refuge.

Table 4: Non-Motorized Public Roads

Trail Name	Length (mi.)	Surface	Condition	Access
Black Point Bypass	1.96	Native	Good	BPWD
Center Road	2.87	Gravel, Native	Good	SR 406, SR 3
L. Pond	5.63	Native	Good	BPWD or SR 3
M. Pond	3.16	Native	Good, Fair	L. Pond
Pump House	0.92	Native	Fair	SR 406
Shiloh Marsh	10.13	Gravel, Native	Good, Fair	Various roads off of SR 3, Shiloh Marsh Road off of US 1
SE Haulover Road	1.90	Gravel, Primitive	Good, Fair	SR 3, Haulover Canal Recreation Area
Timberline Dike	5.35	Native	Good	Catfish Creek or Peacock's Pocket
Total	***31.92***			

Parking Facilities

There are 21 designated public parking facilities on the Refuge located at visitor use areas. Four of the 21 parking facilities are paved, as indicated in Table 5. Other designated parking facilities are grass, gravel, or native surface without defined spaces. The paved parking areas all provide for bus or trailer turn-arounds. Table 5 shows parking facilities organized by visitor use area.

Table 5: Parking Facilities*

Name	Number of Spaces[23]	Condition	Notes
Hiking Trails			
Cruickshank	18	Excellent	Parking located amid BPWD; Bus accessible
Oak & Palm Hammock	28	Good	Share trailhead and parking lot; Bus accessible; 2 handicap spaces
Pine Flatwoods	8	Good	Bus accessible
Scrub Ridge	20	Good	Bus accessible
Boat Ramps			
Bairs Cove	28	Good	For boats and trailers; Bus accessible
Bairs Cove Overflow	10	Fair	Unpaved surface; Bus accessible
Beacon 42	25	Good	Bus accessible
Biolab	35	Good	Bus accessible
WSEG	5	Good	
Roads			
Black Point By Pass	12	Excellent	Parking located amid BPWD; Bus accessible
L. Pond	50	Fair	Located off of SR 3
Shiloh Marsh (3)	10	Good	
Dummitt Cove	15	Fair	
Old Haulover Canal	10	Poor	
SW Haulover Canal	10	Fair	Bus accessible
Saw Mill	20	Good	Trailhead parking for Shiloh Marsh
Other			
Manatee Observation Deck	16	Excellent	2 handicap spaces, 1 bus space; Bus accessible
Visitor Center	16	Good	1 handicap space; Bus accessible
Visitor Center Overflow	30	Excellent	Bus accessible
Visitor Information Kiosk at south entrance	28	Good	2 handicap spaces; Bus accessible

*Shaded rows indicate a paved parking lot

Railroad

NASA owns a 38-mile, industrial short rail line used for transporting space-related materials, including hazardous materials. The rail line originates in Central Florida, crosses the Indian River Lagoon north of Titusville, and traverses the Refuge roughly following the alignment of SR 402 until it turns south at SR 3

[23] For non-paved parking locations, the number of spaces was estimated by square footages and experience of Refuge staff.

to enter the KSC secure area, where it connects to Cape Canaveral Air Force Station rail lines. The track is designed for 60 miles per hour but normal operating speeds are around 25 miles per hour to reduce maintenance cost and increase the life span. The railroad is contractor-operated and use of the rail line has dwindled since the ending of the space shuttle program in 2011. Although NASA foresees a future need of the rail line, there is a potential for leasing the line to private space companies or Port Canaveral for freight movement. The Refuge's Visitor Services Plan refers to collaborating with NASA to use the rail line for concession based operated tram tours through its public areas.[24]

Transit

The Refuge currently is located within a few miles of the Space Coast Area Transit (SCAT) service area, and FWS also operates a single vehicle transit-based tour within Refuge boundaries. Both services are described below.

Space Coast Area Transit

SCAT provides public transit service in Brevard County, including service to Titusville in the vicinity of the Refuge. In fiscal year 2012, SCAT served 2.2 million passengers on 16 fixed routes and other transit and mobility services. Single ride fares are $1.25, with discounts for multiple ride packages, seniors, disabled, veterans, and students.[25] SCAT routes 2 and 5 currently operate near the Refuge, with both routes converging in Titusville (approximately two miles from the Refuge southern entrance); however, no service crosses from Titusville onto Merritt Island. Descriptions of the three nearest routes are provided below.

- Route 2 serves Titusville in a loop, reaching shopping and employment centers within Titusville, including Searstown Mall, the Parrish Medical Center, the North Brevard Library, and Titusville's Government Center. Route 2 operates approximately every hour Monday through Friday from 7:00 AM to 8:00 PM, with limited service on Saturdays.
- Route 5 connects Searstown Mall with the community of Mims, located north of Titusville, along U.S. 1. A flag stop route, Route 5 allows riders to stop at any safe location along the route, including Parrish Medical Center, Brevard Community College, and Mims Public Library. Route 5 operates generally every hour Monday through Friday from 8:00 AM to 5:00 PM. There is no weekend service.
- Route 1 North loop connects Titusville with the southern half of Brevard County. The north loop runs between the Titusville and Viera Government Centers, roughly thirty miles apart, with scheduled stops at the Veterans Clinic, the Cocoa Transit Center, the Port St. John shopping center, US 50 and SR 1, and the Searstown Mall. The Titusville Government Center is less than a mile from the historic downtown section. This route is in service Monday through Friday from 5:00 AM until 8:30 PM with one hour headways. There is no weekend service.

New service from Titusville to Merritt Island is proposed in SCAT's 2012 Transit Development Plan.[26] Alternative 21, which would transport riders from Titusville to CNS, would pass by the Refuge Visitor Center on SR 402. Due to a lack of available funding, SCAT is currently not pursuing implementation of this route, although the agency is making improvements to its existing service. SCAT has extended service hours on existing routes in high demand, including Route 2 in Titusville, and the agency plans to add more bus shifts to ease crowding in early 2014.

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[24] U.S. Fish and Wildlife Service, *Merritt Island National Wildlife Refuge Visitor Services Plan*, 2008,VSP-79.
[25] Space Coast Area Transit, Info and Fares, 2013, accessed November 24, 2013, http://www.ridescat.com/transit/
[26] Space Coast Area Transit, *2013-2022 Transit Development Plan*, 2012.

Refuge-Owned Bus

The Refuge owns a 14-passenger bus used for nature and birding tours (see Figure 8). Frequency of the tours is dependent on the season with tours provided multiple times a week during the peak season and twice a week during the off-peak season. Locations of the tours vary among the public driving routes but mainly include BPWD. Tours are led by Refuge volunteers (including interpretation) and can be a general nature tour, a beginning birding tour, or a wildlife specific tour (such as a tour on raptors). The tours last from two to four hours, and cost $3 per person (tours are not recommended for young children due to their length).

The Refuge has an on-site fueling facility for the bus and other vehicles in their fleet, but maintenance on the bus is provided off-site.

Potential routes and service characteristics for Refuge use of the 14-passenger bus in the short term (within five years) are described in the Short-Term Transit Plan.

Figure 8: MINWR 14-Passenger Bus

School Groups Visiting Refuge

The Refuge hosts approximately 3,000 schoolchildren annually for field trips. The Refuge Ranger in charge of visitor services, environmental education, and public use programs oversees school field trips and other environmental education groups, in addition to volunteer and other interpretive programs. Most schools bring students in a school bus, funded by the school or students. Field trips visit the Visitor Center, the Sendler Education Pavilion, and other sites around the Refuge, depending on the age of students and type of educational program. Teachers can bring their students on self-guided Refuge tours but the Refuge does not provide a specific program curriculum for self-guided groups. Most of the self-guided groups are from high schools and colleges.

Synthesis of Existing Conditions

Merritt Island National Wildlife Refuge contains a large land and water area with numerous opportunities for wildlife-based recreation. FWS manages a significant network of infrastructure to help its visitors access those opportunities and staff work closely with partners to enhance the visitor

experience. However, with its location near highly-visited regional attractions and its proximity to tourism gateways like Port Canaveral and Orlando, FWS and its partners see more opportunities for new and existing visitors and new types of visitor experiences.

Furthermore, due to its vast size and the separation of public and restricted use areas, visitors could benefit from designated tours and guided opportunities to access new parts of the Refuge, provide more educational opportunities, and share the Refuge's wildlife conservation message. The Existing Conditions showcase a mature and highly visited refuge with extensive multi-modal transportation systems, but they also show high potential for transit to add value and serve new audiences.

Chapter 2: Transit Partners and Audiences

Merritt Island National Wildlife Refuge
Transit Planning Study

Partners

The Refuge is well-connected with its Federal agency and local neighbors. As an important land management agency and regional attraction in Brevard County, the Refuge maintains strong relationships with its partners for management activities, regional economic development, and transportation. Table 6 describes high-level interests and characteristics of Refuge partners (and potential partners) to start mapping the roles they may play in future transportation at the Refuge.

See Appendix G for a list of partners involved in the development of this Transit Planning Study.

Table 6: Refuge Current and Potential Partners

Partner Name	Key Interests	Relationship to the Refuge	Relationship to Transportation / Transit
Federal Agency Partners			
NPS Canaveral National Seashore	Preserve CNS for wildlife and future generations; currently manage CNS to provide an uncrowded experience to the public	NPS and FWS management believes in working together to preserve the island and provide enjoyment for its visitors.	Visitors to the southern district of CNS must pass through the Refuge; future tours may include NPS-managed areas; relationships with local schools may help promote Refuge transit use.
Kennedy Space Center - Administration/ Planning	Provide master planning for the development of KSC space related facilities	KSC and FWS enjoy a good working relationship where each agency consults each other on major projects.	KSC owns and maintains major Refuge roads.
Transportation and Government			
Space Coast Transportation Planning Organization (TPO)	Provide planning for transportation/ mobility related projects for Brevard County	TPO and FWS collaborates on Refuge related projects	TPO projects support access to the Refuge for vehicles and bicycles.
Volusia Transportation Planning Organization	Provide planning and programming for transportation/mobility related projects for Volusia County	The TPO and FWS collaborate on Refuge related projects	Northern tip of Refuge is located in Volusia; TPO projects support access to the Refuge for vehicles and bicycles
Space Coast Area Transit	Provide public transportation services for all of Brevard County	No formal relationship	There is potential for the SCAT system to provide a public transportation connection to the Refuge.
City of Titusville	Provides planning, transportation, utilities, and environmental support for the City of Titusville and its development.	The City and FWS collaborate on projects such as developing bicycle paths. Titusville Planning has a representative on the Technical Advisory Committee of the TPO.	Titusville projects support access to the Refuge and amenities that Refuge visitors frequently use.
Florida Department of Transportation	Provide a safe transportation system that ensures the mobility of	FDOT and the Refuge both participate in regional	FDOT owns and maintains several of the roads outside of and offering

Partner Name	Key Interests	Relationship to the Refuge	Relationship to Transportation / Transit
	people and goods, enhances economic prosperity and preserves the quality of the environment and communities (FDOT mission statement)	transportation projects (such as new bike trails) in which both parties have an interest.	access to the Refuge.
Tourism, Business, and Nature			
Kennedy Space Center-Visitor Complex (KSC-VC) / Delaware North	Educate visitors about NASA and the development of the space program	Representatives from Delaware North/KSC-VC are on the Merritt Island Wildlife Association (MIWA) board.	The KSC-VC is one of the major regional tourist attractions; there is potential to coordinate with the VC's existing bus tours.
Titusville Area Chamber of Commerce	Support businesses and economic development in the City of Titusville	The Chamber promotes the Refuge as an important attraction for the area	The Chamber promotes visitation to Titusville; the Chamber could promote transit tours and connect the Refuge with schools, tourists, and other private partners in North Brevard.
Brevard County Tourism Development Council	Promote visitation to attractions across Brevard County among state, national, and international tourists	The TDC worked with the Refuge on the Balancing Nature and Commerce project; the TDC supports community planning that incorporates sustainable nature based commerce.	The TDC may provide support for transportation projects that contribute to regional access and mobility for tourists.
Indian River Lagoon National Scenic Byway Coalition	Support visitation and development of the by-way that runs throughout Brevard Co. including the Refuge; Byways recognize, preserve, and enhance selected roads with the purpose of highlighting archeological, cultural, historic, natural, recreational, or scenic interests	FWS participates in Coalition meetings; FWS supports the extension of the by-way to include a loop through the Refuge. By-way brochures advertise Refuge as a destination along the route.	Visitors to the Byway will most likely also be interested in the Refuge.

Partner Name	Key Interests	Relationship to the Refuge	Relationship to Transportation / Transit
Brevard Nature Alliance	Raise the citizen and visitor awareness of the value of Brevard County's natural resources (non-profit organization)	There are intersections between BNA membership and Refuge volunteers and friends. BNA applies for special use permits on the Refuge for their annual wildlife festival.	The BNA promotes Refuge visitation and annual events, including transit at those events.
St. John's River Alliance	Represent the 310 mile river flowing north in eastern Florida from Palm Bay to Jacksonville (non-profit organization)	No formal relationship	Recreational activities along the St. John's river such as fishing or boating attract tourists.
Brevard County Environmentally Endangered Lands (EEL)	Protect and preserve Brevard County's natural resources	EEL and FWS work cooperatively on resource and visitor management; many EEL are located near Refuge property.	EEL shares a similar mission to FWS and attract similar visitors; there is potential for collaboration.
Refuge-Specific Partners			
Merritt Island Wildlife Association	Support the Refuge primarily by fundraising but also through promoting the Refuge and attracting visitors	MIWA manages the Refuge gift shop and helps support the Refuge financially. MIWA cost-shared the purchase of the Refuge 14-passenger bus.	MIWA sends out quarterly newsletters to Friends Group members and distributes Refuge brochures throughout the local area; they could promote transit.
Refuge Volunteers	Perform maintenance, education, interpretive, and visitor services tasks; a Refuge Ranger oversees the 200 or more volunteers	Volunteers drive the Refuge-owned 14 passenger bus for tours and provide interpretive and educational information to visitors.	Volunteers could continue to operate the transit vehicle, depending on the transit model.

Transit Audiences

The Refuge's goals for transit are to expand access opportunities and enhance connections with the Space Coast region while also addressing the need to reduce congestion on the Refuge's roads and trails. With this in mind, the study examines potential transit audiences, ranging from current Refuge visitors who may benefit from a new type of experience to the thousands of national and international tourists who visit the Space Coast region each year.

Related to its goals for this transit study, the Refuge would like to work with its regional partners to add new types of visitors in a way that is sustainable to the Refuge's natural resources and the staff's management capacity. Following the U.S. Fish and Wildlife Service's conservation mission, Refuge staff focuses on management activities that protect the Refuge's unique natural resources, including threatened and endangered species. In managing visitors, the Refuge focuses on amenities and infrastructure that serve wildlife-dependent recreational uses: wildlife observation, fishing, hunting, interpretation, environmental education, and wilderness photography. As part of the study, the Refuge conducted a planning exercise to assess its own capacity to manage its transportation infrastructure and to understand how transit can be a tool in managing diverse visitation. Transit must be carefully planned with an understanding of target audiences to achieve this balance.

Current Audiences

With limited budget and staff and large numbers of existing visitors, Refuge staff are concerned that increasing visitation may threaten their ability to uphold the conservation mission. Therefore, the Refuge staff prefers to focus on existing visitors as an initial transit audience. For these visitors, transit can be a means to both enhance the visitor experience and to reduce congestion that occurs during peak visitation cycles.

Refuge staff characterizes existing visitors as:

- Repeat visitors, with an average of seven visits to MINWR per year.
- An average group size of three adults and one child under the age of 17.
- Approximately 37 percent are local, 50 percent are from the State of Florida, and the remaining 50 percent are from out-of-state.
- An average of 60 years old, white, with a college or graduate school education, and an annual income of $50,000 to $75,000.[27]

The Refuge focus on existing visitors is intended to conserve limited resources and to cater transit to a captive audience that has already expressed interest in the Refuge's natural resources. In the short-term, focusing transit on existing visitors lowers the risk for the design and implementation of a new transit system as Refuge staff can more easily predict what visitors would like to see and how they might use a transit system.

Potential New Audiences

The Refuge management also recognizes that it manages a unique regional resource with potential to attract new visitors. Expanding and diversifying visitation is a critical tool in building a future constituency for wildlife protection, as the FWS recognizes through initiatives like the Urban Wildlife Refuge Initiative. With its urban location and its close ties to partners throughout the Region, the Refuge

[27] Sexton, N. et al., United States Geological Survey, *National Wildlife Refuge Visitor Survey 2010/2011: Individual Refuge Results for Merritt Island National Wildlife Refuge*, 2012. In the 2010 Visitor Survey, 99 percent of visitors identified as white, with 1 percent identifying as American Indian. Ninety-eight percent are non-Hispanic, and two percent identified as Hispanic.

would like to see new types of visitors, particularly from underserved communities representing minority and low-income populations.

Recognizing the sensitive balance of targeting transit to new visitors, the study team held discussions with stakeholders from around the region, representing many of the partners listed in Table 6. The stakeholders recognized opportunities to use Refuge transit to accomplish regional economic development and nature-based recreation goals. Below, some of the potential audiences are listed and described with characteristics to define how feasible it would be for them to use transit. Analysis later in this report will determine if their use of transit would help the Refuge achieve its goals.

South Brevard and Daytona Residents. Of the more than 500,000 residents of South Brevard and South Volusia Counties, Refuge staff estimate that the majority have never visited the Refuge. New interpretive experiences offered through transit tours may attract new visitors from these areas.

Brevard and Volusia Counties both contain significant underserved populations, including Latinos, African-Americans, and persons living below the poverty line.[28] Along with the residents of Titusville (described below), these populations represent opportunities to attract new types of visitors to the Refuge and engage a wider audience in the FWS's conservation mission. Transit is one potential entry point for underserved communities to access the Refuge, especially through partnerships with a community group.

Titusville Residents. The approximately 44,000 residents of Titusville are the potential visitors with the closest access to the Refuge (approximately five miles away). This group may initiate or increase visitation through new transit tour opportunities or access from downtown Titusville. Some residents may be interested in connecting to Refuge transit via walking or biking on the A. Max Brewer Memorial Parkway Bridge, which terminates at the southern Refuge entrance. Titusville residents may offer an opportunity to diversify visitors through partnerships with proximate school and community groups. [29]

Orlando / East Orange County Residents. Located within a half-hour's drive of the Refuge, Orlando and East Orange County residents are a significant potential new audience for Refuge visitation and transit**.** Refuge partners note that East Orlando is one of the fastest growing areas of Central Florida, and identifying recreational groups, schools, and other partners in Easter Orlando could help grow and diversify Refuge visitation.

Port Canaveral Cruise Passengers. Port Canaveral cruise passengers, numbering 3.7 million annually,[30] either stop at the port for six to eight hours or start their cruise at the port with opportunities for local excursions before or after the cruise. According to Port staff, passengers are looking for unique, diverse recreation options, with more opportunities needed in nature-based recreation.[31] The Port is a 40-

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[28] As of the 2010 Census, Brevard County had approximately 57,000 African-Americans (10.5 percent of the total population), 48,000 Latino residents (8.8 percent), and 68,000 people living below the poverty line (12.5 percent). Volusia County had approximately 54,400 African-Americans (11 percent of the total population), 58,400 Latino residents (11.8 percent), and 80,000 people living below the poverty line (15 percent). U.S. Census Bureau, QuicksFacts, accessed December 23, 2013: http://quickfacts.census.gov/qfd/states/12/12009.html and http://quickfacts.census.gov/qfd/states/12/12127.html.

[29] As of 2012, the population of Titusville was estimated to be 43,940. The U.S. Census found that 13.5 percent are African-American, 6.5 percent are Latino, and 15.2 percent live below the poverty line. QuicksFacts, accessed December 23, 2013: http://quickfacts.census.gov/qfd/states/12/1271900.html.

[30] Florida Ports Council, *Port Canaveral*, accessed December 23, 2013, http://www.flaports.org/Sub_Content3.aspx?id=14&pid=3

[31] Jim Dubea and Carol Nobel, phone interview, November 1, 2013.

minute drive from the Refuge, but there may be opportunities to partner with existing drivers and tour operators.

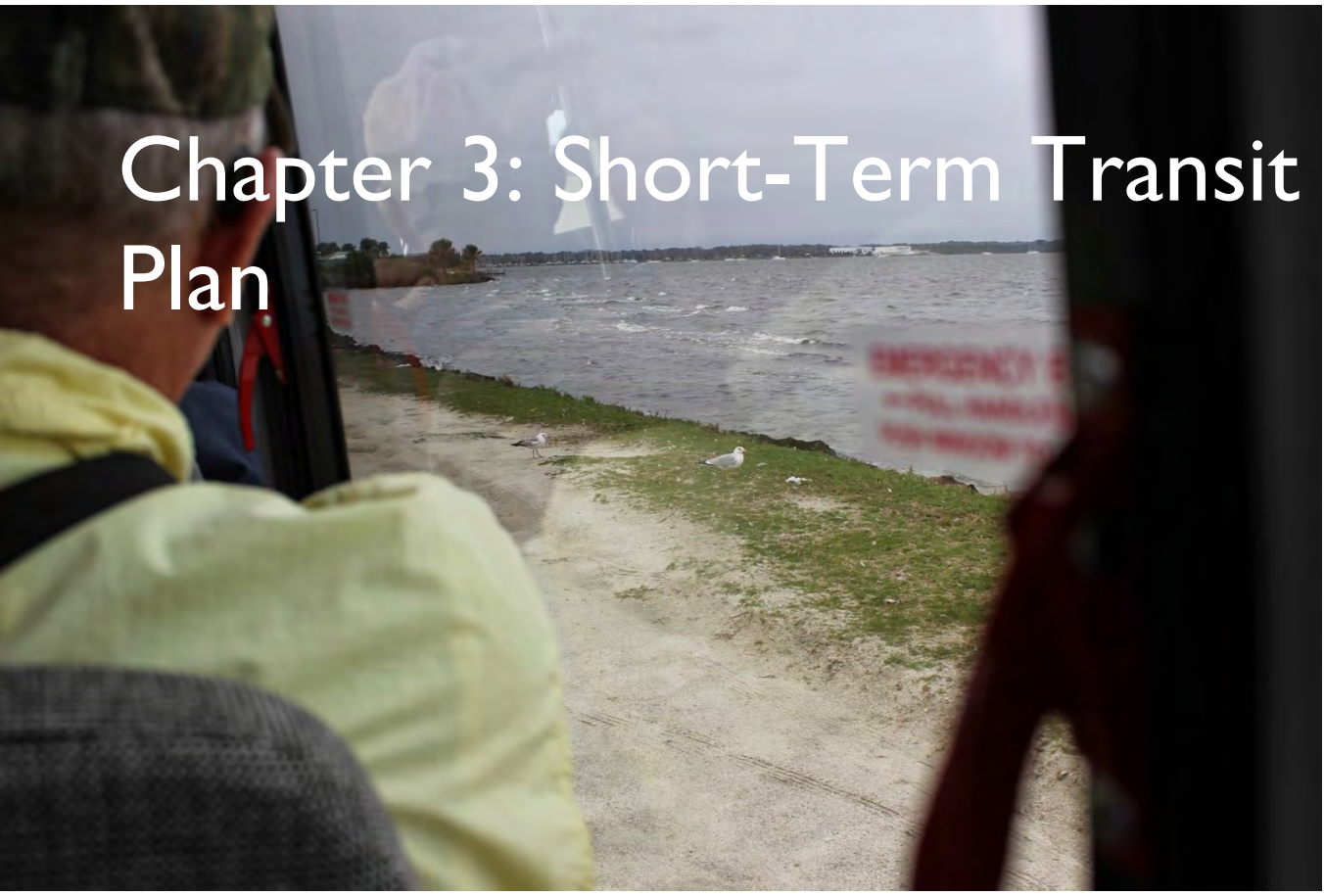
Brevard Seniors. Over 110,000 Brevard residents are over the age of 65, representing 20 percent of the population (compared to the statewide average of 17 percent),[32] and Brevard also has a significant population of seasonal residents. With more leisure time or non-traditional work schedules than younger adults, seniors may be a captive audience for nature-based recreation, particularly tours that include interpretation outside the use of their personal vehicles. These senior citizens likely own vehicles but are also more likely to have mobility issues.

Colleges and Schools. There are more than 20 post-secondary schools in Brevard County. The students are potential audiences both to take advantage of educational opportunities and because of their relatively low car ownership rates. The Refuge already hosts many schools annually for field trips, but a transit service may offer additional capacity for serving different types of student groups.

Marina Boaters. More than 13,000 people pass through the Titusville Municipal Marina during the spring and fall months. These boaters do not have a private vehicle for use during their stay in Titusville, and they may be interested in nature-based recreation opportunities during their stay. Boaters tend to be retirees without children and without significant mobility impairments.

International and U.S. Tourists. A small number of international and U.S. tourists arrive to the Space Coast via bus or shuttle. Although these visitors are very small in number, they may be accustomed to transit use and may be seeking car free opportunities. A larger group of tourists come to the Space Coast to visit KSC or local beaches via private vehicle, representing significant potential visitors but without an immediate *need* for transit. Some of these visitors take day trips from Orlando, whereas others stay at hotels, mostly near Cocoa Beach or Daytona Beach, and have their own cars. Some may be interested in Refuge tours but would need significant marketing.

[32] U.S. Census Bureau, 2010 Census Interactive Population search, accessed December 23, 2013, https://www.census.gov/2010census/popmap/ipmtext.php?fl=12



Chapter 3: Short-Term Transit Plan

Merritt Island National Wildlife Refuge
Transit Planning Study

Introduction

This short-term transit plan makes recommendations to improve transit tours within a five year period to better align with the Refuge's visitor services priorities while using existing resources. This section explores opportunities for enhancing or expanding existing transit tours in the short term. The Refuge currently utilizes one 14-passenger vehicle to conduct regular transit tours operated by volunteer drivers. Refuge staff report that tours are in high demand and regularly fill to capacity, and volunteers report positive feedback from visitors. Additionally, staff report that the system is highly flexible to accommodate volunteer and visitor interest. In 2013, the Refuge developed the *14P Bus Operator Training Booklet* ("Bus Policy") to add structure and safety measures to their tour operations.

Though the current system is well-regarded, the study team observed the following potential opportunities to improve existing transit tours:

- Transit tours do not follow a defined program or script, and tour guides may deliver interpretation that does not align with the priorities of the Refuge and visitor services program.
- There are no set routes, and Refuge staff do not know beforehand which roads the bus will travel during a tour.
- There is no reliable way for Refuge staff to communicate with tour drivers during the tour.
- While overall operating costs are very low, the Refuge has not been formally tracking these costs or anticipating future expenses.
- Visitors who take tours are fairly homogenous and representative of the average Refuge visitor;[33] there is an opportunity to increase the diversity of visitation through partnerships and outreach.
- There are inconsistencies with the implementation of the fee program launched in 2011.

This plan considers the long-term goals of the larger Merritt Island Transit Planning Study but focuses upon actions that can be implemented in the next five years, without major increases in capital expenditures or staff resources. The short-term transit plan includes action items to guide the Refuge through implementation with several elements identified as implementation components to be explored in more detail outside of this plan.

Organization of Short-Term Transit Plan

The study team identified *programmatic* and *technical* needs for short-term transit.

- *Programmatic* needs focus on the connection between transit service and the Refuge's visitor services program. These needs can only be addressed through strategic planning and decision making from Refuge staff. Actions listed for *programmatic* needs are contingent upon a clear direction from Refuge management. Elements of the short-term transit plan that are *programmatic* in nature include:
    - Program Types and Interpretation
    - Staff Capacity
- Technical needs concern the operation of transit service. Programmatic decisions should drive the specific actions or timing of technical needs; technical needs can then be implemented (fully or in part) by partners, volunteers, or Refuge staff once the programmatic direction is set. Elements of the short-term transit plan that are technical in nature include:

[33] As documented in the Current Audiences section, the average Refuge visitor is 60 years old, white, with a college or graduate school education, and an annual income of $50,000 to $75,000.

- Safety
- Routes
- Scheduling
- Estimated Program Costs
- Marketing Strategy

Program Types and Interpretation

The Refuge can strategically develop program types that align the transit tour program with visitor services priorities, which support the priorities of the Refuge as outlined in the Refuge's CCP. As defined in the Visitor Services Plan (VSP), "the purpose of the Merritt Island National Wildlife Refuges (NWR) Public Use Program is to foster understanding and instill appreciation of the fish, wildlife, and plants and their conservation by providing the public with safe, high quality, appropriate and compatible wildlife dependent recreational and educational programs and activities." The visitor services program established a vision statement summer 2014, which aligns with overall Refuge management priorities:

> *Merritt Island National Wildlife Refuge offers safe, accessible wildlife-oriented opportunities in nature for all comfort levels, creating "stepping stone" experiences that will ultimately foster conservation and stewardship ethics in future generations of Americans.*

The "stepping stone experiences" include multiple points of access for diverse types of visitors. Transit can facilitate introductory experiences for visitors who are less comfortable with the Refuge or with birding, and it can also encourage visitors with a moderate level of experience and comfort to pursue more in-depth nature exploration. The planning team considered this vision statement in its program types below, and in the Interpretive Messages and Training section of the Long-Term Transit Plan.

The existing transit-based interpretive programs are called "Beginning Birding Tours," which are between two to four hours in length. New program types could vary in objectives, interpretive content, and duration, allowing the Refuge to expand its visitor base and further its visitor services priorities. This section outlines program types that could be implemented in the short term. The outlined program types in Table 7 align with programming priorities established by the Refuge staff. Each program contains cells with the following information:

- Program objectives and connection to visitor services priorities, with a target audience (if applicable);
- Logistics and scheduling considerations, which may align with target audience or tour content;
- Suggested interpretive themes based on priorities outlined in the CCP and VSP; and
- Opportunities for advertising and marketing each type of tour.

Table 7: Potential Program Types

Tour	Objective	Schedule & Logistics	Marketing
Beginning Birding Tour (Existing)	To provide visitors an introduction to birds on the Refuge and species identification. Tour is geared towards adolescents and adults.	1. During peak season, up to four times per week 2. Primarily on Tuesdays, Thursdays, Saturdays, and Sundays at 9 a.m.	1. Advertised under 'Calendar of Events' on website 2. Posted on Facebook page 3. Promoted at the Visitor Center 4. Posted on community calendars
Families	To provide touring opportunities for families with young children.	1. Weekends and weekday afternoons 2. Limit tours to two specific locations for a short, consistent duration	Collaborate or advertise at local organizations that attract families, such as the Titusville Library, the YMCA, or churches
Nature and Technology	To provide an introduction to the history of the Refuge and the unique connection it has with KSC.	1. Weekends and weekdays 2. Update refuge video currently shown on KSC general bus tour 3. Provide talking points to KSC tour bus drivers related to wildlife and nature on KSC and along the tour route	1. Partner with the Titusville Library to establish joint programs such as during National Wildlife Refuge week 2. Partner with KSC to tours in the Refuge 3. Provide Refuge programs calendar at KSC Visitor Complex
Seashore Tour	To highlight the natural and cultural resources in CNS' southern district. Tour is geared to local residents or tourists who are interested in learning more about beach ecosystems.	1. Focus tours during CNS' peak season and on weekends 2. Include stops within the Refuge and CNS 3. Partner with NPS for interpretive content, drivers, and funding.	1. Partner with NPS to advertise to CNS visitors
Advanced Birding Tour	To provide in-depth interpretation on birds found at the Refuge. Tour is geared to visitors with prior birding experience, including tourists.	1. Focus tours during the migratory bird season 2. Tour routes may include multiple stops to see different types of birds, varying based on seasonal presence of birds	1. Market among current Refuge visitors 2. Investigate outreach efforts of other refuges and friends groups around Florida and the U.S. 3. Market at all Central Florida birding festivals

Interpretation

The program types outlined in Table 7 are ideally linked to a formal interpretation program, which Refuge staff are interested in developing in the short term and is included in the Program Type and Interpretation Actions below. The intent of a formal interpretation program is to ensure all interpretive and public use programs, including tours, are directly tied to visitor services priorities. This tie will allow the Refuge to control its messages to the visiting public and to diversify the current visitor services program through public programs that highlight the multiple and unique purposes of the Refuge.

The development of a formal interpretation program is recommended as an implementation component of this study. This document discusses the need for a formal program and preliminary next steps and actions, including costs of establishing a program and possible funding options.

Current Public Programs

The current interpretative public program relies primarily on volunteers. The volunteers develop and deliver the interpretation on a variety of wildlife and nature-based themes. Roughly thirty different types of public programs were offered in FY 2011-2012. The majority of these programs are short presentations that take place in the Visitor Center auditorium.

One program type is Beginning Birding Tours, which uses the bus to provide interpretation on points throughout the Refuge. The average duration of the bus tours is three hours. During the peak season, bus tours typically take place every Sunday, Tuesday, Thursday, and Saturday. In the off season, the bus tour takes place on Saturdays. See Appendix B for a chart on all the public programs offered.

Actions

The following actions can help Refuge staff develop and refine formal interpretation related to the bus tour and its programs.

1. **Outline Refuge interpretive themes to align with stated programming priorities.** Outlining the priorities of the visitor services

Partnering with CNS

CNS and the Refuge not only share a border but co-manage 34,000 acres of land and have a cooperative working relationship. CNS has expressed a willingness to partner with the Refuge to develop tours that include Refuge and CNS interpretation. Although FWS and NPS have different missions, there is a possible overlap in the interests of their visitor base and a specific and scripted interpretive program highlighting natural and cultural resources of CNS would diversify each entity's existing public use program. Below are ways the Refuge and CNS could collaborate in expanding and developing transit-based tours.

1. Evaluate the Reciprocal Fee Program. The Refuge and CNS have a reciprocal agreement with fee collection and revenue sharing. Both parties have expressed an interest to re-evaluate their respective fee programs and see a need to raise the current fee rate. Before a partnership in a tour program can be developed, the fee program will need to be evaluated.
    a. Timeframe: Summer/Fall 2015
2. Develop a "Seashore Tour." A partnering tour program could consist of utilizing the Refuge bus and a Refuge driver with an interpretation developed by CNS possibly given by a CNS volunteer.
    a. Timeframe: 2016
3. Use CNS as a resource for developing a Refuge interpretation program. A strength of NPS is their interpretation programs and adherence to developed scripts. Building upon an established relationship, the Refuge could partner with CNS to help develop a formal interpretation script in a low-cost manner.
    a. Timeframe: TBD

program will assist in developing new programs and an interpretation curriculum. This may be aligned with ongoing visitor services program planning through 2016.
    a. Timeframe: Summer 2014
    b. Status: In progress, to be revisited with continued engagement of visitor services program planning team.
2. **Assess effectiveness and visitor satisfaction of current public programs.** The Refuge would like to assess the effectiveness and success of the existing public programs prior to expanding and formalizing their public programs. [34] Measures for effectiveness and visitor satisfaction should consider that current demand may be more related to the education and interpretation components of the existing public programs than to the quality of transportation services. Additionally, FWS must comply with the Paperwork Reduction Act and have any visitor surveys approved through the Office of Management and Budget.
    a. Develop performance measures/metrics
        i. Timeframe: Fall 2015
    b. Develop methods to formally or informally gather information from the public
        i. Timeframe: Fall 2015
    c. Collect data
        i. Timeframe: Winter 2015
3. **Develop program types to align with Refuge programming priorities and expressed visitor interest.** Refuge staff would like to develop an interpretation curriculum and scripted interpretation for public programs that is consistent with its programming priorities.
    a. Develop program types, based on documented Refuge and visitor services programming priorities, and use to update Table 7: Potential Program Types.
        i. Timeframe: After programming priorities are documented
    b. Identify needs for curriculum/ scripted interpretation for up to 6 program types.
        i. Timeframe: 2015-2016
4. **Assess current capacity of Refuge to achieve curriculum development** (see Staff Capacity section).
    a. Timeframe: Summer 2015
5. **Determine outside resources to provide adequate capacity and develop curriculum.** Potential resources could include grant money, interns, and partnering with the Seashore. Actions include applying for grants, hiring and overseeing interns, and contacting the Seashore.
    a. Timeframe: 2015-Summer 2016
6. **Train volunteers in scripted programs.**
    a. Volunteers should undergo training that includes program types, scripts, routes, and additional safety updates (see Safety).
    b. Develop training material from program type and scripted interpretation
        i. Timeframe: Fall 2015
    c. Schedule and deliver training sessions for volunteers
        i. Timeframe: Fall 2015

Safety

Refuge management have expressed concerns about the safety of volunteers and visitors on transit tours, and the Refuge wants to ensure that safety measures are in place for future transit operations. To

[34] This action item is designed to better integrate visitor services program planning with transportation; it is not a dependency for implementation of the short-term transit plan.

that end, the Refuge developed the Bus Policy for volunteer bus drivers, which "is intended to reduce the risk of accident and promote safety for the driver as well as the passengers associated with the operation of the vehicle." An abridged version of the Bus Policy can be found in Appendix H. The Bus Policy lists the following safety requirements for operating the existing bus:

- Ensuring the bus is in safe working condition before and after tours;
- Possessing a valid U.S. driver's license with an acceptable driving record;
- Obtaining certification from the Refuge in First Aid, cardiopulmonary resuscitation (CPR), and use of an automated external defibrillator (AED);
- Undergoing a background investigation; and
- Attending the Refuge's driver training and completing an online defensive driving training course.

The Bus Policy provides the foundation for a safe transit program, but Refuge staff have identified opportunities to increase safety and general management accountability in the short term. These opportunities are related to communications and knowledge of bus location as well as recommendations to update or enhance the Bus Policy to implement safety measures.

Bus Location

The Bus Policy provides drivers the flexibility to take Refuge visitors on any of 14 designated transit touring roads and destinations (see Figure 9). This flexibility allows volunteers to customize their tours according to visitor interest and wildlife presence, but causes Refuge staff to be unaware of the bus's location or how long the tours will last. As a result, Refuge staff have expressed their preference to have a set of fixed tour routes rather than complete flexibility for volunteers to select their route. This safety concern is further addressed in the Routes section.

Communication between Drivers and Staff

In addition to the variability in the location and duration of the tours, there is currently no formal communication system between the bus driver and Refuge staff. Staff therefore may not know where the bus is at any given time during a tour. Refuge staff have expressed concern over the lack of reliable communication between bus drivers and staff or Visitor Center volunteers during tours. Under the Bus Policy, the Refuge is to provide a "communication device (cell phone) for emergency or incident purposes to be taken on tours." As of February 2014, a formal communication device for use between the bus driver and Refuge staff is not in place.

Guidelines for Young Children

The existing Bus Policy does not address the safety of young children on the transit tour. Florida law requires children aged 5 and younger to be secured in a federally approved child restraint (either a carrier or a booster) while in a moving vehicle.[35] While the existing bus has seatbelts, bus tours are likely not appropriate for children requiring restraints due to the length of the tours and the lack of facilities outside of the Visitor Center. The short-term transit plan recommends that families with children under 6 be required to provide their own child restraints, and that parents and guardians use discretion when deciding to bring younger children on bus tours.

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[35] State of Florida, *Florida State Uniform Traffic Control, The 2014 Florida Statutes*, accessed May 1, 2015, http://www.leg.state.fl.us/statuTes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0316/Sections/0316.613.html

Actions

The following actions would help ensure that Refuge staff has a means to communicate with the bus driver during a tour.

1. **Implement an official communication device (cell or radio).** Because the availability of cellular phone service varies drastically throughout the Refuge, a two-way radio is likely the most reliable form of communication between bus drivers and Refuge staff. This will not require a change in the Bus Policy, but rather a compliance to what is already established.
    a. Timeframe: Fall 2015
    b. Status: Started/in progress
2. **Update the Bus Policy.**
    a. **Develop protocol for communications before, during, and after the tour, including in the case of an emergency.** As an added measure of accountability, Refuge staff proposed that drivers alert the Visitor Center when transitioning from one major segment of a tour to another (e.g., "The tour is leaving Black Point Wildlife Drive and heading to the Manatee Observation Deck."). This would provide staff at the Visitor Center a better understanding of where the tour is at all times.
        i. Timeframe: Fall 2015
    b. **Provide written guidelines for young children on the bus tour.** Based on Florida law and the facilities outside of the Visitor Center, bus tours are not appropriate for children aged 5 and under, unless parents or guardians provide their own child restraints.
        i. Timeframe: Fall 2015

Routes

The Bus Policy provides drivers the flexibility to take Refuge visitors on any of fourteen designated transit touring roads and destinations (see Figure 9). These roads and destinations include:

- Bair's Cove Boat Ramp
- Seashore parking lots
- BPWD
- Manatee Observation Deck
- Oak/Palm Hammock Parking Lot
- Parrish Park East of Max Brewer Bridge[36]
- SR 406 (A. Max Brewer Memorial Parkway)
- Pine Flatwoods parking lot
- Refuge Headquarters Area
- Refuge Visitor Information Center
- Sendler Education Post
- Scrub Ridge Trail Road / Parking Lot
- SR 3 (Kennedy Parkway)
- SR 402 (Beach Road)

[36] Parrish Park is adjacent to the Refuge and owned by the City of Titusville.

Figure 9: Map of Designated Transit Tour Routes on the Refuge[37]

Sample Routes

The sample routes illustrated below provide a foundation to develop a list of approved, fixed routes that correspond with program types and enhanced transit tour program safety. Each tour that would follow these three sample routes begins and ends at the Visitor Center (although tours could be altered to begin at external destinations). For each route, the length of time of individual tours will vary considerably depending on wildlife presence and visitor interest. Therefore, Table 8 includes an estimated *minimum* time needed for driving (without stopping for wildlife viewing) and loading and unloading passengers. Other information in Table 8 includes tour name, mileage, Refuge roads covered in the route, and destinations.

[37] Merritt Island Bus Policy, see Appendix H: Refuge Bus Policy.

Table 8: Sample Routes

Route Name	Length of tour	Roads included	Destinations	Minimum driving time
Existing tour route	30.7 miles	• SR 402 • SR 406 • SR 3 • BPWD	• Parrish Park • BPWD • Bairs Cove • Headquarters, maintenance area	1 hour
Black Point Wildlife Drive	15 miles	• SR 402 • SR 406 • BPWD	• BPWD	45 minutes
Manatee Tour	22.5 miles	• SR 402 • SR 3	• Manatee Observation Deck • Bairs Cove	45 minutes

Existing Tour Route

The tour route described in this section is based on the most frequent destinations of the "Beginning Birding" tours given in February and March of 2014, including:

- Parrish Park,
- BPWD,
- Bairs Cove, and
- Headquarters and maintenance area.

While actual routes vary, this route is meant to represent the range of themes and destinations covered on a traditional tour. This tour provides passengers a high-level overview of the Refuge and its plant and animal species, with a focus on the Refuge's bird species. During the off-season in the summer months, the tours focus on more general nature themes, as species presence is low during this time.

Passengers are encouraged to exit the bus for wildlife viewing on Parrish Park, BPWD, and at Bairs Cove. In total, the tour lasts approximately three hours, including a restroom break on BPWD. The route takes passengers through approximately 30.7 miles of Refuge and City of Titusville property (see Figure 10).

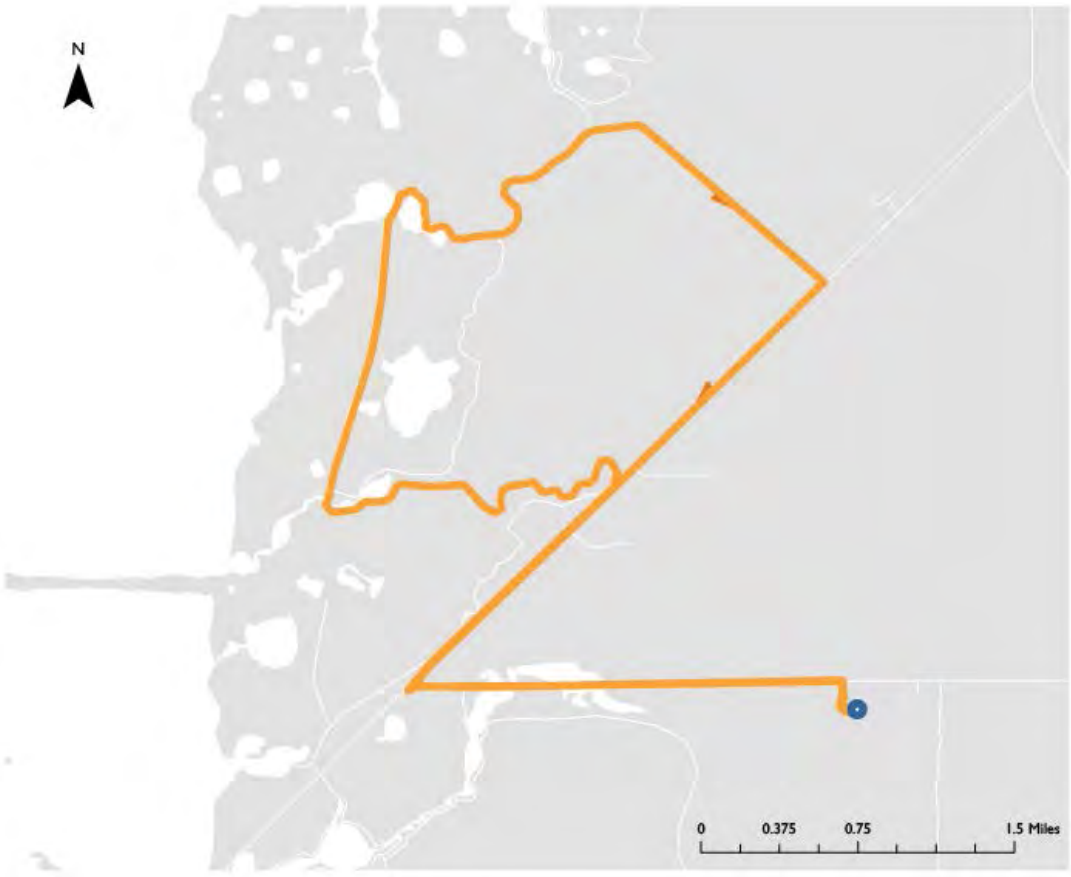
Figure 10: Existing Tour Route

Due to the length of the tour, the existing route may not be appropriate for younger audiences. The breadth of destinations in the tour route, however, allows the route to align with the objectives of the Beginning Birding Tour and the Advanced Birding Tour programs (see Table 7).

Black Point Wildlife Drive

Primarily located on one of the Refuge's popular public use sites, this route could provide a briefer overview of the plant and animal species present at the Refuge than the existing tour route. Like in the existing tour route, the volunteer driver may allow passengers to exit the bus for wildlife viewing at multiple points on BPWD. The 15-mile tour route is likely to last under two hours, although the time may vary based on the number of stops, species presence, and congestion on BPWD (see Figure 11).

Figure 11: Black Point Wildlife Drive Route



Because the BPWD route would be shorter than the existing route yet could still provide an overview of natural resources at the Refuge, it may be an appropriate alternative for families with young children and other audiences. The route could be aligned with the objectives of the Families, Beginning, and Advanced Birding Tour programs (see Table 7), depending on the script and themes covered.

Manatee Tour

This route could provide visitors access to the two sites on the Refuge where manatees are most likely to be observed: the Manatee Observation Deck and Bairs Cove. Prior to boarding the bus, Refuge staff or volunteers would provide a short presentation on manatees in the Visitor Center auditorium. Once on the bus tour, passengers would have the opportunity to exit the bus to view manatees and other wildlife at both locations. The tour is likely to last under two hours (including time for the presentation in the Visitor Center), and the route is approximately 22.5 miles long (see Figure 12).

Figure 12: Manatee Tour Route

This route could provide a very specific program focus that is only appropriate when water temperatures are warm enough for manatees to be present. Like the Black Point Wildlife Drive route, the Manatee Tour Route would be shorter than the existing tour route, and it may be an appropriate alternative to the existing route for families with young children and other audiences. This route is intended to align with the objectives of the Families program and may also be appropriate for basic birding activities and the Beginning Birding program (see Table 7).

Actions

The following actions would address concerns regarding the location of the bus during tours.

1. **Update the Bus Policy with a list of approved routes.**
    a. Timeframe: 2016
2. **Establish a protocol for volunteer drivers to select from the list of approved routes and communicate selected route with Refuge staff or Visitor Center volunteers.**
    a. Timeframe: 2016
3. **Establish a protocol for volunteers who want to temporarily vary from a fixed route (such as to accommodate wildlife presence).**
    a. Timeframe: 2016

Scheduling

While Refuge staff and volunteers recognize the potential for expansion of the Refuge's transit tour program, major expansion is not feasible in the short term due to staff capacity, infrastructure, and funding. This section describes how service could be enhanced within these constraints. The following schedules are provided:

- Similar tour frequency to the current transit tour program with the addition of program types
- Increased service frequencies (on-Refuge only)
- Increased service frequencies with connections to external destinations

Existing Schedule

The existing bus program schedule is typically comprised of four tours per week: one on every Tuesday, Thursday, Saturday, and Sunday morning at 9:00 AM. The program runs during the Refuge's peak visitation season from December through March. Tours may be offered once or twice a week during the Refuge's off season, but they are dependent upon driver availability. Schedules are published on the Refuge's website and on the Visitor Center's Public Use Program Calendar.

The Refuge could continue to operate tours at its current frequency (four tours per week during peak season) while incorporating the program types described previously (see Table 7). The Refuge could also vary start times to accommodate families with young children. Table 9 shows a sample week schedule with potential program types.

Table 9: Example of Transit Tour Program Schedule with Program Types

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Families, 2:00 PM		**Nature & Tech**, 10:00 AM		**Advanced Birding Tour**, 9:00 AM		**Beginning Birding Tour**, 9:00 AM

Schedules for Increased Service

A schedule that accommodates various start times and program types can be incorporated in the transit tour program with increased service. The bus scheduling scenario illustrated in

Table 10 doubles the number of tours offered each week (from four to eight). Service on weekends is increased to accommodate the increase in visitors typically seen during these days. In addition to providing tours in the afternoon, this scheduling scenario incorporates Program Types, which provides more opportunities for different audiences to benefit from the bus tour program.

Table 10: Example of Tour Bus Program Schedule with Increased Service

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Nature & Tech, 10:00 AM *and* **Family Tour**, 2:00 PM		**Nature & Tech**, 10:00 AM		**Advanced Birding Tour**, 9:00 AM	**Nature & Tech**, 10:00 AM *and* **Seashore Tour**, 2:00 PM	**Nature & Tech**, 9:00 AM *and* **Advanced Birding Tour**, 1:00 PM

The scheduling scenario illustrated in Table 11 enhances the previous schedule with placeholders for external destinations. The placeholder on Friday morning would be ideal for local school groups, while the placeholder in the early afternoon on Wednesdays is scheduled for audiences that would be available during the midweek, such as seniors groups. In the case that an external destination is not identified, a Seashore Tour or Beginning Birding Tour will be substituted on these days.

Table 11: Example of Tour Bus Program Schedule with Increased Service and External Destinations*

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Nature & Tech, 10:00 AM *and* **Family Tour**, 2:00 PM		**Advanced Birding Tour**, 10:00 AM	**Nature & Tech**, 12:30 PM *or* **Seashore Tour** or **Beginning Birding**, 12:30 PM	**Advanced Birding Tour**, 9:00 AM	**Nature & Tech**, 9:00 AM *or* **Seashore Tour** or **Beginning Birding**, 1:00 PM	**Nature & Tech**, 9:00 AM *and* **Family Tour**, 2:00 PM

*Underlined tours include a pick-up at an external destination.

Criteria for Increasing Service

Increased service provides more opportunities for visitors to experience transit tours and potentially could attract new Refuge visitors. However, increased service requires increased costs (see Estimated Program Costs) and volunteer driver time. Refuge management staff should determine when and if to increase service based on the following recommended criteria:

- Demand for current transit tours, as measured by number of visitors that sign up for tours;
- Availability of volunteer drivers;
- Development of curriculum for one or more program types;
- Refuge staff capacity to oversee driver training and tour scheduling; and
- Marketing efforts to advertise tours (may be done in conjunction with local partners).
- Ability of the bus to handle increased tours and hours of operation (identification of a threshold for bus operation)

Actions

The following actions would allow the Refuge to set and adjust a tour schedule according to the Refuge's goals and visitor demand. These actions also address communications about the schedule to staff, volunteers, and visitors.

1. **Conduct a meeting with visitor services staff at the beginning of each tour season to discuss visitor services program priorities and how to reflect them in the tour program.**
    a. Timeframe: Annually starting in October 2015
2. **Set weekly schedules for a one-month period.** Based on outcomes of the meeting with visitor services staff, the program manager can determine the frequency of service and the program types on a monthly basis. Monthly scheduling allows the Refuge to maintain flexibility. The schedule should reflect visitor services program priorities and management considerations.
    a. Timeframe: Annually starting in October 2015
3. **For tours with external destinations, outreach to partners in advance of tour season to solicit interest** (see Partners section). Add external destination tours to the schedule based on partner interest and Refuge capacity.
    a. Timeframe: Summer 2016

4. **Share draft monthly schedule with Refuge staff and volunteers; adjust based on feedback and driver availability.**
    a. Timeframe: 2017 and beyond
5. Publish tour schedule in accordance with marketing strategy.

Estimated Program Costs

This section estimates the cost of operating and maintaining the existing and potential transit tour programs. These cost estimates are for planning purposes; they establish a baseline of costs for the current transit tours and approximate increases that may be anticipated with enhanced or increased service in the short term.

Methodology and Assumptions

All cost estimates were generated from the Volpe Center's *Bus Lifecycle Cost Model* tool, with some default data (initial capital costs, driver labor costs, etc.) altered for the Refuge's unique circumstances.[38] The cost estimate assumes that volunteers will continue to conduct tours in the short-term.

The average cost per mile to operate the current bus is $1.50, with fuel costs of $0.50 per mile[39] and maintenance costs of $1.00 per mile. The simple methodology in the short-term transit plan focuses on this cost-per-mile estimate, with several additional management and programmatic costs, such as labor costs for developing the program curriculum, identified for further analysis (the Staff Capacity section includes additional information on labor costs).

Additionally, these estimates do not include costs associated with replacing the bus because the current bus will likely not need to be replaced in the next five years. Similar buses are designed for seven years of use or 200,000 miles; however, buses may last longer if use is low and they are properly stored and maintained.[40] Based on current General Services Administration pricing and options, similar buses cost approximately $60,000-$80,000 to replace.

Existing Transit Tour Program

The cost estimates in Table 12 are based on the existing tour route illustrated in Sample Routes subsection. Seasonal estimates are based on 2014's transit tour program schedule, with four tours a week taking place from December through March (for a total of 64 tours annually).[41] These cost estimates do not factor unscheduled tours at the request of groups.

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[38] A medium-duty cutaway bus was selected in the cost model tool as the closest representation to the light-duty bus currently operated at the Refuge. The tool template is available at: volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling

[39] The gasoline cost per gallon was altered in the cost model template to $3.50.

[40] Volpe Center, *Bus Lifecycle Cost Model for Federal Land Management Agencies User's Guide*, 2011, 5, http://ntl.bts.gov/lib/44000/44200/44244/Bus_Lifecycle_Cost_Model_User_s_Guide.pdf

[41] The cost estimate calculation is based on peak season tours only. In some years, the Refuge has operated tours less frequently during the off-peak season. Cost estimates could be increased on a per-tour basis for off-season tours.

Table 12: Existing Tour Route Seasonal Mileage and Cost Estimates

	Mileage	Cost
Per tour	30.7	$46.05
Seasonal total	1,964.8	$2,947.20

Transit Tour Program Cost Estimate for Schedule for Increased Service

Expanding the transit tour program to include additional routes and increased frequencies may have a considerable impact on the operational and maintenance costs of the program. The program cost estimates in Table 13, Table 14, and Table 15 are based on the routes described in the previous Sample Routes subsection.

Table 13: Existing Tour Route Cost Estimates

	1 Trip Weekly	2 Trips Weekly	4 Trips Weekly	6 Trips Weekly
Weekly total cost	$46	$92	$184	$276
Monthly total cost	$184	$368	$736	$1,105
Seasonal total cost	$737	$1,474	$2,947	$4,421

Table 14: BPWD Route Cost Estimates

	1 Trip Weekly	2 Trips Weekly	4 Trips Weekly	6 Trips Weekly
Weekly total cost	$22	$45	$90	$135
Monthly total cost	$90	$180	$360	$540
Seasonal total cost	$360	$720	$1,440	$2,160

Table 15: Manatee Tour Route Cost Estimates

	1 Trip Weekly	2 Trips Weekly	4 Trips Weekly	6 Trips Weekly
Weekly total cost	$34	$67	$135	$202
Monthly total cost	$135	$270	$540	$810
Seasonal total cost	$540	$1,080	$2,160	$3,240

These costs can be mixed-and-matched to arrive at various weekly and seasonal cost estimates. For example, if the weekly schedule for increased service illustrated in Table 10, for example, included four existing route trips, two BPWD Route trips, and two Manatee Tour Route trips, then the weekly bus program cost would be $296; the seasonal bus program cost would be $4,747.

As discussed in the Routes section, the enhanced transit tour program may also include regular service or service by request to external destinations in the Titusville area for targeted visitor groups or special events. Table 16 lists possible external destinations and the roundtrip cost estimate between the Visitor Center and the external destinations.

Table 16: External Destinations Distances and Cost Estimates from the Visitor Center

Destination	Distance from Visitor Center (in miles)	Roundtrip Cost Estimate
Downtown Titusville	5.5	$16.50
CNS (Parking Lot 1)	7.2	$21.60

Destination	Distance from Visitor Center (in miles)	Roundtrip Cost Estimate
CNS Visitor Center	5.4	$16.20
Marina	5.6	$16.80
Titusville Towers	5.5	$16.50
Titusville Library	7.0	$21.00

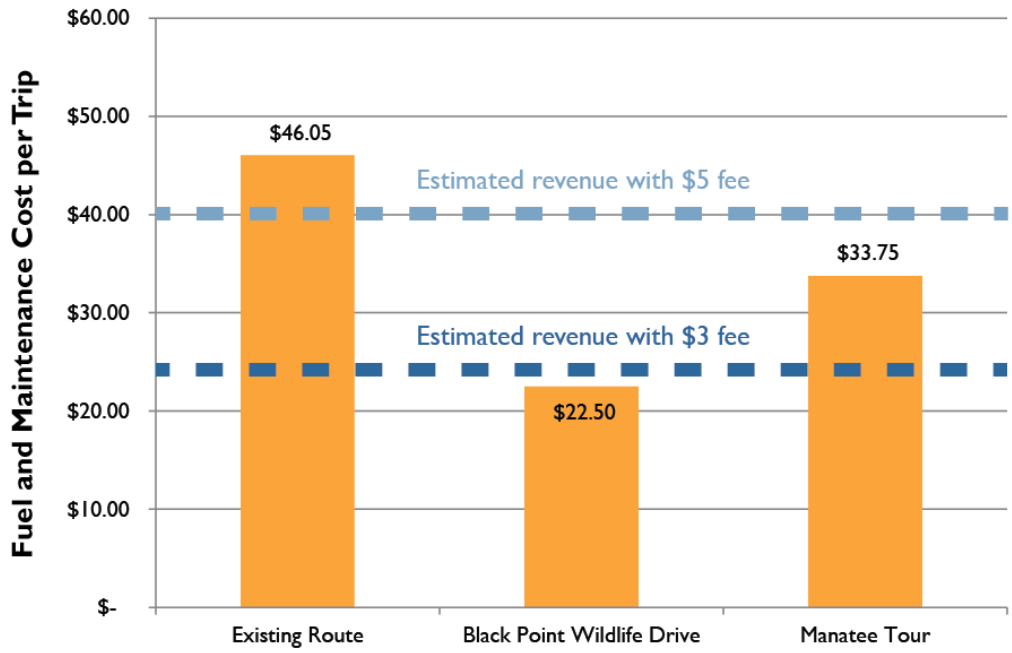
Current Funding Situation

The Refuge cost-shared the purchase of the bus that is currently in operation in 2011 with the Refuge's Friends group, the Merritt Island Wildlife Association (MIWA). Following the purchase of the bus, MIWA donated the bus to the Refuge.

The current fee for attending the Bird Tour is $3 per adult. Children 16 and under ride for free. The fee program returns 80 percent of the transit fee back to the Refuge, with the remainder returning to the southeast region for overall visitor services programs.The fees that stay with the Refuge are directed to visitor services programs, which can be used for expenses related to transit tour operations. While the Refuge currently tracks total transit tour revenues, it does not explicitly connect those revenues to any expenses related to the transit tour program (such as fuel). Funds to maintain and fuel the vehicle come from the Refuge budget. Refuge staff have expressed a desire to track the budget of the transit tour program in the future.

Data from the 2014 transit tour program indicates an average of 12 passengers per tour. The Refuge estimates an average of two passengers under the age of 16 are exempt from paying the tour fee, for an estimated total of $24 in revenue from fees (80 percent of $30 total) per tour. Even if the current $3.00 fee were to go entirely to expenses related to the bus program, it would not be enough to cover current program costs; Figure 13 illustrates an estimated $22 shortfall between the cost per trip on the existing route and the total collection of fees. Increasing the fee to $5 would cover more of the costs, but would still result in an estimated $6 shortfall per trip.

Figure 13: Fuel and Maintenance Cost per Trip with Estimated Revenue



Potential Funding Sources and Partnership Opportunities

While increasing the fee to ride the bus to $5 is a potential future funding source, there are other opportunities for funding the transit tour program. These opportunities include:

- Federal/private grants;
- Funding sources or in-kind support from local partners;
- Additional fees for tours that include external destinations;
- Lowering the age of children exempt from paying the fee.

Staff may explore these funding sources as an implementation element to this plan.

Actions

The following actions would address concerns related to general transit tour program funding accountability and funding the transit tour program in the short-term.

1. **Develop and implement protocol to track total transit tour revenues.** This action would establish baseline data for current costs, including fuel and maintenance, based on actual expenditures. It can also be used to measure performance in the future and to explicitly connect revenues to any expenses related to the transit tour program.
    a. Timeframe: Aggregate data starting in Fall 2014; ongoing
2. **Consider potential funding sources and partnership opportunities.** This action entails research into potential funding sources and determination of their applicability to the transit tours. It also involves outreach to partners to provide resources or in-kind services to the tour program.
    a. Timeframe: 2015-2016

Staff Capacity

The short-term transit plan recommends improvements to and expansions of its public use transit-based programs, which may demand increased capacity and resources of Refuge management staff to develop and implement these programs. This section summarizes the current capacity of the Refuge and identifies short-term needs for managing the public use and interpretive programs related to transit.

Current Capacity of the Visitor Services Program Staff

Currently, three full-time Refuge staff positions (2 permanent and 1 temporary) and two temporary part-time Refuge staff positions run and manage the visitor services program and the Visitor Center with assistance from Refuge volunteers. On most weekends, a Refuge law enforcement officer and one Visitor Center staff are the only two uniformed staff on the Refuge. There is not a dedicated interpretive ranger at the Refuge and the interpretation is mainly left to volunteers. Additionally, the Refuge provides two RV pad sites on Refuge property as a housing location for up to four volunteers in return for their work at the Refuge. RV volunteers' responsibilities range from assisting with maintenance and caretaking of the public use infrastructure to helping to manage the public and educational programs. The roles of the positions supporting the visitor services program are described in Appendix C.

The Refuge has recently restructured its visitor services program staff to have one full-time and one part-time staff member do fee collection at the visitor center. One part-time fee collector is responsible for collecting fees from the iron rangers in the field. The other visitor services staff include a Supervisory Refuge Ranger who manages the Refuge complex's visitor services programs, and a Refuge Ranger that manages the Visitor Center and the volunteer program. The CCP documented that in order to achieve the goals, objectives, and strategies outlined, the Refuge requires 5.5 full-time employees to run the visitor services program,[42] but the funding forecast for the program in the next ten years suggests that these hires would not be financially sustainable. The Refuge hopes that it can continue to employ cost-efficient staffing solutions, such as hiring designated fee collectors, to extend the capacity of all visitor program staff in the future.

Transit Capacity

The operations and management of a transit system entails a number of responsibilities for Refuge staff, volunteers, and partners. Even the current small-scale transit system involves staff and volunteer support in areas like safety, maintenance, and interpretation. Table 17 lists possible tasks that are either currently performed or that should be performed in the future. This table is a starting point for the Refuge to discuss staff capacity for managing transit.

Table 17: Tasks Needed for Short-Term Transit

Category	Task	Current	Future
Operations and Management	Inspect vehicle for basic condition, cleanliness (before each tour)	Volunteer Driver	Volunteer Driver
	Drive vehicles	Volunteer Driver	Volunteer Driver
	Deliver interpretation	Volunteer Driver	Volunteer Driver
	Collect basic ridership counts	Volunteer Driver	Volunteer Driver
	Define or confirm role and responsibilities of all involved in the transit system	NONE	Program Manager

[42] U.S. Fish and Wildlife Service, 2008, 131.

Category	Task	Current	Future
	Define total hours of volunteer time needed per week or month (depends on schedule)	NONE	Program Manager
	Define training needed	Supervisory Refuge Ranger	Program Manager
	Overall transit management	NONE	Program Manager
	Collect fares	Volunteers	Visitor Center staff
	Develop interpretation (or oversee)	NONE	Program Manager
	Develop and deliver driver training	Supervisory and Refuge Rangers	Program Manager
	Develop/adjust weekly and monthly schedules	NONE	Program Manager
	Manage budget, including tracking fuel costs and paying for maintenance	Supervisory Refuge Ranger	Program Manager
	Analyze and track ridership	NONE	Program Manager
Safety	Undergo safety training	Volunteer Driver	Volunteer Driver
	Develop and enforce safety policy	Supervisory Refuge Ranger and Law Enforcement Officer	Program Manager
	Perform driving record review	Department of Motor Vehicles	Department of Motor Vehicles
	Perform driver background investigation	Supervisory Refuge Ranger	Program Manager
	Provide first aid/CPR training	NONE	Refuge
Maintenance	Perform regular vehicle inspections	Volunteers	Volunteers
	Perform semi-annual maintenance	NONE	Maintenance staff
	Fuel vehicle	Volunteers	Volunteers
Marketing and Outreach	Coordinate with groups for special events[43]	Supervisory Refuge Ranger	Program Manager
	Manage marketing	NONE	Program Manager
	Coordinate internally for special events	Supervisory Refuge Ranger	Program Manager
	Manage reservations	Volunteers	Volunteers
	Produce marketing materials	NONE	Partners, volunteers
	Distribute marketing materials	NONE	Partners, volunteers

Actions

The following actions would allow the Refuge to identify, prioritize, and potentially fulfill both short- and long-term transit capacity needs.

[43] The person who manages this coordination should have the authority to add special tours. This person should have the ability to coordinate drivers and authorize the use of funds/fuel for operation.

1. **Refine and prioritize Refuge short-term capacity needs, including transit capacity needs.** The tasks listed in Table 17 are specific to the existing or enhanced transit system. However, the Refuge has additional capacity needs that may be higher priority than the transit system.[44] Transit capacity should be assessed in a discussion with Refuge staff in the context of overall Refuge capacity needs.
    a. Discussion with Refuge staff to identify critical needs and prioritize needs.
    b. Write up description of unmet, priority needs
        a. Timeframe: Summer 2015
2. **Match needs to existing and potential capacity.**
    a. Identify tasks that can be filled by volunteers or partners, and train/work with volunteers or partners to fulfill. This may include an update of the Bus Policy and Volunteer Training to incorporate tasks that can be fulfilled by volunteers.
        a. Timeframe: Winter 2015
    b. Identify tasks that can be filled by interns, term staff, or rotational assignments, and write job descriptions for those tasks.
        a. Timeframe: Winter 2015
    c. Hire interns, term staff, or rotating staff (as feasible).
        a. Timeframe: As needed
    d. Add one RV pad to increase recruitment of RV volunteers
        a. Timeframe: TBD
3. **Document long-term capacity needs.** The CCP calls for an additional three full-time staff for its visitor services program (in addition to the 2.5 staff that currently work with the program). The CCP does not explicitly consider capacity needs for a transit program.
    a. Identify capacity needs for long-term transit (based on preferred scenario, to be developed).
    b. Revise Visitor Services Plan to reflect transit capacity needs as an internal management document.
    c. Maintain position descriptions and transit capacity tasks.
    d. Identify funding sources, partnerships, and other opportunities to fulfill long-term staffing needs.
        a. Timeframe: 2016-2017

Marketing Strategy

A marketing strategy is recommended to help the Refuge meet its goals of offering access to new visitors. Through outreach to new and underserved communities, including both local residents and tourists, the Refuge can also contribute to the broader Space Coast regional economy by highlighting the tours as a unique activity that supports nature-based tourism efforts of the region. Currently, the Refuge and MIWA use very limited marketing and outreach for the tours, including posts on the Refuge website and at the Visitor Center. Renaissance Titusville has infrequently posted information on the tours.

Several local and regional stakeholders, including the Titusville Chamber of Commerce and the Brevard Tourism Development Commission, expressed the desire for a broader marketing effort for the Refuge and also offered to support the effort through their own resources and relationships. The Refuge should

[44] The Refuge clearly has needs that exceed capacity. By documenting these needs, the Refuge is in a better position to justify new staff, rotational staff, interns, volunteers, etc. However, with the limited staff and turnover, finding someone to actually document may not be a priority.

maintain control of the messages broadcast to the visiting public, and therefore it can work closely with its stakeholders to develop a simple marketing strategy for transit tours in the short term.

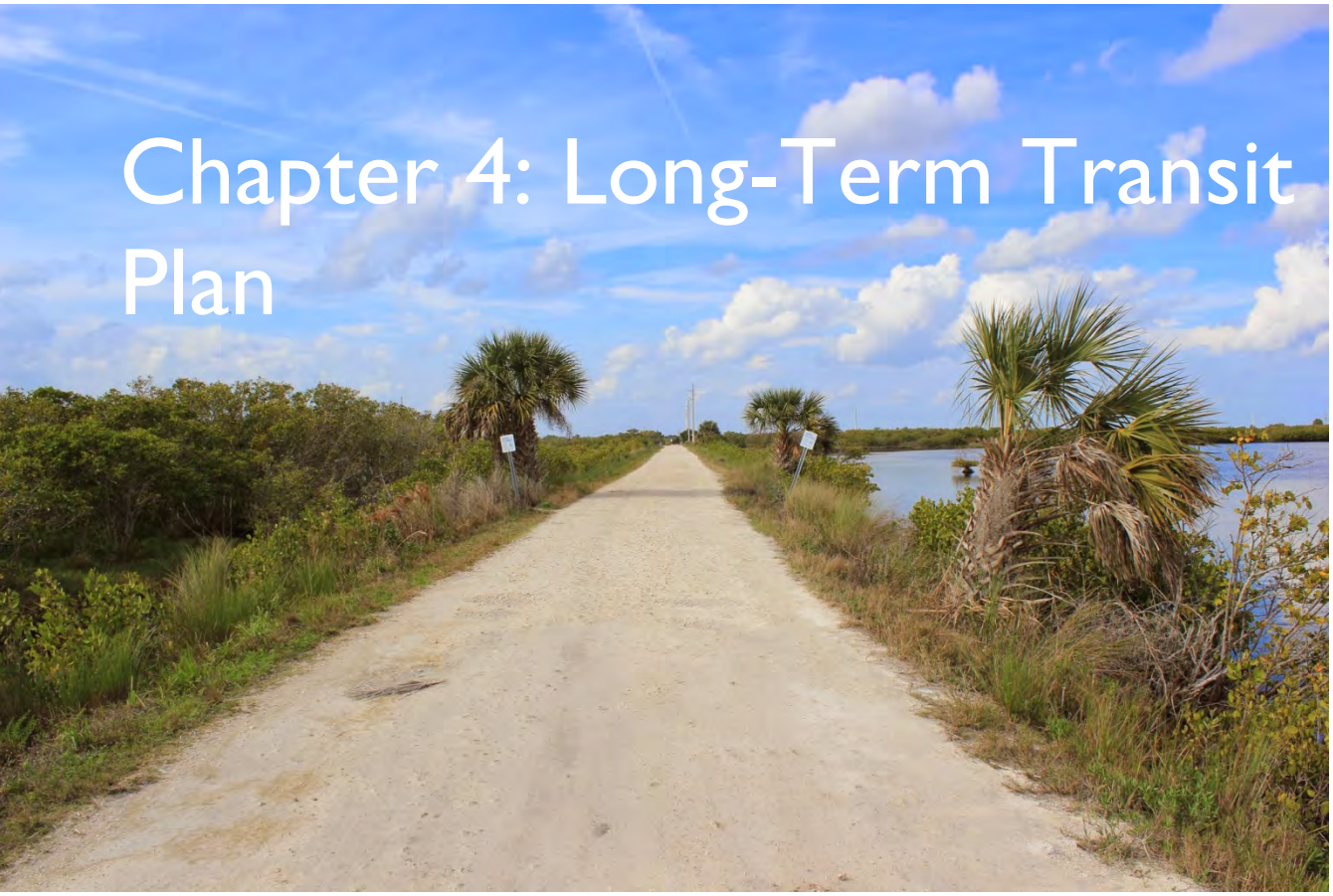
Actions

The following actions will allow the Refuge to work with partners to develop and implement a marketing strategy.

1. **Develop marketing messages and ground rules.** Refuge staff should develop key messages about the Refuge and about transit tours to share with partners. This can include interpretive and environmental education messages, as well as logistical tour details. Ground rules may include types of outreach or messages that would be inappropriate to include. Messages could be developed by an intern or through a Refuge staff meeting.
    i. Timeframe: Summer 2015
2. **Develop marketing strategy.** The marketing strategy may be led by the Refuge or a local stakeholder (or group of stakeholders) using the messages and ground rules established by Refuge staff. The strategy can be very simple, but it should outline roles, materials, schedules, and costs for marketing.
    i. Timeframe: 2015-2016
3. **Work with stakeholders to implement strategy.**
    i. Timeframe: 2016-2017

Conclusions

This short-term transit plan can help the Refuge begin to achieve the goals of this study using existing resources within a five year period. It calls on the Refuge to strategically set its programming priorities and update the transit tours to match these priorities, allowing the Refuge to lead the development and delivery of interpretive messages to visitors. It also calls for the Refuge to leverage the capacity of volunteers and partner organizations, recognizing that the Refuge has its own staff limitations. As the Refuge considers implementation of this plan, the Actions can be a guide, to be implemented in whole or in part, as Refuge resources allow. An enhanced transit tour program, with greater ties to the Refuge's programming priorities and increased involvement of regional partners, can establish a strong foundation upon which to consider the long-term opportunities for transit at Merritt Island NWR.



Chapter 4: Long-Term Transit Plan

Merritt Island National Wildlife Refuge
Transit Planning Study

Introduction

This chapter, a long-term transit plan, makes recommendations to improve transit tours on the Refuge beyond the short-term plan's scope of five years. To help meet the Refuge's transit goals, the long-term transit plan looks at several scenarios for transit under the following lenses:

- Strategic investment of transit infrastructure;
- Visitor experience and diversity;
- Sensitivity to wildlife and habitat; and
- Refuge capacity and management.

To consider different future possibilities, the plan explores options for improving transit through four long-term transit scenarios: Baseline Scenario, Concentrated Use on BPWD, Dispersed Transit, and Mandatory Transit on BPWD.

Planning scope and time horizon

This plan makes recommendations for transit operations that could take place on and near the Refuge in 15 years and beyond (the short-term transit plan is intended to cover transit needs in the next five years). The time frame allows the Refuge to explore scenarios that are rooted in current and anticipated needs and challenges, while recognizing that circumstances may change in the future.

Unlike the short-term transit plan, the long-term transit plan considers transit scenarios that would require moderate to major capital improvements or an increase in staff time and resources. The scenarios consider major infrastructure investments, new partnerships, and shifts in visitation that may not be feasible in the short term.

Connections to existing conditions

The Existing Conditions chapter revealed several considerations, explained below, that are critical to the design of future transit. Specifically, the size of the Refuge and its limited staff capacity are two major themes that should factor into all long-term scenarios.

The Refuge is very large, with many amenities in isolated areas.

Because of the distance between visitor use areas and the seclusion of these areas, transit cannot offer on-and-off service; for visitor safety and comfort, transit will be limited to guided tours. Additionally, visitor uses should be concentrated as much as possible in a few areas. Concentrating uses allows law enforcement to better serve areas with high visitation.

The future construction of the new Visitor Center (in the same general location as the current Visitor Center) will further establish that surrounding area as a concentrated visitor use zone. Additionally, the construction of the new Visitor Center presents opportunities to develop staging areas for transit. Phase 1 will start in fiscal year 2017 (October 2016), and will consist of design and partial construction of the facility. The facility will be completed during Phase 2 in fiscal year 2019. Funding for road and parking improvements is not available in these phases, and will be requested separately through federal, state and local agencies.

Current and anticipated staff capacity is limited.

The Refuge does not anticipate any major changes in its staff numbers. Therefore, transit should take place on only a few routes and areas that can be maintained and enforced for concentrated visitor use. In part for this reason, the Refuge desires a system owned and operated by a concession, which should

draw less upon Refuge staff for management.[45] If a concession operates transit, it must be financially self-sustaining. Accordingly, this transit plan considers the long-term needs for FWS staff to oversee a transit system that is owned and operated by others and recommend ways to build or fund capacity.

Methodology

The planning team developed and vetted each long-term transit scenario through meetings with Refuge senior staff and stakeholders. The team examined scenarios using evaluation criteria, and this plan selects a preferred scenario using these criteria and other factors. The process used to arrive at the preferred scenario was:

- **The planning team drafted long-term scenarios based on concerns with the current system, existing Refuge conditions, and study goals.** The short-term transit plan provided a foundation for potential routes, operations, and management.
- **The planning team developed evaluation criteria based on study goals.** The evaluation criteria use data sources like traffic counts to illustrate how the scenario may affect desired transit plan outcomes.
- **Refuge staff examined and critiqued the draft scenarios and evaluation criteria and proposed new long-term transit scenarios.** Refuge staff from visitor services and interpretation, public safety and law enforcement, fire management, and biology provided input during a site visit in September 2014.
- **Refuge management approved final versions of the scenarios, resulting from Refuge staff meetings.** The final scenarios incorporate routes and operations proposed by Refuge staff. Management removed a few proposed transit routes and scenarios from consideration due to environmental or financial feasibility.
- **The planning team conducted qualitative and quantitative analysis on each scenario.** The long-term transit plan includes brief descriptions and quantitative analysis of the four scenarios, including visitor distribution and financial analysis.[46]
- **The planning team applied evaluation criteria to the final scenarios.** The Refuge can use these evaluation criteria to determine the best scenario or combination of scenarios for transit in the long-term.

The planning team also conducted a visitor distribution analysis that considers the impacts that each scenario may have on overall Refuge visitation patterns. This analysis uses data from the Refuge Annual Performance Plan (RAPP) and the USGS Visitor Survey, as well as insights from Refuge staff and volunteers. RAPP and Visitor Survey data provided the percentage of visitors that participated in various activities (birdwatching, auto tour driving, photography, etc.). The planning team then asked Refuge staff and volunteers to estimate which locations are most popular for these activities and what proportions of visitors participating in each activity would visit each location. Finally, the planning team asked Refuge staff and volunteers to estimate where visitors might go if BPWD or other Refuge amenities were closed or too crowded. The planning team then extrapolated this information to each of the four scenarios, arriving at information contained in the Visitor Distribution section and summarized in each scenario.

[45] Systems operated by volunteers and partners may also be feasible from a Refuge staff capacity standpoint, but these business models are less feasible for other reasons. See also Appendix D: Transit Business Models.
[46] More details on the cost estimates and visitor distribution analysis are included in those sections.

Why Use Scenarios?

Scenarios for long-term transit help the Refuge, its stakeholders, and the public envision different paths for transit programming and management on and near the Refuge. Scenarios also allow those involved in transit planning to see how those paths accomplish the goals of the Transit Planning Study. Additionally, long-term transit scenarios:

- Set a baseline to understand the impacts of management decisions;
- Provide enough information to make decisions, but not detailed analytics;
- Provide elements that can be combined to form new scenarios; and
- Help the Refuge select and communicate its preferences.

Finally, the scenarios included in this long-term transit plan allow the Refuge to compare future potential visitation patterns and management strategies, such as using transit to concentrate visitors in one area of the Refuge versus using transit to disperse visitors to different areas.

Considering the Refuge's current resource limitations (and anticipated limited future funding), the scenarios may contain both "feasible" and "reach" substitutions for infrastructure and programming, which are defined as:

- "Feasible" transit routes and infrastructure improvements can be realized without major investments or extensive environmental review and permitting.
- "Reach" options are infrastructure investments that would require outside funding through the Federal Lands Transportation Program or other funding sources, extensive NEPA review, and/or multi-year design and construction projects. The "reach" scenarios are documented, along with their potential value, in case resource allocations change in the future.

The plan assumes that the Refuge would implement the "feasible" options in all scenarios, but the option of "reach" improvements, like widening BPWD from start to end to relieve congestion, may be critical under certain circumstances or desirable if funding is available.

Long-Term Transit Scenarios

The planning team developed the following long-term transit scenarios, which have been vetted through thorough meetings with Refuge senior staff and stakeholders. Aspects that are the same for each transit scenario, such as transit staging, vehicle selection, and business models, are described in the Considerations for All Transit Scenarios section.

I. Baseline Scenario

Scenario Description and Rationale

The Baseline Scenario represents conditions and transportation on the Refuge absent any new significant transit investment. It is included as a means of comparison to show how evaluation criteria and other conditions on the Refuge may change once new transit service is added.

Transit in the Baseline Scenario is similar to the transit tours that currently take place on the Refuge. Tours include interpretation by the driver and allow for passengers to exit the vehicle for short periods of time to observe wildlife. The scenario assumes the implementation of recommendations included in the short-term transit section of this report, including recommendations for safety and alignment with visitor services key messages. Therefore, transit may be offered with up to double the current tour frequency, depending on Refuge management direction and volunteer and staff capacity.

Where Transit Operates

See Figure 14 for a map of an exploratory Baseline Scenario route (see Short-Term Transit section for mileage and driving time). The Baseline Scenario uses the following roads:

- SR 402,
- SR 406,
- BPWD,
- SR 3, and
- Manatee Observation Deck.

Scenario Characteristics

In this scenario, transit is characterized by:

1. Volunteer-driven, three hour tours;
2. Tours occur weekdays and weekends during peak season and weekends only off-peak season;
3. An average of 5 tours per week during peak season and 1 tour per week during off-peak season;
4. Basic routes and program types managed by Refuge visitor services staff; and
5. Transit ridership consisting of primarily older, white, middle- or upper-income, and those familiar with the Refuge and/or with birding.[43]

[47] Based on Refuge staff and volunteer observations. See also Chapter 1: Existing Conditions for visitor demographics.

Figure 14: Baseline Scenario

Impacts to Visitation

Under this scenario, the distribution of visitors is expected to remain similar to what is seen today. While BPWD is the most popular destination, there is also very high visitation at Manatee Observation Deck (in season for manatee viewing), the Visitor Center and surrounding trails (for orientation, wildlife viewing, and interpretive programs), Biolab Road (for wildlife viewing and bank fishing), Bairs Cove and Biolab boat ramps (for wildlife viewing and boat launches), and Peacock's Pocket (for wildlife viewing and bank fishing). Other sites around the Refuge receive lower visitation.

Transit use is most concentrated on BPWD, with most if not all tours including this route. Transit routes also include Parrish Park and the Manatee Observation Deck. The approximate percentage of all Refuge visitors who use transit is approximately 0.14 percent, based on estimates for transit use in 2014.

The visitor distribution analysis finds no notable change in visitor distribution from current conditions, as future crowding is expected to be at or near current levels. This means that visitors are not likely to choose to visit other parts of the Refuge due to crowding on BPWD, unless these visitors are already doing so in current conditions.

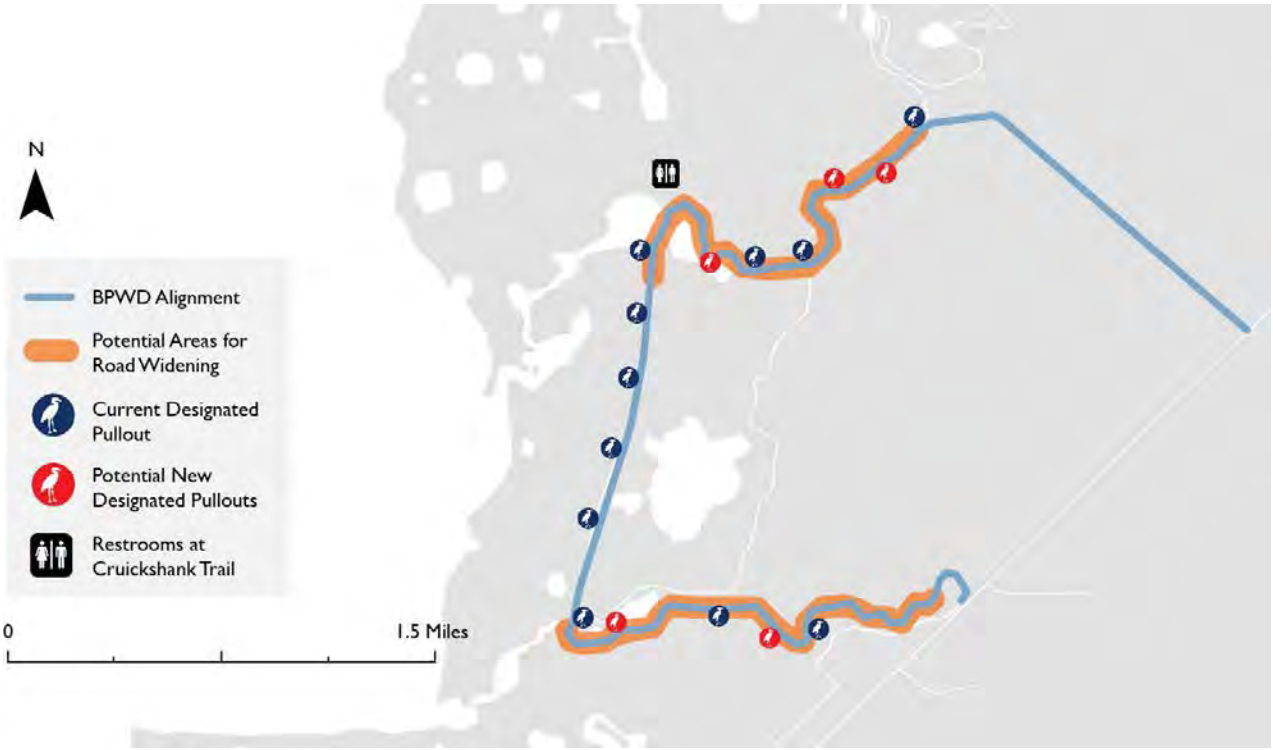
Infrastructure and Maintenance Needs

The Refuge will need to maintain all of its roads at current conditions, or better. Since most use will continue to concentrate at BPWD, there is an increased need to keep that road in excellent condition

and also make improvements to keep the road safe and enjoyable. The most critical improvements to BPWD, all of which are "feasible," (see Figure 15) include:

- Build more pullouts,
- Conduct regular (and potentially more frequent) grading and vegetation management,
- Add signage to influence driver behavior and speeds, and
- Where feasible without significant environmental impact, construct limited road widening at turns or in critical passing areas.

Figure 15: Feasible and Critical Improvements to BPWD for Long-Range Transit Use



Additional "reach" improvements that would be valuable if funding were available are:

- Conduct significant widening to BPWD along its entire length (starting with segments that are strategically important for safety, passing, and congestion alleviation) and
- Improve one or more other auto routes, such as Biolab Road, to be comparable to the current condition of BPWD to provide substitute/additional private vehicle experiences.

Safety Considerations

The Refuge would likely have similar or increased levels of visitation to today and similar visitor dispersion patterns, resulting in the same safety concerns that the Refuge now experiences, such as:

- Limited law enforcement presence at dispersed visitor amenities;
- Volunteer drivers and infrequent road maintenance may result in risk of transit accidents;
- Congestion and driver behavior on BPWD, especially during peak periods, may block access for emergency vehicles; and

- Roads that are not designated by modal use may experience conflicts between modes and safety hazards for more vulnerable users (bicyclists and pedestrians).

Staff Capacity

In this scenario, Refuge staff is responsible for all of the following:

- Oversight of transit operations, reservations, and revenues;
- Training of volunteer drivers;
- Transit vehicle maintenance;
- Upkeep of bus safety policy;
- Law enforcement across all Refuge amenities (and likely inability to meet demand due to significant dispersion of visitation);
- Maintenance of BPWD in excellent condition (regular/frequent grading and mowing); and
- Maintenance of other Refuge amenities in safe operating condition.

While these are similar to the current staff responsibilities, staff capacity needs may increase if visitation increases and if Refuge staff positions are cut in the future.

II. Concentrated Use on Black Point Wildlife Drive

Scenario Description and Rationale

The Concentrated Scenario envisions that BPWD becomes the primary attraction for visitor activities, especially for visitors who are looking for guidance in experiencing the Refuge. While BPWD is already the most popular visitor amenity, this scenario involves a management decision to direct most visitors in search of a vehicle-based, wildlife observation experience to BPWD. While other routes may remain open to private vehicles (for experienced birders, bank fisherman, hunters, etc.), the Refuge would direct maintenance and visitor services resources to prioritize BPWD to create a high-quality experience.

The Concentrated Scenario is characterized by the following:

1. Develop a new transit route adjacent to BPWD that diverts transit tours from all or part of the current auto-tour route. For planning purposes, this route is envisioned as potentially splitting from private vehicle traffic at the entrance to BPWD on T-10G, and/or using Black Point Bypass. Transit would operate with the auto-tour route for the final 2.25 miles of BPWD, where no alternate routes are available (see Figure 16 for a more detailed route description).
2. Conduct improvements to BPWD to improve traffic flow. These improvements include additional pullouts, strategic road widening, and signage.
3. Use a concessionaire to operate transit tours and manage private vehicle traffic flow into BPWD. During peak visitation periods, the concessionaire would permit vehicles to enter at levels that would ensure safe operating conditions.

Scenario Characteristics

In this scenario, transit is characterized by:

1. Concessionaire-operated 2.5 hour tours;
2. An average of 21 tours per week during peak season and 14 tours per week during off-peak season;
3. Basic routes and program types developed by Refuge visitor services staff and operated by concessionaire; and
4. Transit ridership is similar to currently Refuge transit riders (see Existing Conditions), with a greater number of families and tourists.

The Concentrated Scenario is included for two reasons. First, by concentrating use at BPWD, resource impacts are concentrated in one small part of the Refuge and minimized elsewhere. Second, concentrated maintenance, construction, and interpretive activities may be attractive from a staff capacity and budget standpoint.

The Concentrated Scenario is not primarily intended to relieve congestion, but it would include some traffic-alleviating provisions. First, a parallel but alternate transit route would divert transit traffic (and displace approximately five to ten percent of private vehicles)[48] from the auto-tour route. Second, the use of a concessionaire to manage traffic flow could help avoid dangerous or very highly congested situations (recognizing that limiting traffic flow may impact visitor experience by increasing wait times or diverting visitors elsewhere).

Where Transit Operates

See Figure 16 for a map of an exploratory Concentrated Use of BPWD route. The Concentrated Use Scenario uses the following roads:

- SR 402,
- SR 406,
- T-10G (tentative),
- W. Rail Road (tentative),
- Wild Bird Trail (tentative),
- Black Point Bypass (tentative), and
- BPWD.

[48] The planning team estimates that five to ten percent of Refuge visitors will elect to use transit instead of driving private vehicles on BPWD.

Figure 16: Concentrated Use on BPWD Scenario

Impacts to Visitation

Under this scenario, visitation is highly concentrated at BPWD. While some visitors come to the Refuge seeking a specific experience (such as bank fishing or hiking) and go elsewhere, the vast majority of visitors seeking wildlife-based recreation will visit BPWD. Some of these visitors use a transit vehicle (staged at the Visitor Center), whereas others head straight to BPWD in their private vehicle. Visitor Center staff, Refuge volunteers, Refuge signage, kiosks, and printed and online media all direct visitors to BPWD for wildlife observation. Consequently, BPWD may experience higher congestion compared to current levels. Congestion management techniques (described above) can help mitigate some congestion, but some visitors will choose to go to other, less crowded areas of the Refuge instead.

Due to the new amenities offered at BPWD, the visitor distribution analysis assumes that visitation to BPWD will increase by 15 percent over current levels. During peak season, the analysis assumes that 10 percent of visitors will chose to visit other attractions rather than face congestion at BPWD. This will result in 12-13 additional vehicles each day at Biolab Road, Manatee Observation Deck, and the Visitor Center/Boardwalk area. Other trails and roads will see minor increases, as shown in Figure 20.

All transit use occurs on the new transit route that follows BPWD (with some of the route on adjacent, newly improved roads). Ridership will include both birders and visitors without birding or Refuge experience. The tour route will be between approximately 15 and 15.7 miles long, depending on the alternate routes selected, and take approximately one and a half hours to drive, with a full tour time estimated around 2.5 hours with stops and interpretation. Under all transit scenarios, stops may either be mapped in advance or may be determined at the concessionaire's discretion, based on wildlife

presence and a safe location to pull aside. Because of the heightened emphasis on transit and investment in transit programming and infrastructure, transit ridership is expected to increase significantly; as many as 2 percent of all Refuge visitors may be expected to use transit.

Infrastructure and Maintenance Needs

Due to the increased use at BPWD, the road must be in excellent condition with improvements to keep the road safe and minimize congestion. The most critical and "feasible" improvements to BPWD are:

- Build more pullouts;
- Conduct regular (and potentially more frequent) grading and vegetation management;
- Add signage to influence driver behavior and speeds;
- Add a gate or concessionaire-staffed booth at BPWD entrance to control entry of private vehicles during times of high congestion; and
- Where feasible without significant environmental impact, construct limited road widening at turns or in critical passing areas.

"Reach" improvements include:

- Conduct significant widening to BPWD along its entire length (starting with segments that are strategically important for safety, passing, and congestion alleviation) and
- Improve one or more other auto routes, such as Biolab Road, to be comparable to the current condition of BPWD to provide substitute private vehicle experiences.

Safety Considerations

The Refuge will likely have increased levels of visitation on BPWD but may be able to curtail congestion and safety risks occurring at other parts of the Refuge. While there would still be a limited law enforcement presence at amenities outside BPWD, the overall risk to visitor safety would still be reduced from the Baseline Scenario. The Refuge could better concentrate law enforcement and safety measures at BPWD, such as through increased pullouts, signage, and controlled or paced entry.

However, safety risks would continue and potentially increase for BPWD users at peak periods. Congestion and driver behavior on BPWD, especially during peak periods, may block access for emergency vehicles. Also, sections of BPWD that are shared by transit and private vehicles would have to be carefully signed and managed to avoid incidents and maintain traffic flow.

Staff Capacity

In this scenario, Refuge staff is responsible for all of the following:

- Solicit and select a concessionaire;
- Develop and maintain a concession contract;
- Monitor transit operations (likely not intensive since route structure is very simple);
- Provide interpretive curriculum to concessionaire;
- Perform law enforcement across all Refuge amenities;
- Maintain BPWD in excellent condition (regular/frequent grading and mowing), including maintenance of new transit route;
- Maintain other Refuge amenities in safe operating condition (especially those that are prioritized as alternates to a congested BPWD).

In the Concentrated Scenario, a concessionaire would operate transit routes, manage entrance and traffic flow on BPWD, manage reservations and ticketing for transit tours, and own and maintain transit

vehicles. The concessionaire could potentially collect visitor fees for private vehicle entry to BPWD, thus reducing Refuge staff burden slightly. As compared to the Baseline Scenario, staff capacity for law enforcement in this scenario would be equal or less, for visitor services would be significantly less, and for road maintenance would be slightly greater.

III. Dispersed Transit

Scenario Description and Rationale

In the Dispersed Transit scenario, BPWD remains the primary auto tour route for private vehicles and the Refuge develops two unique new routes with high wildlife observation value that are only open for transit tours. This scenario provides multiple featured experiences on the Refuge to appeal to more "stepping stones" of audiences.

The Dispersed Transit scenario is characterized by the following:

1. Develop a new "introductory" tour route that offers visitors a one and a half hour guided Refuge experience. For planning purposes, this route will start and end at the Visitor Center and travel on West Gator Creek Road.
2. Develop a new "advanced" tour route that offers visitors a three-hour, guided Refuge experience. For planning purposes, this route will start and end at the Visitor Center, travel to L Pond Road, and exit on the straightaway paved portion of BPWD.
3. Direct private vehicles to BPWD, although assume that some visitors will choose transit instead.

The Dispersed Transit Scenario is included to showcase the potential benefits and costs of investing in new routes with regard to visitor experience, maintenance, construction, resource protection, and staff capacity. Refuge staff also is interested in exploring how new and unique types of transit experiences may draw different types of visitor groups and affect overall visitor dispersion.

Where Transit Operates

See Figure 17 for a map of an exploratory Dispersed Transit scenario route. This scenario uses the following roads:

- SR 402,
- SR 406,
- West Gator Creek Road (Introductory Tour only),
- SR 3 (Advanced Tour only),
- L Pond Road (Advanced Tour only), and
- BPWD (Advanced Tour only).

Scenario Characteristics

In this scenario, transit is characterized by:

1. Concessionaire-operated tours;
2. An average of 18 tours per week during peak season and 10 tours per week during off-peak season;
3. Basic routes and program types identified by Refuge visitor services staff; and
4. Service that caters to diverse "stepping stones" of visitors.
    a. Transit ridership (for the Advanced Tour) is similar to current Refuge transit tour ridership; and
    b. Transit ridership (for the Introductory Tour) consists of more families and tourists not necessarily familiar with the Refuge and/or with birding.

Figure 17: Dispersed Transit Scenario

Impacts to Visitation

Under this scenario, private vehicle use is concentrated at BPWD, although some visitors could use Biolab Road, Peacock's Pocket, and other routes for wildlife viewing. This scenario presents visitors with more developed options and amenities for viewing wildlife, so visitation is intentionally more dispersed (compared with the Baseline Scenario). This scenario will result in less "displaced" congestion and visitation (where visitors would go to an alternate visitor use area because their first choice is congested or closed to their preferred mode). BPWD may still experience congestion if visitors opt to use private vehicles instead of transit and during periods that transit is not operating, but transit scheduling can help alleviate this.

Transit use is split between the two new routes (L Pond Road and West Gator Creek). The "introductory" route is 8.1 miles and can be completed in less than 1.5 hours. Ridership on this route can include families with children, visitors who are not as comfortable in the outdoors or on a Refuge, and those with less total time for a visit. The "advanced" route is 19.4 miles and approximately 3 hours in length, including stops for interpretation. Ridership on this route is likely to include experienced birders, those who are familiar with the Refuge or comfortable in the outdoors, and visitors who are looking for a more in-depth experience. Because of the diversity of routes and programs, transit ridership is expected to increase significantly from current usage; as many as 2 to 3 percent of all Refuge visitors may use transit.

The visitor distribution analysis anticipates that some BPWD visitors would chose to take a tour instead of visiting BPWD, decreasing the overall visitation at that location by approximately 5 percent. However,

there is no anticipated increase at other amenities as a result of transit. Gator Creek would experience a shift from visitors in private vehicles to visitors in transit vehicles only.

Infrastructure and Maintenance Needs

This scenario requires two significant infrastructure investments through the development of new transit routes for introductory and advanced tours. The introductory tour, envisioned to use West Gator Creek Road, would need minor improvements to ensure safe access, turning radii, and visibility for a transit vehicle. The Refuge would also need to install a gate to control transit vehicle access. If additional funding were available ("reach" option), the road should be graded and vegetation trimmed more frequently to allow for greater rider comfort. Since this introductory tour will attract visitors with less outdoors experience and families with children, there is value in improving the road condition and maintaining it at a better condition.

The advanced tour, tentatively planned for L Pond Road and exiting out on the straightaway of BPWD, would require more significant improvements. While the road would not need to be in excellent condition (since it would be open only to transit vehicles with trained drivers), the following "feasible" improvements would be needed:

- Improve weak/damaged road segments of L Pond (at minimum to be safely passable for a transit vehicle, optimally to be comfortable for visitors);
- Bolster or support road sections that are vulnerable to storm damage or flooding;
- Add gate at entrance and exit to L Pond Road (preferably an automated gate);
- Grade road and manage vegetation frequently enough to allow for safe access and visibility; and
- Develop an access management plan for sharing the route exit with BPWD.

A "reach" option for this scenario would be to improve both new transit routes to a better condition and add more visitor amenities like bird blinds and observation decks.

There is the potential for less intensive maintenance to BPWD, because more private vehicles may be diverted to other parts of the Refuge and transit will not operate on BPWD. BPWD would still need seasonal grading and vegetation management, but it may be done less frequently than the Baseline or other scenarios. The planning team still recommends additional pullouts and signage at BPWD for visitor safety and congestion management.

Safety Considerations

Visitors who participate in transit tours would have minimal safety risks, considering that they would be under supervision of trained drivers and traveling on roads that are maintained for the safe operation of a transit vehicle.

Safety risks and law enforcement needs for other Refuge amenities and routes would depend on visitor distribution. If most visitors concentrate on BPWD, then safety risks would be similar to the Baseline and Concentrated Use Scenarios (see these scenarios for suggested infrastructure improvements and management techniques). If visitors adopt a more dispersed pattern and travel in larger numbers to Biolab Road, hiking trails, or other amenities, there could be increased risks for traffic accidents, vandalism, and slow emergency response. These risks would be especially acute in the likely event that the Refuge is unable to maintain all of these amenities in an excellent condition and that law enforcement is unable to adequately monitor all amenities.

Staff Capacity

In this scenario, Refuge staff is responsible for all of the following:

- Solicit and select a concessionaire;
- Develop and maintain a concession contract;
- Monitor transit operations (somewhat more intensive since route structure is varied);
- Provide interpretive curriculum to concessionaire;
- Provide law enforcement across all Refuge amenities (although level would depend on visitor dispersion patterns);
- Maintain BPWD in excellent condition (regular/frequent grading and mowing);
- Maintain new transit routes in safe, comfortable operating condition and protect routes from storm damage and flooding; and
- Maintain other Refuge amenities in safe operating condition.

As with the Concentrated Use Scenario, a concessionaire would operate transit routes, manage entrance and traffic flow on BPWD, manage reservations and ticketing for transit tours, own and maintain transit vehicles, and could collect visitor fees for private vehicle entry to BPWD. As compared to the Baseline Scenario, staff capacity for law enforcement in this scenario would be less since visitors to new transit routes would be supervised at all times and congestion on BPWD would be reduced,[49] for visitor services would be significantly less since they would not oversee a transit program, and for road maintenance would be significantly greater due to the development and upkeep of multiple transit routes.

IV. Mandatory Transit on BPWD

Scenario Description and Rationale

In this scenario, BPWD is open exclusively to transit vehicles during periods of peak visitation. The Refuge staff and planning team recognize this scenario to be both the most politically challenging as well as the most likely to significantly relieve congestion on BPWD.

Scenario Characteristics

In this scenario, transit is characterized by:

1. Concessionaire-operated tours;
2. An average of 84 tours per week (approximately 12 tours per day) only during peak season, but with the option to offer service at other times of the year;
3. Program type(s) identified by Refuge visitor services staff; and
4. Transit ridership consisting of experienced birders, families, and tourists, and those both familiar and unfamiliar with the Refuge and/or with birding.

The Mandatory Transit Scenario is characterized by:

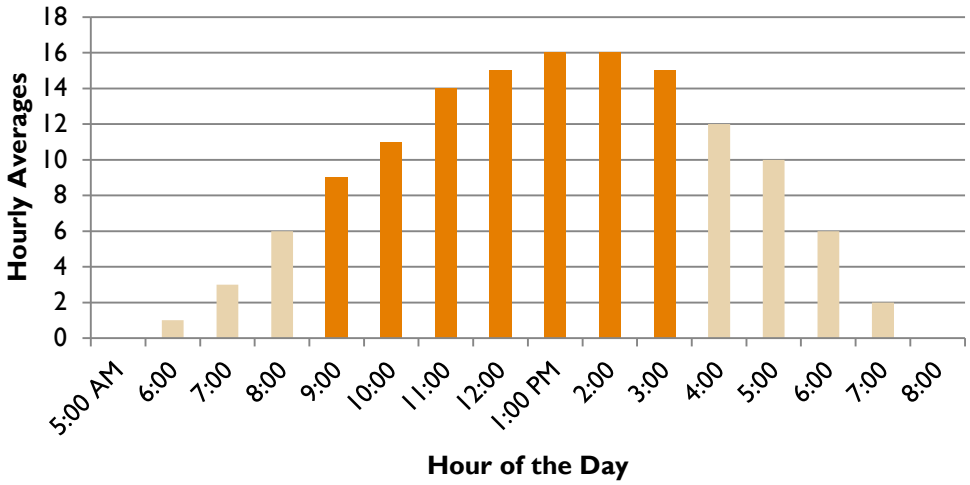
1. During most of the year (April through November), BPWD is open to both private vehicles and transit tours.
2. During peak season (December through March, 7 days a week) and peak hours (10 AM to 4 PM), BPWD is closed to private vehicles and open only to transit vehicles. Transit vehicles operate at high volumes during these hours to accommodate visitor demand.
3. For planning purposes, BPWD would be open to private vehicles during peak seasons before 9 AM and after 4 PM. Transit tours would be offered between 10 AM and 4 PM, when over70 percent of BPWD visitors use the road (see Figure 18).[50]

[49] While transit spreads visitation to a larger part of the primary visitor use "triangle," there are very little additional demands on staff for law enforcement in these areas as visitors are always supervised by transit operators.

[50] The 10 a.m. transit start time is to provide a delay between transit and private vehicles to avoid conflicts.

4. Transit could either be offered on a voluntary basis during the off-peak season (April through November) or not, depending on Refuge preference and business feasibility.
5. Transit is not offered elsewhere on the Refuge.

Figure 18: Hourly Average Traffic Counts on BPWD, May 2012 - July 2013*



*Proposed times for when BPWD would be closed to private vehicles are highlighted.

Despite the expected political opposition, the Mandatory Transit Scenario is included to show congestion relief potential. The Mandatory Transit Scenario does not involve any significant new construction and may be the most viable for a concessionaire. Finally, it is included because this transit scenario most closely resembles successful transit systems on other Refuges and public lands sites that are comparable to Merritt Island.

Where Transit Operates

See Figure 19 for a map of an exploratory Mandatory Transit of BPWD scenario route. This scenario uses the following roads:

- SR 402,
- SR 406, and
- BPWD.

Figure 19: Mandatory Transit on BPWD

Impacts to Visitation

During times of the day and year when transit is mandatory, BPWD will experience lower overall levels of visitation and congestion. However, the planning team predicts that visitation will be dispersed elsewhere in the Refuge. Additionally, private vehicle visitation at BPWD will likely increase during early morning and late afternoon hours when transit is not mandatory, resulting in new instances of congestion at these times.

The visitor distribution analysis finds the most significant redistribution of visitors as a result of Scenario 4. During peak season, an average of 200 vehicles use BPWD daily. 70 percent of those visitors (140 vehicles) visit BPWD between 9 a.m. and 4 p.m., when the road would be closed to non-transit vehicles in Scenario 4. Using assumptions from Refuge staff and volunteers, the planning team estimates sizable increases at other Refuge amenities:

- Biolab Road, Manatee Observation Deck, and the Visitor Center/Boardwalk could each receive 80-100 additional vehicles (beyond current peak-day levels);
- Canaveral National Seashore may receive nearly 50 additional vehicles;
- Gator Creek, Hammock Trails, and Scrub Ridge Trail would receive upwards of 25 additional vehicles; and
- An estimated 26 vehicles would not visit the Refuge at all.

Figure 20 shows these anticipated impacts.

The route is 15 miles and 2 to 2.5 hours in length, including stops for wildlife viewing, which may be mapped in advance or at the discretion of the driver based on wildlife presence. Transit riders will include a range of visitors, including those who are new to the outdoors, those who are beginning or new birders, families with children, and seniors. Experienced birders and those with a lot of experience on the Refuge are not likely to use mandatory transit; they will seek substitute experiences at other locations or visit BPWD outside of mandatory transit hours.

The planning team estimates that between 220 and 330 people will use mandatory transit to visit BPWD each day (when transit is operational). This number considers the current level of BPWD visitation from 10 AM to 4 PM (which is approximately 73 percent of total BPWD daily visitation) and makes two assumptions. First, it assumes that 10 to 20 percent will choose to go elsewhere in the Refuge or visit BPWD at a different time, and second, it assumes that overall visitation may increase up to 10 percent.[51]

Infrastructure and Maintenance Needs

While this scenario would decrease use at BPWD during the most congested times, the time-bound mandatory transit would likely increase visitation (and congestion) during other times. Therefore, the road must be in excellent condition with safety and congestion mitigation improvements. See the Concentrated Use Scenario for suggested "feasible" and "reach" investments.

The Refuge would need a new kiosk and gate combination to control access to BPWD, as well as a turnaround area for drivers that come to BPWD during transit-only hours. Depending on the access control system and the role of the concessionaire, there may also need to be a shelter, restroom, and water source at the entrance to BPWD.

Safety Considerations

Safety risks would decrease during times of mandatory transit. However, the planning team anticipates that visitation will shift temporally so that BPWD will experience congestion more frequently during non-peak hours. Safety risks in this case will be similar to the Baseline Scenario and Concentrated Use Scenarios with the need for increased pullouts, signage, and monitoring (although hours of safety risks will be reduced).

When mandatory transit is operating, the planning team anticipates significant visitor dispersion elsewhere in the Refuge. This would increase safety risks to these visitors, as the Refuge is unlikely to be able to maintain excellent road conditions and law enforcement presence at all other Refuge amenities. Risks include traffic accidents, vandalism, and slow emergency response. Measures to mitigate these risks include directing visitors in private vehicles to designated amenities that are maintained for visitor safety and having a concentrated law enforcement presence. (Law enforcement would likely not be needed on BPWD during mandatory transit as visitors would be supervised at all times.)

Another safety risk is increased congestion and turnaround traffic at the entrance to BPWD during times of mandatory transit. There may be a need for Refuge or concessionaire staff to direct traffic.

Staff Capacity

In this scenario, Refuge staff is responsible for the following:

- Solicit and select a concessionaire;

[51] This is a conservative estimate. The visitation trends analysis in Existing Conditions (see Figure 3) shows an annual average increase of five percent between 2002 and 2011 for VIC visitation.

- Develop and maintain a concession contract;
- Monitor transit operations (likely not intensive since route structure is very simple);
- Provide interpretive curriculum to concessionaire;
- Provide law enforcement across all Refuge amenities;
- Maintain BPWD in excellent condition (regular/frequent grading and mowing); and
- Maintain other Refuge amenities in safe operating condition (especially those that are prioritized as alternates to a congested BPWD).

A concessionaire would operate transit routes, manage entrance and traffic flow on BPWD, manage reservations and ticketing for transit tours, own and maintain transit vehicles, and could collect visitor fees for private vehicle entry to BPWD. As compared to the Baseline Scenario, staff capacity for law enforcement in this scenario would be equal or greater (during times of mandatory transit when visitation is heavily dispersed), for visitor services would be significantly less, and for road maintenance would be equal or greater.

Visitor Distribution Analysis

The visitor distribution analysis uses data from the RAPP, the USGS Visitor Survey, and anecdotal information and assumptions from Refuge volunteers and staff to predict how transit scenarios may affect overall Refuge visitation patterns. Visitors usually travel to several Refuge amenities in a single visit to participate in activities like wildlife observation, hiking, and photography. In many cases, visitors are influenced by Refuge staff, volunteers, and official signage and literature in choosing where to go.

The visitor distribution analysis also considers that highly congested conditions will detract from the experience of some visitors, especially for activities like birdwatching where crowds can deter birds. Refuge staff report, for example, that there may already be a “tipping point” in which some visitors choose to not come to the Refuge or do not come to BPWD on very high visitation days. If BPWD is congested beyond current levels due to some of the strategies included in this Transit Planning Study, visitors may elect to go elsewhere in the Refuge or not visit at all. This type of information may be informative to the Refuge when selecting a transit scenario and planning for future visitation.

Figure 20 shows the results of the visitor distribution analysis. Results of the visitor distribution analysis for each scenario are included in the scenario descriptions above. While these numbers are approximations based on assumptions (see Methodology), they do indicate some potential trends. Notably, Scenario 4 (mandatory transit) would have the greatest impact on diverting vehicles elsewhere in the Refuge. Scenario 2 (concentrated use on BPWD) would also redistribute some vehicles due to crowding, but likely at levels that would have less of a management impact.

Figure 20: Daily Vehicle Distribution at Refuge Attractions as a Result of Transit Use

Financial Analysis

The Refuge recognizes that accomplishing the goals of the Transit Planning Study will have real financial costs, but the Refuge shares the same future budgetary uncertainty as other FWS units across the nation. Refuge staff have set a management objective that transit be financially self-sufficient and manageable using current staff levels. The Refuge selected a concessionaire business model based on its ability to meet this management objective (see Appendix D for an overview of business models explored for this plan). A concessionaire must be able to operate profitably to enter a contract with FWS, and therefore business feasibility is critical to the success of a Refuge transit system.

This financial analysis component estimates costs to the Refuge and to the concessionaire to help assess the management, operational, and financial feasibility of a transit system. These costs are meant as high-level planning estimates, based on the best data available. The planning team recommends conducting independent cost estimates prior to any capital purchases.

Costs to the Refuge

The costs to the Refuge include the following:

1. Maintenance and repairs to *routes* used for transit;
2. New supporting infrastructure (kiosks, benches, shade structures, restrooms);
3. Route repairs or maintenance needs that *indirectly* result from new transit service;[52] and
4. Staff costs for transit oversight.

The section also predicts revenues that the Refuge might take in from transit operations and how these could offset costs.

Estimation of Infrastructure Costs

Transit Route Improvements and New Supporting Infrastructure

The first and likely most significant infrastructure costs are improvements to the roads that would be used by transit vehicles. Table 18 on the following page shows the roads that would need to be improved in each scenario, data on each route, and cost estimates for needed improvements. Information on the cost estimate sources follow.

[52] Indirect effects of transit use can be difficult to predict and quantify (see the Visitor Distribution analysis for more details), and therefore the cost estimates are based on a few example effects that may occur and related infrastructure costs.

Table 18: Cost Estimates for Infrastructure by Scenario

Scenario	Route	Surface	Condition	Improvements Needed	Length or unit	Cost per lane mile or unit	Total Cost	Annual / One-Time Cost
1	BPWD, Sec 001-006	Gravel	Excellent	2 routine maintenance activities per year	5.15	$6,000	$30,900	Annual
	BPWD, Sec 007	Asphalt	Fair	Single chip seal	1.15	$7,033	$8,088	One-time
	BPWD	Gravel		Add five pullouts	5	$20,000	$100,000	One-time
	BPWD	Gravel		Vegetation removal/shoulder maintenance	6.3	$586	$3,692	Annual
	BPWD	Gravel		Add ten signs	10	$300	$3,000	One-time
	Total Cost Scenario 1						**$145,680**	
2	BPWD			All Scenario 1 improvements			$145,680	
	BPWD			Gate/booth	1	$10,000	$10,000	One-time
	T-10G (tentative)	Natural	Fair	Light rehab/heavy preventative maintenance	2.3	$10,000	$23,000	One-time
	T-10G (tentative)	Natural	Fair	1 routine maintenance activity per year	2.3	$2,000	$4,600	Annual
	Total Cost Scenario 2						**$183,280**	
3	L-Pond Road	Natural		Reconstruct roadbed, sideslopes, ditches, re-gravel and compact	0.6	$83,810	$50,286	One-time
	L-Pond Road	Natural		Spot stabilization	0.6	$26,374	$15,824	One-time
	L-Pond Road			Automated gate	2	$10,000	$20,000	One-time
	L-Pond Road	Natural	Good	2 routine maintenance activities per year	5.03	$4,000	$20,120	Annual
	L-Pond Road	Natural		Regular shoulder maintenance	6	$586	$3,299	Annual
	West Gator Creek	Gravel	Good	1 routine maintenance activity per year	1.34	$3,000	$4,020	Annual
	East Gator Creek	Gravel	Good	1 routine maintenance activity per year	1.53	$3,000	$4,590	Annual
	West Gator Creek	Gravel	Good	Spot stabilization	0.4	$40,000	$16,000	One-time
	West Gator Creek			Automated gate	1	$10,000	$10,000	One-time
	Total Cost Scenario 3						**$144,140**	
4	BPWD			All Scenario 1 improvements			$145,680	
	BPWD			Gate/booth	1	$10,000	$10,000	One-time
	BPWD			Turnaround at entry	0.05	$697,000	$34,850	One-time
	BPWD			Shelter	1	$11,500	$11,500	One-time
	BPWD			Restroom	1	$1,000	$1,000	One-time
	Total Cost Scenario 4						**$203,030**	

Cost estimate information for road repair, preventative maintenance, and rehabilitation activities are from the FWS Maintenance and Rehabilitation Activities / Analysis for Prioritization and Optimization.[53] All roads are categorized by condition and environment, with the assumption that all Refuge roads fit into the "Wet No Freeze" environment category. The following maintenance and rehabilitation activities are recommended for each road condition:

- If a road is in **excellent condition**, do nothing.
- If a road is in **good condition**, perform two routine maintenance activities per year (e.g., re-grading).
- If a road is in **fair condition**, perform light rehabilitation or heavy preventative maintenance (e.g., blade and maintain crown).

Note that some maintenance activities may need to be performed annually (such as vegetation removal and routine maintenance activities), but annual costs will vary based on road condition and use.

The costs of selected activities are as follows:

- Gravel routine maintenance = $3,000 per lane mile;
- Native routine maintenance = $4,000 per lane mile;
- Gravel heavy preventative maintenance or light rehab = $40,000 per lane mile;
- Reconstruct roadbed, sideslopes, ditches, re-gravel and compact = $83,810 per lane mile;
- Ditch or side slope repair, shoulder maintenance, blade and maintain crown = $586 per lane mile; and
- Spot stabilization with fabric or aggregate =$26,374 per lane mile.

Sources for cost estimates of additional elements are as follows:

1. Bus shelter = $11,500[54]
2. Bench = $1,550[55]
3. Bus pullouts = $15,000 - $70,000[56]
4. Automatic gate = $10,000[57]
5. Signs = $300 each[58]
6. Turnaround at entry is based on replacement value of Section 001 of BPWD, multiplied by a 0.05 mile distance.

These costs are for planning purposes only and rely on reported conditions of roadways from the 2010 Refuge Inventory and staff-reported updates. The planning team did not survey roads in question or complete updated condition assessments.

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[53] Task Order 13-014 U.S. Fish and Wildlife Service Region 5 Analysis for Prioritization and Optimization. Document provided by Eastern Federal Lands, dated February 14, 2014.
[54] Price estimated by advisors in the Volpe Center's Security and Emergency Management Division.
[55] *Bicycle Safety Guide and Countermeasure Selection System*, accessed November 2014, http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=2
[56] Ibid. This estimate appears to be for paved pullouts in urban locations, so the cost in MINWR can assumed to be lower. Cost varies depending on drainage needs, utilities, and amenities.
[57] Price estimated by advisors in the Volpe Center's Security and Emergency Management Division.
[58] *Bicycle Safety Guide and Countermeasure Selection System*, accessed November 2014, http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=56

Staff Capacity Cost

Staff currently spend time on tour oversight, volunteer coordination, policy and guidance, vehicle maintenance, and marketing and outreach. While none of these responsibilities is a full time job for any Refuge staff, they can be time-consuming. While it is difficult to precisely quantify staff time and costs, each scenario contains a qualitative estimate of staff capacity demands. Table 19 provides a high-level quantitative estimate of staff capacity costs.

There are a few considerations related to Table 19:

- Law enforcement and road maintenance refer to activities throughout the Refuge. Increases in staff capacity assume indirect effects of transit distributed across the Refuge.
- Maintenance activities are most significant in the years leading up to new or expanded transit service (e.g., developing a new transit route or staging area). Maintenance staff capacity during later years may be offset by a prioritization of overall road maintenance activities.
- Fee collection estimates assume that the concessionaire can handle all fee collection, but that at least one full time employee (FTE) would need to remain at the Visitor Center to answer visitor questions.

In all scenarios, there are associated costs with staff capacity in multiple program areas. In Scenarios 2 through 4, the costs and staff time related to direct transit program oversight are minimal. Rather, the costs reflect how overall staff capacity related to the visitor services program (including law enforcement and maintenance of facilities for visitor use) will shift depending on the future direction of transit. Scenarios 2 through 4 come closer to the management objective that a new transit system is self-sustaining, but there will still be an overall demand for staff capacity that indirectly relates to transit use.

Table 19: Staff Capacity Cost Estimates

Staff Capacity Area	Staff Responsible	Scenario 1	2	3	4
Transit program oversight and marketing	Visitor services (2 FTE)	10% of 2 FTE	1-5% of 1 FTE	1-5% of 1 FTE	1-5% of 1 FTE
Interpretation	Visitor services (2 FTE)	10% of 1 FTE	1-5% of 1 FTE	1-5% of 1 FTE	1-5% of 1 FTE
Safety and law enforcement	Law enforcement rangers (2 FTE)	100% of 2 FTE	95-100% of 2 FTE	90% of 2 FTE	110% of 2 FTE (during mandatory transit)
Road maintenance	Maintenance	100% of FTE	110% of FTE	120-150% of FTE	110% of FTE
Fee collection	Visitor services (1 FTE & 2 PTE)	100% of 1 FTE, 2 PTE	1 FTE at Visitor Center	1 FTE at Visitor Center	1 FTE at Visitor Center

Other Costs

The short-term transit plan estimates that the Refuge currently spends $46 per transit tour for vehicle fuel and maintenance costs (the total cost may be less for shorter tours). The Refuge receives approximately $30 from transit tour participant fees, leaving a Refuge cost of approximately $16 per

tour. With four tours per week over a 16 week season, the total Refuge cost is $1,024. This is a relatively small cost to the Refuge. However, if the Refuge were to expand their tour operations in Scenario 1 to eight tours per week and expand their season to 24 weeks per year, the cost would increase to $3,072. In Scenarios 2 through 4, the Refuge would not incur costs for vehicle fueling and maintenance (although there are other infrastructure capital and maintenance costs to consider) because a concessionaire would cover these costs.

Anticipated Revenues

The Refuge anticipates using a concession contract for transit operations for Scenarios 2 through 4. Under this arrangement, the Refuge will sign a contract with a concessionaire that spells out the type and level of transit service that the concessionaire will provide on the Refuge, along with other details like dates of service, interpretive messages to include on tours, safety protocols, and fees that the concessionaire can charge to visitors. As documented in the contract, the concessionaire will pay a fee to FWS for the right to operate transit (and potentially other businesses) on the Refuge. This fee will be determined during contract development based on inputs from the Refuge, the Regional Office, and the concessionaire about what would be feasible from a business perspective.

The fee that the concessionaire pays to the FWS is divided into two parts. The majority of the fee returns to the U.S. Treasury and is not available to the Refuge. A small amount is provided back to the Refuge for oversight of the concessionaire (at other Refuges the "oversight" fee is only a few thousand dollars per year). The "oversight" fee is not sufficient to hire additional staff or pay for infrastructure improvements, two of the most significant transit costs to the Refuge (as outlined above).

The planning team recommends that the Refuge include in the concession contract that the transit tour price should be adjusted to include the amenity fee for BPWD. The amenity fee is what the visitor pays to use a specified amenity on the Refuge, such as BPWD or Bairs Cove boat ramp. Since visitors on the transit tour would use the amenity for which a fee is charged, they must contribute to the amenity fee through their transit tour ticket. For example, when a visitor pays the concessionaire $10 for a transit tour ticket, $1 of that ticket price would go to the Refuge as an amenity fee and the remaining $9 would go to the concessionaire to cover costs of the tour. Ding Darling NWR has this type of arrangement with their concessionaire, and it helps to ensure that the Refuge receives revenue to maintain the infrastructure of the Wildlife Drive.[59]

Visitor Cost of Transit versus Private Vehicle

If Refuge transit will accomplish the goals of congestion relief and enhanced access, there must be sufficient transit ridership to have an impact on vehicle travel patterns. Transit service must be high enough to be viable for a concessionaire from a business perspective and also high enough to reduce the number of vehicles at congested Refuge amenities during peak periods. *Pricing* is one of the simplest ways to affect visitor behavior, and therefore pricing of transit tours should be coordinated with pricing of Refuge amenity fees to ensure that one mode is not strongly incentivized over another.

The price of a transit tour will be set during the concession contract negotiation and involve factors like profitability for the concessionaire; anticipated ridership; and capital, operations, and maintenance costs. The price can only be adjusted during renegotiations of the concession contract (usually every five years, depending on terms of contract). Under REA, the FWS may charge amenity fees to visitors for

[59] Jeff Combs, Ding Darling National Wildlife Refuge Ranger, email, received November 23, 2014.

areas where special amenities (including interpretive services) are provided.[60] FWS fees are planned and managed through a five-year business plan for each site that charges fees; this business plan should include spending plans or projects to use the fee revenue within the five year period. Furthermore, FWS is required to conduct public participation and outreach for all fee proposals.[61] Therefore, any fee adjustment should be planned significantly in advance.

The Refuge is interested in maintaining a consistent source of fee revenue from BPWD (and other amenities) to fund necessary maintenance activities, and the concessionaire will be interested in maximizing profits and minimizing expenses. Since the concessionaire will have a minimum transit tour ticket price that would allow them to operate profitably, the Refuge should consider the transit tour price when setting future amenity fees.

While the planning team recognizes that the transit tour has certain additive values to using a private vehicle (interpretation, freedom from driving, very minor fuel savings), the team still recommends that the amenity fee should not be considerably lower than the corresponding fees for a visitor to take a transit tour. The team believes that many visitors will respond to financial incentives to take the transit tour,[62] and only through this additional transit ridership will congestion relief goals be realized. Additionally, the planning team recommends that the Refuge include an amenity or recreation fee as part of the transit ticket price, which can be included in the concession agreement.

Business Viability for Concession

Since the long-term transit plan assumes that a concessionaire, not the Refuge, will operate transit service, there is less of a need to calculate costs associated with transit service. The concessionaire may already own and maintain a large fleet of vehicles or have specific preferences or methods for transit operation at the Refuge, which would affect costs.

This Transit Planning Study is concerned with estimating whether transit would be *viable* for a concessionaire from a business perspective. More accurately, the planning team considers (at a high level) what levels of service and ticket prices would be needed to cover estimated costs and whether these are feasible. This section estimates route costs for each route, along with ranges of frequency. It also considers whether such levels of service could likely be achieved given current visitation levels and patterns. It examines other tour routes around the region to compare prices.

Route Costs

Each long-term scenario utilizes different routes to appeal to different audiences, resulting in varying costs for the concessionaire to operate each tour. The cost estimates below take into consideration the approximate roundtrip mileage and the resulting fuel and maintenance costs as well as the cost to pay a driver during the length of the tour.

Operations and maintenance costs may vary depending on the condition of the roads traveled. Gravel road surfaces and other factors may reduce fuel economy by as much as 20 to 27 percent, and poor road conditions may increase overall operating and maintenance costs by as much as two to four times

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[60] FWS, *The Recreation Fee Program*, 2013, http://www.fws.gov/refuges/visitors/recreationfees_062005.html

[61] U.S. Department of the Interior, U.S. Department of Agriculture, *Implementation of the Federal Lands Recreation Enhancement Act*, 2012, http://www.doi.gov/ppa/upload/flrea_triennial_report_2012_final.pdf

[62] This applies to Scenarios 2 and 3. Scenario 4 is mandatory transit, which is even more compelling for visitors to use transit.

when compared to operating vehicles along a typical flat, smooth surface.[63] Table 20 and Figure 21 compare the estimated route costs by scenario per trip with the average number of tours per week (for both peak and non-peak seasons) between the four scenarios.

Table 20: Estimated Route Costs by Scenario per Trip

Scenario	Approximate Miles Roundtrip	Fuel & Maintenance[64] Costs per Trip	Approximate Length of Tour (Hours)	Driver Costs per Tour[65]	Total Operating & Maintenance Costs per Trip
Scenario 1: Baseline	30.7	$46.05	3	N/A	$46.05
Scenario 2: Concentrated Use on BPWD	15.3	$22.95	2.5	$34.48	$57.43
Scenario 3: Dispersed Transit (Introductory Tour)	8.1	$12.15	1.5	$20.69	$32.84
Scenario 3: Dispersed Transit (Advanced Tour)	19.4	$29.10	3	$41.37	$70.47
Scenario 4: Mandatory Transit on BPWD	15	$22.50	2.5	$34.48	$56.98

[63] Volpe Center, *Bus Lifecycle Cost Model for Federal Land Management Agencies User's Guide*, 2011, 13 http://ntl.bts.gov/lib/44000/44200/44244/Bus_Lifecycle_Cost_Model_User_s_Guide.pdf

[64] A medium-duty cutaway bus was selected in the cost model tool as the closest representation to the light-duty bus currently operated at MINWR. Other vehicle types, including vehicles using alternative fuels, may have different fuel and maintenance costs. The tool template used to determine these costs is available at: volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling

[65] Based on $13.79 mean hourly wage for motor vehicle operators (all other) in Florida, from the Bureau of Labor Statistics' May 2013 State Occupational Employment and Wage Estimates. http://www.bls.gov/oes/current/oes_fl.htm#53-0000

Figure 21: Average Number of Tours per Week by Scenario

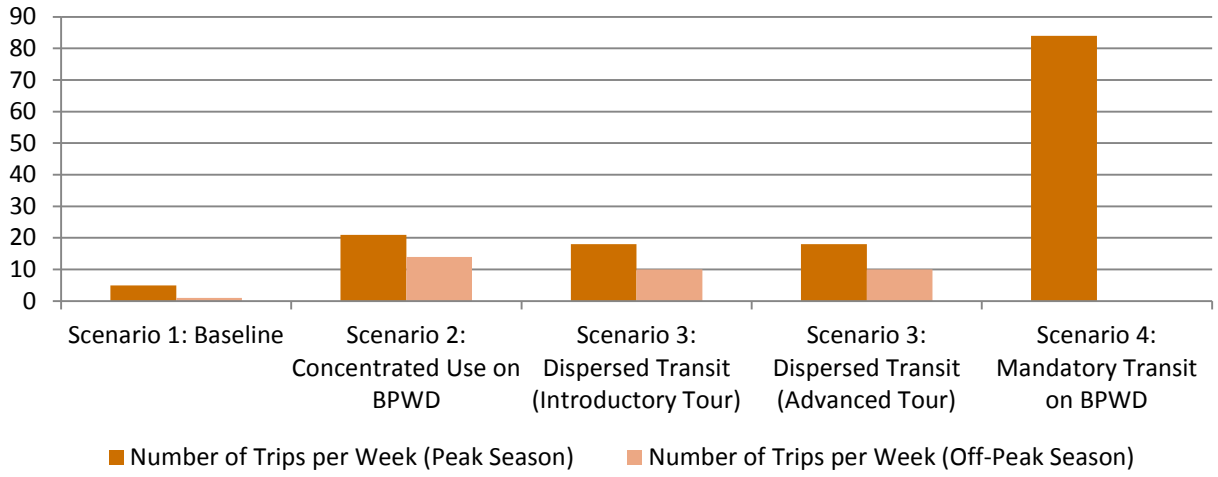


Table 21 lists estimated annual route costs by scenario. These estimates assume all roads and dikes have been improved to "good" condition for transit use.

Table 21: Estimated Annual Route Costs by Scenario

Scenario	Total Operating & Maintenance Costs per Trip	Estimated Number[66] of Tours per Year	Total Operations and Maintenance Costs per Year
Scenario 1: Baseline	$46.05	116	$5,342
Scenario 2: Concentrated Use on BPWD	$57.43	800	$45,944
Scenario 3: Dispersed Transit (Introductory Tour)	$32.84	600	$19,704
Scenario 3: Dispersed Transit (Advanced Tour)	$70.47	600	$42,282
Scenario 4: Mandatory Transit on BPWD	$50.08	1,400	$70,112

Total Cost to Concessionaire / Business Feasibility

The route costs are only one element of overall costs to the concessionaire. Other major costs include vehicle purchase or lease and other capital costs, labor (for program management, driver training, vehicle maintenance, etc.), and vehicle storage and maintenance facilities, among others.

The planning team assumes that the costs listed in Table 21 would represent 50 percent or less of total costs to the concessionaire, and that ticket prices should cover at least 150 percent of the cost-per-tour to ensure that the concessionaire can operate profitably (since Scenario 1 is Refuge operated, the 150 percent does not apply). Table 22 shows resulting *minimum* ticket prices, based on full tour occupancy. Since the average ticket price is under $5 in all enhanced transit scenarios, the planning team feels that it would be financially feasible to operate transit at these levels of service and routes. In reality, the

[66] The Baseline Scenario assumes vehicles continue to hold an average of 12 passengers per tour, while all other scenarios assume the capacities of the vehicles have been doubled to 24 passengers.

ticket prices would be higher than prices in Table 22 to account for trips where there are fewer passengers than seats (tours that don't "sell out").

Table 22: Estimated Ticket Costs Needed per Scenario

Scenario	Total Operating & Maintenance Costs per Trip	150% of Cost per Trip	Passengers per Trip	Average Cost per Passenger per Tour
Scenario 1: Baseline	$46.05	NA	12	$5.76
Scenario 2: Concentrated Use on BPWD	$57.43	$86.15	24	$3.59
Scenario 3: Dispersed Transit (Introductory Tour)	$32.84	$49.26	24	$2.05
Scenario 3: Dispersed Transit (Advanced Tour)	$70.47	$105.71	24	$4.40
Scenario 4: Mandatory Transit on BPWD	$56.98	$85.47	24	$3.56

Comparison with Regional and National Nature Tours and Attractions

Table 23 shows the names, lengths, and costs of several regional attractions around Brevard County, as well as several comparable federal land units in Florida or elsewhere in the U.S. The nature-themed tours in Brevard County are largely water-based and some require special equipment or skills (e.g., kayaking or biking). The average price for these tours is $32 for adults and $26 for children, which is considerably higher than what the concessionaire would likely charge for Refuge tours. The land-based options, including the Sea Turtle Conservancy's Guided Sea Turtle Walk, are priced at $15 per person, which may be a more feasible comparison for a Refuge tour.

Table 23: Costs of Regional Tours and Attractions[67]

Name of Tour	Company	Tour Length	Adult	Child
KSC Bus Tour (includes KSC admission)	Delaware North/KSC		$50	$40
KSC Up Close Tour	Delaware North/KSC		$25	$19
Boat Tour (cost increase if fewer than 6 people)	Turtle Mound Tours	2 hours	$20	$20
Merritt Island Refuge Kayak Tour	A Day Away	1.5 hours	$30	$20
Combo Refuge Kayak Tour	A Day Away	3 hours	$58	$48
Kayak Tour	Peace of Mind	2 hours	$40	$33
Manatee and Dolphin Encounter Tour	Calypso Kayaking	2 hours	$30	$20
Brevard Zoo	Brevard Zoo	NA	$16	$12
Guided Sea Turtle Walk	Sea Turtle Conservancy	2-3 hours	$15	$15
Bird Island Reach (Bike/Hike/Kayak	Florida EcoTrek	2.5 hours	$39	$39

[67] Tour prices from tour operator websites, accessed November 2014. Federal land transit costs reported by federal land units in June and July of 2014.

Name of Tour	Company	Tour Length	Adult	Child
tour)				
30 minute airport ride	Twister Airboat Rides	30 min	$24	$16
Average price			$32	$26
Median price			$30	$20
Name of Federal Land Unit	**Concessionaire**	**Location**	**Adult**	**Child**
Ding Darling NWR	Tarpon Bay Explorers	Sanibel, FL	$13	$8
Everglades National Park	Shark Valley Tram Tours	Miami, FL	$22	$13
Santa Ana NWR	Refuge-operated tours	Alamo, TX	$4	$2
Great Dismal Swamp NWR	City of Suffolk operated tours	Suffolk, VA	$10	$8
Average and median price			$12	$8

The brief cost comparison demonstrates that visitors to the area are accustomed to paying $15 or more per person for nature-based tours, and ticket prices in this range would not be unreasonable. The Refuge may want to work with the concessionaire to charge rates below these amounts (and more akin to other tours at federal land units) to make transit tours more accessible and to increase ridership. As shown in Table 22, initial financial analysis indicates that ticket prices that average $5 per person (with full vehicle occupancy) would be feasible. Since costs for a concessionaire may vary significantly from the planning team's estimates and since full vehicle occupancy cannot be assumed, the ticket prices may need to be higher than $5. The regional comparison indicates that prices of $15 or more per adult may be competitive with other attractions and tours.

Total Costs for Each Scenario

For planning purposes, Table 24 shows the "lifecycle" cost for each scenario. The "lifecycle" cost is based on a ten-year cycle (or approximately two five-year concession contracts) and an approximate number of vehicles based on the planned tour frequency (see Figure 21). The planning team anticipates that most, if not all, costs will be covered by ticket sales.

Table 24: 10-year costs for each scenario

Scenario	Vehicle Cost	Number of Vehicles	Operations and Maintenance Costs Per Year	Total Cost (10 years)
Scenario 1	$70,000	1	$5,342	$123,420
Scenario 2	$185,000	2	$45,944	$829,440
Scenario 3	$185,000	2	$61,986	$989,860
Scenario 4	$275,000	6	$70,112	$2,351,120

Considerations for All Transit Scenarios

There are a number of infrastructure and operational needs that would need to be addressed in any new transit service, regardless of scenario.

Staging and Parking

A transit staging area provides riders with a safe place to park, wait for, and board transit vehicles. Parking areas allow visitors to park their vehicles in a central, strategic location and board a transit

vehicle, thus eliminating congestion and parking impacts closer to protected resources. Currently, all transit staging and parking is located at the Visitor Center and is not separated from other Visitor Center activities or parking spaces. Riders wait for the start of the tour to be announced in the Visitor Center, and then board the bus as a group outside the entrance to the Visitor Center in the visitor parking lot.

Staging that is safe and comfortable requires amenities for visitors waiting to board the vehicle. Amenities include shelter from the sun and rain, benches, trash cans, and access to potable water and restrooms. Visitors should also be aware of how to contact the proper authorities in the case of an emergency. The Visitor Center currently provides these amenities and services, but other potential staging locations do not.

Transit Parking Needs

If transit staging is to continue to take place at the Visitor Center, its parking lot must accommodate both transit and Visitor Center activities. The anticipated rise in transit riders at the Refuge, which would have lower parking turnover rates than traditional visitors, would result in increased need for parking in the new Visitor Center. The Visitor Center and its overflow parking lots contain 46 parking spaces, which are filled to capacity during peak visitation season. See Table 25 for parking lot sizes at other Refuges with transit.

Table 25: Parking Lots at Refuges with Transit

Refuge	Number of Parking Spaces at/near Visitor Center	Annual Visitation
Merritt Island	46 (including overflow)	1,137,779
Ding Darling	100 (estimate)	521,476
Santa Ana	120 (estimate)	129,500

Even though the Refuge's visitation is higher than those of other refuges, the parking capacity at or near its Visitor Center for an expanded transit system likely does not need to be higher than at other refuges due to visitor distribution patterns.[68] The analysis in Table 26 shows estimated parking spaces needed by season for the Visitor Center visitors and for transit riders (see Appendix I for the quantitative analysis that was used to reach these findings). While additional capacity is not needed during off-peak, it would be needed during peak season.[69] Table 27 lists the number of vehicles parked outside of the Visitor Center throughout the day in both peak and off-peak times.

Table 26: Parking Needed at Visitor Center

Visitor Spaces Required for…	Current Average	Enhanced Transit (Peak Season)	Enhanced Transit (Off-Season)	Mandatory Transit on BPWD
Visitor Center	28	46	11	28
Transit	8	14-20	9-12	33-49
Total	**36**	**60-66**	**20-23**	**61-77**

[68] Visitors are dispersed at MINWR's multiple primary visitor use areas whereas Ding Darling and Santa Ana are much smaller refuges). Also, vehicle turnover at the Visitor Center is relatively high (estimated at half an hour).

Table 27: Hourly Visitor Center Parking (December 2013)

Hour	Vehicles per Hour (Peak)	Vehicles per Hour (Off-Peak)	Percentage of daily total (Based on Dec. 2013 hourly counts)
9:00 AM	25.6	6.1	13%
10:00 AM	23.5	5.6	12%
11:00 AM	45.5	10.9	23%
12:00 PM	32.2	7.7	16%
1:00 PM	29.0	7.0	14%
2:00 PM	25.9	6.2	13%
3:00 PM	18.3	4.4	9%
Total	**200**	**48**	

The Visitor Center parking lot also may exceed capacity during special events during peak season, especially if transit is operational.[70] However, the planning team does not recommend expanding parking for these occasional uses and recommends instead using overflow lots or parking management volunteers. Early conceptual plans for the replacement Visitor Center's parking lot, which were made available towards the end of this plan's development, include 103 parking spaces: 17 spaces for tour bus parking; 8 spaces for employees; and 78 spaces for Visitor Center visitors.

Considerations for Visitor Center Transit Staging

The Refuge would like to continue to stage transit operations out of or near the Visitor Center due to its convenient location and the ability of visitor services staff to more easily monitor transit services. Staging near the Visitor Center also provides riders with access to amenities like restrooms, shelter, and water fountains. While the current design of the parking lot allows for the bus to load passengers at the Visitor Center while keeping a lane of traffic open in the turnaround, different transit vehicle types may require unique setups. Larger vehicles, for example, may impede traffic and require a turnaround radius larger than the center island in the current parking lot. Ideally, transit staging would incorporate:

- A designated loading area that is permanently reserved for transit;
- Space for easy circulation of the transit vehicle;
- Barriers, signage, or design to separate usage with other modes; and
- Safe pedestrian access from the parking area and Visitor Center.

The Visitor Center also presents a number of limitations that must be considered with long-term transit. The Visitor Center and its parking lot are only open to the general public from 9:00 AM to 4:00 PM, preventing any staging for early morning or late evening programs. Because most programs are anticipated to take place during the times with highest visitation, the operating hours of the Visitor Center are not likely to have any major impact transit staging. Additionally, the concessionaire may need on-site indoor space for ticket sales and general administration, which may not be available at the Visitor Center. Concessionaire office space could be incorporated in the new Visitor Center, in a small kiosk, or in a new freestanding building.

[70] MINWR has procedures in place during these events for additional overflow parking. For example, some visitors are instructed to park on the access road between the Visitor Center and Headquarters during peak season.

Alternative Staging Sites

Given these concerns, Refuge staff identified a number of alternative sites for staging transit operations in the long-term:

- The **area immediately to the west of the Visitor Center**, envisioned as a future kids' fishing pond in the current Visitor Services program visioning,[71] could also be developed for transit parking and staging. Transit operations could be designed and scheduled in a way so as to not conflict with fishing activities. Aside from shelter and signage, staging elements like water and restrooms would likely not need to be added because of the proximity to existing amenities at the Visitor Center. The proximity to the Visitor Center would also allow Refuge staff to better monitor transit operations.
- The **northwest corner of SR 402 and SR 3**, known as "Wilson's Corner," is owned by KSC but used by CNS for maintenance operations. The site could be redeveloped as a transit parking and staging area after NPS vacates the buildings (as planned). While the site is not actively being used, there is no timeline for KSC to transfer oversight and use of the property to FWS. Because Wilson's Corner is set back from the road, there are concerns about the visibility and security of the area. An advantage of this alternative is that it already has impervious surfaces and therefore would lessen the new footprint for a staging area. However, the site would need to add new shelter, seating, and restrooms, and it would be an additional visitor use area requiring supervision of Refuge law enforcement.
- The **proposed gateway to Merritt Island**, specifically the Gator Creek Road parking area, could serve as a secondary parking and staging area (there would not be visitor amenities here). This staging area would be most feasible under Scenario 3 (Dispersed Transit) in which an "introductory" tour route included West Gator Creek. Staging transit and parking at this location includes potential concerns like long-term use from non-transit users, safety of pedestrians crossing SR 402, safety of vehicles turning into and out of parking area, and need for increased law enforcement.

Identifying and developing staging areas outside the Refuge is a longer-term goal for Refuge staff, but not an immediate outcome of the long-term transit planning study (see Regional Connections and Partnerships). Stakeholders identified potential staging locations in the City of Titusville, including:

- The **Wells Fargo Bank parking lot** on Indian River Avenue (5 miles from the Visitor Center), which is located within walking distance of Downtown Titusville and three SCAT bus routes, and has available parking, and
- The forthcoming **Titus Landing development** (7 miles from Visitor Center), a regional shopping destination in central Titusville which will tentatively serve as a transfer hub for SCAT.

Road Prioritization and Maintenance

Under all scenarios, there is a significant probability that some of the Refuge roads that are currently used for wildlife observation and bank fishing will deteriorate in the future. If the Refuge continues to experience staff and funding shortfalls, the Refuge may not be able to maintain these roads to a condition that is safe for visitor use, and the Refuge may need to close these routes or limit their use

[71] At the time of publication, Refuge staff were undergoing a visitor services visioning exercise to plan for the future of the visitor services program. The basic vision is included in the Interpretive Messages and Training section.

(seasonally or by mode). Accordingly, and although outside the scope of this Transit Planning Study, the Refuge would need to prioritize routes and other infrastructure to maintain for visitor use.

Concession Business Model

A concession business model involves a contract between the Refuge and a private concessionaire. The contract provides details about the type and level of transit service that the concessionaire must provide, how much they can charge visitors, and any fees that the concessionaire pays to the Refuge, among other aspects of transit operations and management. Refuge staff believe a concession business model for long-term transit would work best for a number of reasons, including:

- The concession business model puts the least management burden on Refuge staff while still enhancing the transit program;
- The business model seems like it would be the most financially and operationally feasible on the Refuge; and
- Similar concession models have been successful at other public lands in Florida.

Refuge staff also envision the concessionaire providing non-transit services, ranging from boat and bicycle rentals to fee collection. These services could enhance the Refuge visitor program and relieve burden on Refuge staff. To see the other business models considered in the development of this plan, see Appendix D.

Refuge Staff Capacity

Under a concession contract, Refuge staff is typically not involved in day-to-day transit operations; however, FWS staff has a critical role in identifying needs for a concession, developing a concession contract, and monitoring the concession performance. Specifically, Refuge staff is involved in developing interpretive script guidelines, random checks on the quality of service, monitoring financial reporting, and addressing smaller administrative tasks. FWS and NPS units with existing concession services note that while daily time commitments are minimal, developing and renewing contracts (annually or every five to ten years) requires a large amount of staff time among multiple unit and regional staff members. Despite this temporary use of staff time, the units interviewed are satisfied with the high quality of service provided by concessionaires.

Developing the concession contract would generally require significant time from the Refuge Manager, Supervisory Park Ranger, and the Regional Contracts and General Services Office.[72] Most Refuge senior staff would likely be involved to some capacity in some aspect (e.g., safety, environmental considerations) of the development of the concession contract.

Business Opportunity and Challenges

One major opportunity that Refuge management sees is the option for the concessionaire to operate other recreational and interpretive activities, like bicycle and pontoon boat tours. The Refuge has not previously offered the level of transit tours currently envisioned in this chapter, and there are inherent risks with beginning a new venture. Therefore, to offset these risks, the concessionaire could offer a suite of interpretive services to supplement their transit service.

Concessionaires at other Refuge and National Park units typically offer a suite of recreational and interpretive services to supplement their transit service. For example, Shark Valley Tram Tours, the concessionaire at Everglades National Park, supplements its tram tour with bicycle tours and operating the gift shop. Because the business case for transit concession at the Refuge is unclear, potential concessionaires may be more likely to start up at the Refuge if they have a safety net of other recreational and interpretive services.

One challenge that Refuges with concession contracts face is that funds received from the concessionaires is fairly limited, as is the Refuge's freedom to spend the fund (see Anticipated Revenues).

Future Operations at KSC

One potential issue for a concessionaire is future flight operations at KSC. If KSC fulfills its

Delaware North Concession Sharing

Delaware North operates bus tours at the KSC under a concessions contract with NASA. One possibility for further exploration would be for FWS to enter into an agreement with NASA to add transit tours on the Refuge to the same Delaware North concession contract. Currently, the Delaware North / NASA agreement contains provisions that a percentage of bus tour revenues go into a capital fund for infrastructure improvements on KSC roads. Delaware North writes a capital improvement plan for how these funds will be spent, the plan is approved by NASA, and Delaware North manages expenditures of the revenues and implementation of the plan. No funds are transferred to NASA. NASA has expressed that this arrangement may be possible but neither FWS nor NASA has pursued further actions or investigation.

There are two main benefits for the Refuge of partnering with NASA's existing agreement:

1. The Refuge would not have to go through a solicitation and selection process for a new concessionaire, and
2. The Refuge may be able to benefit from some infrastructure improvements through transit revenues, in the same model that currently works for KSC capital improvements.

An ancillary benefit is that the concessionaire would be more resilient to Refuge closures for shuttle launches due to its business at KSC. Several barriers may remain, including financial and logistical feasibility for Delaware North, Refuge oversight of transit operations, and FWS or NASA regulatory or legal challenges. The transit plan recommends continued conversations between FWS, NASA, and Delaware North to determine if this option would be feasible.

[72] The Refuge may receive a small fee from the concessionaire to cover staff management costs, in the order of a few thousand dollars per year.

plans to become a commercial spaceport with regular launches, there is the possibility that NASA will close parts of the Refuge to the public during launches. These closures can result in a concessionaire not being able to fulfil the desired level of transit service or other services (bike, boat, etc.), and the closures may not be predictable at the time of writing a concession contract.

The use of the Shuttle Landing Facility, located approximately 1.5 miles to the southeast of the Visitor Center, could impact Refuge operations, especially if launches or landings take place multiple times a week. Three vertical launch pads will also likely result in security changes over time:

- 39A, located approximately 8 miles to the southeast of the Visitor Center, is anticipated to be used by SpaceX approximately once a month, starting in 2015.
- 39B, located approximately 7 miles to the southeast of the Visitor Center, is anticipated to be used by NASA starting in 2017 or 2018. Launches would occur every two to three years.
- A proposed vertical launch pad north of 39B would also have multiple launches a month. Construction on this pad could begin within a year.

During previous shuttle launches, areas of the Refuge were closed to the public from one to three days in advance of a launch. Future launches may require varying security protocol. Due to the tentative nature of future plans and privacy concerns at NASA, there is no assurance that NASA will be able to allow a concession service to operate during closures and no likely resolution to this risk in the near term.

Vehicle Selection

Scenario 1 requires the Refuge to (continue to) own and maintain its own transit vehicle. In the other three scenarios, the concessionaire would own and maintain vehicles. The concessionaire would likely select a vehicle based not only on Refuge conditions, transit routes, and level of service, but also upon the concessionaire's business model, maintenance capacity, and other factors that might vary widely between businesses. Therefore, the vehicle selection analysis in this report is included at a high level for the purpose of showing some of the likely options and considerations for vehicle selection.

A few relevant characteristics in vehicle selection include passenger capacity, speed, passenger comfort and visibility, fuel type, and maintenance needs. Similar interpretive transit programs typically use open air bus or tram vehicles, although the Refuge highlights the climate control available in its current vehicle as an advantage of the current program. Vehicles with higher capacity would provide better business opportunity in the long term. Table 28 shows examples of a few transit vehicles currently in use at the Refuge and nearby Federal land units.

Table 28: Examples of Transit Tour Vehicles

Merritt Island NWR	Ding Darling NWR	Everglades National Park
		
Low ridership 12 passenger capacity	Low-Medium ridership 16 passenger capacity	High ridership 48 passenger capacity

The types of vehicles suitable for transit on the Refuge are limited by the conditions of the roads and its environment. Refuge roads and dikes that are not State Routes were typically not designed for transit use. BPWD, for example, has a vehicle length limit of 26 feet for safety purposes. Other roads and dikes under consideration for long-term transit use may have similar restrictions. The salty condition of the environment may necessitate regular cleanings are necessary to prevent corrosion. Rust is already a problem on the current Refuge vehicle.

Tour service vehicle options

Passenger capacity is a potential restriction for Scenario 1, as the Refuge does not want to require its volunteer drivers to procure a Commercial Driver's License (CDL) (needed to operate a vehicle capable of transporting more than 15 passengers). Low-capacity vehicles that may be operated without a CDL include passenger vans, small electric shuttle vehicles, and light-duty "cutaway" style buses similar to the existing vehicle in service at Merritt Island, as shown in Table 29.

Table 29: Vehicle Options for up to 15 Passengers (Source: Volpe Center)

	citEcar e-shuttle[73]	Full size passenger van	Light-duty shuttle
Cost	$15-25,000	$30-40,000	$60-70,000
Passengers	Up to 10	Up to 15	Up to 15
Length	14-17 feet	20 feet	22 feet
Fuel Source	Battery-electric	Diesel	Diesel
Range	Up to 50 miles	< 300	< 300
Expected life	3-5 years	5 years	5-7 years
Low Speed Vehicle	Yes	No	No

The vehicle options in Table 29 include the CitEcar, built on a golf-kart chassis, a full-size passenger van and a "cutaway" style light-duty shuttle bus. The CitEcar is useful for small groups of less than 10 people

[73] Because it is not legal for use on public roads, the CitEcar is not a viable option for proposed tour routes. The CitEcar is included in this analysis due to several benefits. It is both quiet and "open-air," and the national dealer is located nearby in Gainesville, Florida. A national trial of such vehicles within FWS refuges discovered the CitEcar is best suited for light-duty service for small groups and are not ideal for frequent use with groups over eight people. If the Refuge plans for a transit service with small groups fully on Refuge-owned roads, the CitEcar may be reconsidered.

and suitable for short-routes on well-maintained roads. A full size passenger van or light-duty shuttle bus offer similar passenger capacities, with a light-duty shuttle offering more comfort, interior space and easier loading and unloading of passengers. If the Refuge is satisfied with the level of service offered by their existing shuttle vehicle, they should consider an equivalent vehicle as a first option.

Table 30: Vehicle Options for More than 15 Passengers

	SV Tramstar LFT	SV Sunliner II	SV Metro Tram	SV Classic American Tram	eBus 22' electric shuttle
Cost	$150-200,000 (Power Unit) $90-110,000 (Trailing Unit) **~$275,000 for both**	$135-185,000 (Power Unit) $69-79,000 (Trailing Unit **~$210,000 for both**	$115-$150,000 (Power Unit) $50-60,000 (Trailing Unit) **~$180,000 for both**	$77-90,000	$395,000
Passengers	20 (P.U) + 28 (T.U.)	20-28 (P.U.) + 28 (T.U)	16 (P.U.) + 28 (T.U.)	24-26	22
Length	21'9" (P.U.) 22'9" (T.U.)	22' (P.U.) 23' (T.U.)	22'6" (P.U.) 23'10" (T.U.)	23.5' – 26'	22'
Fuel Source	Gasoline or Diesel	Gasoline or Diesel	Gasoline or Diesel	Diesel	Battery-Electric
Range (miles)	>250	> 250	> 250	>300	Up to 125
Expected life	7-10 years	7-10 years	7-10 years	7-10 years	7-10 years
Low Speed Vehicle?	No	No	Yes	No	No

The Specialty Vehicles (SV) with trailers represent current, open-air trams available on the market today. For heavier duty use on rough terrain (especially Scenario 3), the Tramstar LFT and Sunliner II options are built on a 3500 series chassis (optional 4500 series upgrade available) and are built on a standard cab chassis. Both are suitable for use on public roads or well-maintained dirt roads; however neither options provides forward visibility through the cab. The SV Metro tram is a dedicated tram chassis and is sufficient for use on asphalt or well-maintained dirt roads but is limited in top speed to 16 miles per hour, rendering it a low-speed vehicle that is not designed for use on public roads. It provides for better forward visibility and a largely unobstructed field-of-view. Both the SV Classic American tram and the eBus 22' battery-electric shuttle are standalone vehicles that do not pull a passenger trailer; they are both road legal and capable of operating on asphalt and well-maintained dirt roads. The SV Classic American tram is an open-air tram, while the eBus 22' shuttle is a closed vehicle; however eBus also produces an open-air tram with a similar drivetrain. Both options would perform well for high-demand service providing regular trips.

Vehicle Recommendation

Current and future routes will likely utilize public roads, therefore the low-speed vehicles are not recommended. If the Refuge selects Scenario 1, it may benefit from having another vehicle similar to the existing shuttle, providing the ability to utilize two vehicles in high-demand situations or to offer multiple routes for service.

If the Refuge selects Scenario 2, 3, or 4, the concessionaire will likely want a vehicle with capacity in excess of 15 passengers. While the concessionaire will ultimately select the best vehicle on the market for their business model and service terms, the planning team recommends the Specialty Vehicles Sunliner II as it has flexibility to carry 20 passengers without a trailing unit or up to 48 passengers when combined with the trailing unit. Such flexibility may prove desirable if service demand fluctuates. For the highest demands and most frequent service (Scenario 4), the planning team recommends the Tramstar LFT, which offers an Altoona-tested platform which represents the most robust open-air platform of all vehicles presented above and can be expected to reliably perform in regular, high-demand scenarios.

Interpretive Messages and Training

All transit tours will include interpretation, and Refuge management expresses a strong desire to control the interpretive messages of transit tours and ensure that those messages align with the vision for the Refuge's Visitor Services Program. As described in detail in the Program Types and Interpretation section of the Short-Term Transit Plan, Refuge staff has drafted the vision of the Refuge as:

> *Merritt Island National Wildlife Refuge offers safe, accessible wildlife-oriented opportunities in nature for all comfort levels, creating "stepping stone experiences" that will ultimately foster conservation and stewardship ethics in future generations of Americans.*

Accordingly, transit should increase accessibility to wildlife-oriented opportunities, especially through interpretive messages given by tour operators. Requirements for interpretive messages can be built into concession contracts, requiring a concessionaire to make key interpretive points or even follow a Refuge-developed script. Curriculum may be developed by Visitor Services staff or interns, and in some tours, it may be appropriate to develop curriculum jointly with NPS staff.

Refuge control over transit tour messages will require an initial investment of FWS staff time in developing messages. Verifying that the messages are preserved over the course of the concession contract will require additional FWS staff time, and the amount of time required will depend on the frequency of review (annually, monthly, randomly, etc.). Some units track visitor satisfaction of concession service through websites like TripAdvisor, or send staff randomly on tours to experience the service. Staff at Ding Darling NWR, for example, regularly meet with their concession staff to provide feedback on the quality of service, including interpretive messaging.

The Implementation Action Plan will include steps to develop messages for transit tours. These messages will align with the Visitor Services Program vision and be developed by Refuge staff and volunteers, as capacity permits.

Regional Connections and Partnerships

Given the limited staff capacity and financial resources of the Refuge, Refuge staff is interested in primarily focusing on enhancing internal transit. The Refuge and its partners agree that external, regional connections to the Refuge through transit would provide many benefits to the Titusville area. However, establishing a successful internal transit system is a necessary first step before expanding to other regional destinations.

Regional connections to the Refuge are considered to be a secondary phase of the long-term transit plan, although regional partners see strong potential for such service. The Refuge should maintain its partnerships with local governments, environmental groups, outdoor recreationalists, economic

development groups, and others so when the Refuge is ready to begin exploring regional connections, its partners are prepared to help (see Table 6 for a list of current and potential regional partners).

In all scenarios, regional partners could work with the concessionaire or other transportation providers to make connections between regional destinations and the staging area for Refuge transit. Through offering regular transit service, the Refuge makes it possible for visitors to have a multi-faceted Refuge experience without the use of a personal vehicle. This Transit Planning Study does not prioritize off-Refuge transit connections due to the mileage from Titusville and the uncertainty of demand for car-free Refuge visitation

Figure 22 illustrates a "need index" of Brevard County residents by Census block to identify the location and demand of underserved populations. The need index is based on U.S. Census data and includes income, car ownership, and percentage of non-white population. FWS and Volpe developed the need index to increase access to refuges among underserved populations. The map shows several Census tracts with medium-high and high-need populations near Cocoa and Titusville. While these populations may be more reliant upon transit or non-motorized transport, the map also shows that bus lines and trails do not currently connect these areas with the Refuge.

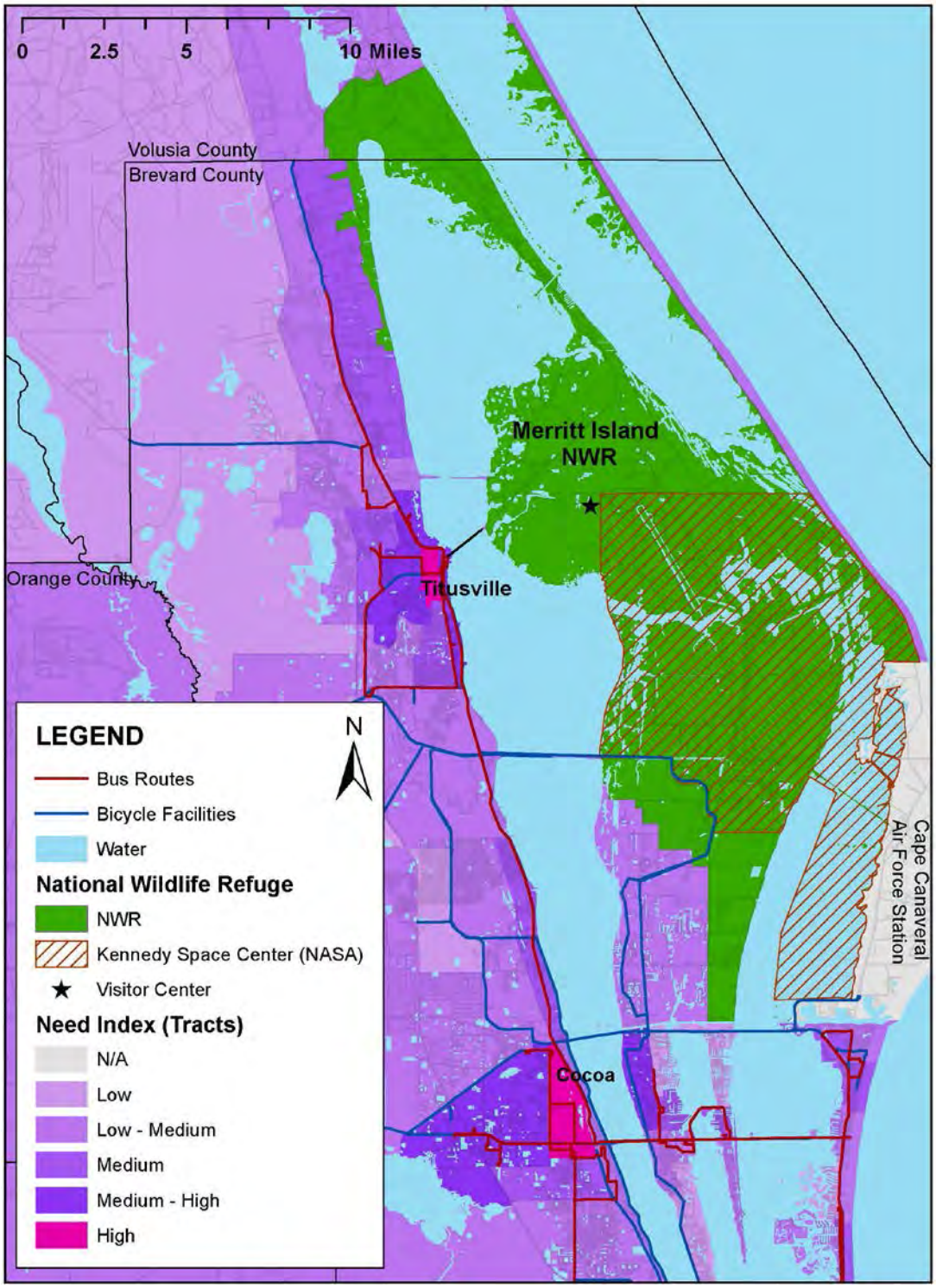
Considering the potential need to serve local populations, partners, community groups, and even Refuge staff and Friends group could facilitate these connections through the following:

- Church or school groups could drive their own (or rented) vans/buses to the Visitor Center and connect to transit tours;
- Special event organizers or tour groups (such as from Port Canaveral) could charter a bus that drives visitors to the Visitor Center/transit staging area;
- The concessionaire could operate a scheduled route to connect to Titusville for an additional fee if there were a business case for doing so (and depending on the vehicle used); and/or
- The Refuge (or its volunteers) could use the current 12-passenger vehicle to connect the Visitor Center/transit staging to downtown Titusville, schools, or community centers.

None of these options are scenario-specific nor are they included in implementation actions in this plan, but the Refuge may work with partners to improve regional connections once an enhanced transit system is in place.

Marketing will be critical to the success of a Refuge transit system, both current and future. The Implementation Action Plan contains recommendations on developing a marketing strategy, with the help of regional partners.

Figure 22: Need Index in Brevard County



Bus and bicycle data shown only for Brevard County. Map developed by the Volpe Center with U.S. Census data.

Evaluation Criteria

Evaluation criteria are a tool to compare the anticipated effects of the long-term transit scenarios and measure the impacts and performance of a transit scenario once it is started. Refuge senior staff selected the evaluation criteria based on the goals of the Transit Planning Study and the data available to measure impacts. These criteria are used in this Study for evaluation purposes, and the Refuge also plans to use them for ongoing performance measurement of the selected scenario. The planning team applied each criteria to each scenario to estimate the impact of each scenario and used this information to compare and select a preferred scenario. Once long-term transit is operational, Refuge staff and volunteers will measure these criteria on an annual basis.

Goal 1: *Develop a transportation system that supports* ***sustainable management practices*** *at the Refuge, including* ***reducing congestion*** *to uphold the Refuge's resource conservation purpose.*

Evaluation criteria for this goal include:

1A. Number of daily or hourly vehicles on BPWD;
1B. Distributions of vehicles on the Refuge along key routes, as measured by traffic counters; and
1C. Amenities or routes in the Refuge accessible by more than one mode.

Currently, the Refuge collects traffic counts along key routes such as BPWD. To evaluate these criteria in the future, the Refuge will need to continue collecting traffic count data through existing and new counters. Volunteers can also conduct annual observations in other areas, like trails, where traditional counters may not be appropriate. Traffic counters, compared as a whole across the Refuge, can provide data for criteria 1B. Criteria 1C will depend on transit routes and bicycle/pedestrian infrastructure.

Goal 2: Expand access opportunities *to the Refuge through multimodal transportation options for a diverse group of current and potential visitors.*

Evaluation criteria for this goal include:

2A. Mode distribution of Refuge visitors on BPWD or throughout the Refuge;
2B. Refuge visitor characteristics (age, origin, race, income, education);
2C. Parts of the Refuge that are accessible by more than one mode (same as criteria 1C); and
2D. Number of locations within the City of Titusville (such as schools, senior centers, and retirement communities) with transit connection to the Refuge.

Like in Goal 1, the Refuge can use existing traffic counters and volunteer counts to ascertain criteria 2A and 2C. The goal of criteria 2A is to show increased diversity in mode choice *overall* across the Refuge and to have designated areas assigned to certain modes. For criteria 2B, data may be collected during official surveys for visitor characteristics and demographics. Since these require prior approval from FWS, they are likely to be collected only every five years. Finally, criteria 2D can be determined based on transit routes and any external partnerships.

Goal 3: Improve connectivity *between the Refuge and the surrounding region.*

Evaluation criteria for this goal include:

3A. Number of targeted external destinations served by transit and
3B. Refuge partner participation in transit operations and marketing.

Because the Refuge does not currently target external destinations through transit and no partners are officially involved in transit operations and marketing, this information is not being gathered now. However, Refuge staff can record this information for criteria 3A and 3B if the transit program begins to expand beyond Refuge boundaries (see also Regional Connections and Partnerships).

The planning also articulated evaluation criteria for an objective related to the sustainable management of the transit program. This objective was identified by Refuge staff as an especially important consideration for long-term transit.

Objective 4: *Develop a transit system that is* ***financially self-sustaining and manageable*** *using current staff levels.*

Evaluation criteria for this objective include:

4A. Revenue of transit tours versus the short-term operating costs;
4B. Lifecycle costs of transportation improvements (long-term);
4C. Staff time devoted to management and oversight; and
4D. Annual infrastructure costs to the Refuge.

Criteria 4A can be estimated annually by comparing the recorded revenues with the operating costs estimates in the short-term transit study. The Refuge identified criteria 4B and 4C as important to consider in the evaluation of scenarios, but Refuge staff does not plan on actively tracking these criteria over time.

Evaluating Long-Term Transit Scenarios

The planning team uses these evaluation criteria to provide information to the Refuge to help staff select the best scenario or combination of scenarios in the planning stage.

Table 31 lists the anticipated results of the long-term transit scenarios by evaluation criteria. Once a scenario is implemented, evaluation criteria can then be used as performance measures to ensure that the FWS is meeting the goals of the Transit Planning Study as intended.

Collecting and analyzing the data required for performance measuring is anticipated to take some staff time, but most of the data are already being regularly collected. The Refuge has noted that some data are from sources that have varying reliability (for example, trail count data may be estimated based on traffic counts near the trailhead). Ultimately, the Refuge may consider how to consistently track data over time, or to improve its overall data quality given its new role in evaluating transit.

Table 31: Evaluation Criteria by Scenario

Goal	Evaluation Criteria	Scenario 1: **Baseline**	Scenario 2: **Concentrated Use on BPWD**	Scenario 3: **Dispersed Transit**	Scenario 4: **Mandatory BPWD transit**
Relieve Congestion	Number of daily or hourly vehicles on BPWD	250 vehicles	Estimate 5% decrease in private vehicles, mostly replaced by transit vehicles.	Estimate 5-10% decrease in vehicles	100% decrease when mandatory transit is offered (replaced by transit vehicles operating every half hour)
	Distributions of vehicles (see Figure 20)	Visitor Center, BPWD, Manatee Obs.	Similar to baseline, potential increase at Biolab and other driving routes	Greater concentration of vehicles at Visitor Center, with 10% of visitors boarding transit tour	Increase in vehicles off of BPWD, including Biolab, Peacock's Pocket, Gator Creek, trails
	Parts of the Refuge accessible by more than one mode	BPWD and Manatee Observation Deck are transit-accessible	Only BPWD is transit-accessible	L-Pond and Gator Creek *only* accessible by transit; BPWD *only* accessible by private vehicle	Only BPWD is transit-accessible
Expand Access	Mode distribution of Refuge visitors (%) *Criteria quantified for transit use only; future bicycle and pedestrian use outside of study scope*	Private vehicle (94%), walking/hiking (20%), boating (6%), biking (2%); <1% transit[74]	2% use transit	2-3% use transit, although many of these also use private vehicle to visit other Refuge locations	66% of BPWD visitors use transit (11% of total Refuge visitors), although all arrive via private vehicle
	Refuge visitor characteristics	Older, white, most local	May attract more families, new visitors	Transit caters to more diverse stepping stones of visitors	May attract more families, new visitors; some visitors may not visit
	Parts of the Refuge accessible by more than one mode	See above			
	Number of Titusville locations with transit connection to Refuge[75]	No regular external destinations	No regular external destinations	No regular external destinations	No regular external destinations

[74] Sexton, N. et al., *National Wildlife Refuge Visitor Survey 2010/2011*, 2012.

[75] External destinations could easily be connected to Visitor Center or other staging location, upon request of groups or through connections with regional partners. However, the study does not consider destinations linked with specific scenarios. See the Regional Connections and Partnerships section for more information.

Goal	Evaluation Criteria	Scenario 1: **Baseline**	Scenario 2: **Concentrated Use on BPWD**	Scenario 3: **Dispersed Transit**	Scenario 4: **Mandatory BPWD transit**
Regional Connections	Number of targeted external destinations served by transit	No regular external destinations	No regular external destinations	No regular external destinations	No regular external destinations
	Refuge partner participation in transit operations and marketing	Partners currently participate in tour marketing; envision a greater marketing role with increased transit operations.			
Sustainable Management	Revenue of transit tour (assume $5 per person) versus operating costs (not including capital/start-up costs)	$60 versus $46 (per tour)	$120 versus $57 (per tour)	$120 versus $33 (per introductory tour) or $70 (per advanced tour)	$120 versus $50 (per tour)
	10-year lifecycle costs of transportation improvements (see Table 24)	$123,420	$829,440	$989,860	$2,351,120
	Staff time devoted to management and oversight *All transit scenarios involve contract writing every few years and ongoing communications and monitoring*	Manage tours, train volunteers	Law enforcement is equal or lesser, visitor is significantly less, road maintenance slightly greater.	Law enforcement is less, visitor services is significantly less, and road maintenance is significantly greater.	Law enforcement in this scenario is equal or greater (during times of mandatory transit when visitation is heavily dispersed), visitor services is significantly less, and road maintenance is equal or greater.
	Annual infrastructure costs to the Refuge (see Table 18)	$34,592	$39,192	$32,029	$34,592

Refuge Comments on Scenarios

The Refuge acknowledges there are unique opportunities and challenges to each long-term scenario identified in this study. After reviewing the analysis of each scenario, Refuge senior staff provided feedback to the planning team. Rather than identify a single scenario as its preferred option, the Refuge provided comments on each scenario. Comments on the long-term scenarios are summarized in Table 32.

Table 32: Refuge Comments on Long-Term Transit Scenarios

Scenario	Benefits	Concerns
Scenario 1: Baseline	• This route offers an overview of the numerous diverse habitats the Refuge has to offer. • The route features the most popular visitor amenities: BPWD and the Manatee Observation Deck. • The program serves beginning birders well.	• Refuge staff has limited capacity to market the program. • Without additional marketing, the audience is unlikely to grow much beyond its current ridership. • Due to the length of the tour, it does not cater well to families with children.
Scenario 2: Concentrated use on BPWD	• This scenario takes advantage of what is already the most popular visitor area on the Refuge (BPWD). The route is likely to be successful to the popularity of the Drive. • Alternate route segments from the current BPWD alignment could prove popular to established visitors.	• It is unclear how strong the business opportunity is, especially if driving BPWD is significantly cheaper. • This program would not necessarily add new audiences. • Improving alternate route segments for transit use will be costly. Many of these routes are not suitable for regular vehicle traffic.
Scenario 3: Dispersed Transit	• Both introductory and advanced tours could incorporate other public use areas. • The L Pond route will provide established visitors an exciting alternative to BPWD.	• Incorporating additional public use areas in tours could make the tours too long for some visitors. • W. Gator Creek may not be the most interesting route for the Introductory Tour. Popular attractions like the Manatee Observation Deck would be better choices. • Improving L Pond Road for transit use will be costly.
Scenario 4: Mandatory Transit on BPWD	• Mandatory transit provides the best opportunity to address congestion along BPWD. • This program would take advantage of the most popular visitor area on the Refuge.	• Mandatory transit will be politically challenging and be unpopular among some visitors and locals. • Diverting visitation to areas other than BPWD may have unintended consequences for law enforcement or visitor services. • Concentrating transit solely on BPWD prevents visitors from using transit to explore other areas.

The Refuge also made the following observations about developing a long-term transit system, regardless of the scenario or combination of scenarios selected:

- Transit connections to Titusville and the Space Coast region in the long-term will require unique partnerships and resources outside of the Refuge;

- Although control over interpretive messaging is important to the Refuge, the concessionaire should have some flexibility in designing routes and programs in order to make its operation as viable as possible; and
- The Refuge and the concessionaire will have to plan for tour routes, messages, and operations to accommodate the needs of diverse audiences, especially families with young children and the elderly.

The comments summarized above provide a foundation for a discussion between the Refuge and a concessionaire on program options. Ultimately, the Refuge will work with a concessionaire to choose a single scenario, a combination of scenarios, or create an entirely new scenario based on the discussion resulting from these initial comments.

Implementation/Action Plan

Because of limited resources anticipated in the short-term, Refuge management will not take immediate action to implement long-term transit. It is still important for the Refuge to identify actions that will help with this implemention in a few years. Several implementation components, including infrastructure improvements and staffing, require long-term investments that may need to be planned many years in advance. This Implementation Plan contains actions that the Refuge will need to consider in the short-term to allow for a successful long-term transit program.

Enlist a Concessionaire

When the Refuge is ready to enlist a concessionaire to operate transit service, the first step will be to contact FWS Southeast Region Contracting and General Services (CGS). Staff from CGS will help Refuge staff to draft a Request for Proposals (RFP) that meets the Refuge's needs and follows all appropriate requirements. If the Refuge has already developed a Statement of Objectives with clear parameters of transit service, CGS staff can help process a solicitation and select a concessionaire within six to eight months. The Refuge may want to approach CGS up to one year prior to soliciting concession service to discuss what to include in a RFP.

CGS will help the Refuge develop and post its RFP on the Federal Business Opportunities website. Once proposals come in, CGS will work with the Station to review the proposals and find the best fit. In general, the Refuge will need to include the following *types* of information in its concession solicitation:

- Required services (and locations), including
  - Transit services;
  - Non-transit services, such as bicycle and kayak rentals or boat tours;[76]
  - Minimum levels of service (days per week, visitation or ridership estimates); and
  - Location to stage transit and other services.
- Authorized services (and locations).
- Estimate of initial investment.
- General operating standards and requirements.
- Role of Refuge staff and partners (if any), including
  - Role in developing tour content and
  - Training of concessionaire staff.
- Roads to be used for transit, including
  - Refuge upkeep and mainteinance of roads.

[76] The Refuge can include language in the RFP that allows for future modification to add new services (for example, if bike rentals are desired at a later date but the bicycle trail is not yet constructed).

- Vehicle inspections and safety standards (if any).

Guidelines on many of these elements are included in this Transit Planning Study. The Refuge should refine its preferences and requirements prior to drafting a solicitation, and then work closely with CGS staff to develop and execute the solicitation.

Once the concession contract is written, it would also include items like operating plan, concessionaire personnel, hours of operation, legal and regulatory compliance, environmental protections, facilities used by concessionaire, maintenance, fees, accounting, and insurance. CGS staff would be closely involved in developing this contract with Refuge staff and the concessionaire.

Staffing / Capacity

Table 33 is an updated version of Table 17 that envisions a long-term transit service operated by a concessionaire. Under this service, a Supervisory Ranger would have a large oversight role in transit, including ensuring that the concession contract contained appropriate standards and policies related to interpretation, operations, safety, and marketing. The Supervisory Ranger would not be involved in daily transit operations but would have significant responsibilities during the contract development and renewal cycles, as well as annually or seasonally to track data and oversee operations. Other Refuge staff would have smaller roles, as shown in the table below.

Table 33: Capacity Needs for Long-Term Transit

Category	Task	Responsible
Operations and Management	Develop standards for vehicle operating condition and cleanliness*[77]	Supervisory Ranger
	Drive vehicles	Concessionaire
	Deliver interpretation	Concessionaire
	Collect basic ridership counts	Concessionaire
	Develop annual and five-year data reporting requirements*	Supervisory Ranger
	Overall transit management	Concessionaire
	Collect fares	Concessionaire
	Develop interpretation (or oversee)	Supervisory and Refuge Rangers
	Develop and deliver driver training	Supervisory and Refuge Rangers
	Develop/adjust weekly and monthly schedules	Concessionaire
	Oversee schedules on a seasonal basis	Supervisory Ranger
	Review annual data	Supervisory Ranger
	Oversee financial reporting and ensure funds are appropriately distributed	Supervisory Ranger
Safety	Develop safety policy*	Supervisory Ranger and Law Enforcement Officer
	Monitor operations for adherence to safety policy	Law Enforcement Officer
Maintenance	Perform regular vehicle inspections	Concessionaire
	Perform semi-annual maintenance	Concessionaire
	Fuel vehicle	Concessionaire
	Develop maintenance standards*	Maintenance staff

[77] Items marked with an asterisk (*) should be included in the concession contract.

Category	Task	Responsible
Marketing and Outreach	Develop standards or requirements for outreach (including relationship with partner agencies)*	Supervisory Ranger
	Coordinate with concessionaire to advertise transit in Refuge promotional materials and website	Supervisory Ranger
	Produce marketing materials	Concessionaire
	Distribute marketing materials	Concessionaire

The Refuge management recognizes that opportunities to increase staff capacity are limited. This table is meant to help the Refuge articulate staffing needs and seek flexible capacity as opportunities arise over the long- and short-terms. It is also meant to help the Refuge plan for when their staff can realistically manage a transit program. Finally, the Refuge can incorporate the opportunity for transit service into future position descriptions.

Infrastructure

Each transit scenario, including the baseline scenario, will require the Refuge to maintain existing roads. Some scenarios call for more intensive construction or maintenance activities. Table 34 contains a list of one-time infrastructure needs that will bring Refuge roads to a safe operating condition for enhanced transit service. It also contains annual maintenance needs directly related to transit scenarios. In some cases, the Refuge already performs the activities listed in the table. Costs associated with each of these needs is included in Table 18.

Table 34: Infrastructure Needs for Transit Scenarios

Scenario	One-Time Infrastructure Needs	Annual Needs
Scenario 1: Baseline	• Single chip seal of asphalt BPWD (1.15 miles) • Add five pullouts to BPWD • Add ten signs to BPWD (indicating safe passing areas, speed limits, pullouts, etc.)	• Perform two routine maintenance activities per year along gravel BPWD sections (5.15 miles) • Annual vegetation removal and shoulder maintenance along BPWD (6.3 miles)
Scenario 2: Concentrated use on BPWD	• Single chip seal of asphalt BPWD (1.15 miles) • Add five pullouts to BPWD • Add ten signs to BPWD (indicating safe passing areas, speed limits, pullouts, etc.) • Construct a gate or booth to control entry • Conduct light rehabilitation work along 2.3 miles of T-10G to improve road condition for transit (2.3 miles)	• Perform two routine maintenance activities per year along gravel BPWD sections (5.15 miles) • Annual vegetation removal and shoulder maintenance along BPWD (6.3 miles) • Conduct one route maintenance activity per year to T-10G to maintain safe transit operating conditions (2.3 miles)
Scenario 3: Dispersed Transit	• Reconstruct roadbed, sideslopes, ditches, re-gravel, and compact on L-Pond Road (0.6 miles) • Perform spot stabilization on L-Pond Road for safe transit operation (0.6 miles) • Add 2 automated gates to control entry to L-Pond Road • Perform spot stabliziation on West Gator Creek for safe transit operation (0.4 miles) • Add 1 automated gate to control entry to West Gator Creek Road	• Perform two routine maintenance activities per year along L-Pond Road (5.03 miles) • Perform annual shoulder maintenance along L-Pond Road (6 miles) • Perform annual routine maintenance (one time per year) along West Gator Creek (1.34 miles) • Perform annual routine maintenance (one time per year) along East Gator Creek (1.53 miles)
Scenario 4: Mandatory Transit on BPWD	• Single chip seal of asphalt BPWD (1.15 miles) • Add five pullouts to BPWD • Add ten signs to BPWD (indicating safe passing areas, speed limits, pullouts, etc.) • Construct a gate or booth to control entry • Construct turnaround at entry gate • Add one shelter and one restroom at entrance	• Perform two routine maintenance activities per year along gravel BPWD sections (5.15 miles) • Annual vegetation removal and shoulder maintenance along BPWD (6.3 miles)

Partnerships

CNS will remain a strategic Refuge partner in both short- and long-term transit. CNS has expressed interest in continued communication with the Refuge as they determine what type of concession contract to pursue.

The Short-Term Transit Plan includes some recommendations and actions for Refuge partnership (see page 38). These actions will strengthen the Refuge's partnership with CNS staff related to transit tours and interpretation. CNS should be included in conversations related to the development of an RFP for transit tours and other concessions. Refuge staff may ask for a CNS staff member to review draft RFPs or contribute to interpretation and curriculum, if appropriate in the future.

Other partners have an interest in Refuge transit as a means of improving visitors' experience and enhancing overall opportunities for regional eco-tourism. The Refuge staff already works closely with many of these groups, including the City of Titusville, Brevard County, and the Merritt Island Wildlife Association. The Refuge should continue to keep partners abreast of progress related to new transit service. Partners may help expand Refuge staff capacity by contributing to:

- Marketing for transit service,
- Recruiting volunteers,
- Gauging the demand for different transit services and programs, and
- Promoting non-transit concession services (bike rental, boat tours).

Regular partner communications can also help identify appropriate connections between Titusville, other parts of Brevard County, and the Refuge. For example, partners may help identify opportunities to bring new community groups (church groups, senior centers, etc.) from Titusville to the Refuge, where they can then transfer to a concession-run transit tour. The Refuge may consider ways to connect partners directly to the transit operator or include a formal role for partners as part of a concession contract (in conjunction with regional CGS staff).

Appendix A: Definitions of Surface Conditions

The following definitions[78] are used to describe pavement condition for various surface types. These are general guidelines for condition indications.

Asphalt	
Excellent	Recently constructed or overlaid road where construction or overlay was performed correctly. No maintenance required. Remaining service life (RSL) = 19-20 years.
Good	Low extent longitudinal and transverse cracks. All cracks are 1/4" or less with little or no crack erosion. Patches are in good condition and applied correctly. Routine maintenance recommended. RSL = 13-18 years.
Fair	Roads are in good structural condition with little or no fatigue cracking. Longitudinal, transverse, and edge cracking is at medium extent and severity. Block cracking is not extensive. Any patches are in good condition. Preventative maintenance recommended. RSL = 7-12 years.
Poor	Road beginning to show signs of structural distress. Fatigue cracking is medium to high extent and medium severity. Cracking will be severe. Surface may have severe block cracking. Patches are in fair to poor condition. There is moderate distortion or rutting and occasional potholes. Rehabilitation recommended. RSL = 1-6 years.
Failed	Road is severely deteriorated. Signs of structural failure appear along with severe and extensive fatigue cracking, distortion, potholes, or extensive patches in poor condition. Reconstruction recommended. RSL = 0 years.
Concrete	
Excellent	New pavement. No maintenance required. RSL = 19-20 years.
Good	First signs of transverse cracking, patch or repair, more extensive pop-outs, or scaling. Sealing or routine maintenance recommended. RSL = 13-18 years.
Fair	Pavement has join or crack spalling, and/or faulting, along with cracking at corners with broken pieces. Any patches are in fair condition and faulting is at a minimum. Preventative maintenance recommended. RSL = 7-12 years.
Poor	Joints and cracks are open 1 inch, spalled, or patched. Faulting is more severe. Rehabilitation recommended. RSL = 1-6 years.
Failed	Most slabs have failed structurally, and faulting is severe. Reconstruction recommended. RSL = 0 years.
Gravel and Native (Native surfaces do not have a gravel layer)	
Excellent	Newly constructed road that has been constructed properly with proper crown, drainage, and gravel layer. Little or no distress. No maintenance recommended. RSL = 8-10 years.
Good	Crown, drainage provisions, and gravel layer are in good condition. Distress limited to traffic effects such as dust, loose aggregate, and low severity corrugations (wash boarding). RSL = 5-7 years.
Fair	Adequate drainage and crown through majority of roadway. Crown repair, ditch improvement may be necessary. Road has more severe corrugations and potholes. Preventative maintenance recommended. RSL = 3-4 years.
Poor	Travel at slow speeds is necessary. Additional gravel layer needed to carry traffic. Poor crown. Ditching is inadequate and rutting is extensive and severe. Rehabilitation recommended. RSL = 1-2 years.
Failed	Travel is difficult, and road may be closed at times. Rutting and corrugations are very severe. Total reconstruction of road is recommended. RSL = 0 years.

[78] Excerpt from the appendix of the Federal Highway Administration's *The Road Inventory of Merritt Island National Wildlife Refuge*, June 2010.

Appendix B: Public Programs Offered

The following formal public programs were offered by the Refuge in 2011 and 2012. This list does not include school and adult environmental education programs, which consist of varying activities and subject material.

- Alligator Program
- Beginning Bird Tour
- Beginning Bird Tour/Presentation
- Butterfly Program/Survey
- Butterfly Survey
- Cruickshank Trail Hike
- Duck ID Program/Tour
- Eagle Program/Tour
- Florida Scrub-Jay Program/Tour
- Gopher Tortoise: Burrowing Buddies
- Hawk Program/Tour
- Junior Ranger Program
- Live Owls and Owl Pellets
- Live Reptiles
- Make a Bird Feeder
- Manatee Program
- Manatee Program/Tour
- Nature Hike
- Nature Photography Made Simple
- Oak Hammock Hike
- Owls and Owl Pellets
- Panther Program
- Plant Program/Tour
- Refuge Nature Bus Tour
- Refuge Nature Driving Tour
- Refuge Photography Club Meeting
- Reptile/Amphibian Night Walk
- Roseate Spoonbill Program
- Roseate Spoonbill Program/Tour
- Sea Turtle for Kids
- Shorebird Program/Driving Tour
- Snakes Alive
- Songbird Hike
- Sounds of the Night
- Trails and Tales
- Trash Bash
- V.C. Boardwalk Tour
- Wading Birds of Merritt Island

Appendix C: Positions Supporting the Visitor Services Program

Supervisory Park Ranger
The Supervisory Park Ranger coordinates overall visitor services program, its direction, and its staff for the Refuge Complex and establishes and maintains partnerships in the community.

Park Ranger
One Park Ranger currently manages the volunteers and the public programs they deliver and organizes environmental education programs for school groups and other organizations.

Fee Collector
One part-time fee collector collects the fees from the four fee collection stations (iron rangers) throughout the Refuge and the fees collected at the visitor center register and counts and records the collected fees (three days per week).

Fee Collectors
One full-time and one part-time fee collector operate the visitor center daily including answering visitor questions and selling passes.

RV Volunteers
The Refuge provides two RV pad sites on Refuge property as a housing location for up to four volunteers in return for their work at the Refuge. RV volunteers who have been at the Refuge during previous years are given more significant responsibility in helping to manage the public and educational programs, while single-season volunteers generally assist with maintenance and caretaking of the public use infrastructure.

Intern
The Refuge has one intern annually assisting with staffing the VIC and conducting public programs. The intern may be supported by organizations such as the Student Conservation Association or the Refuge's Friends group.

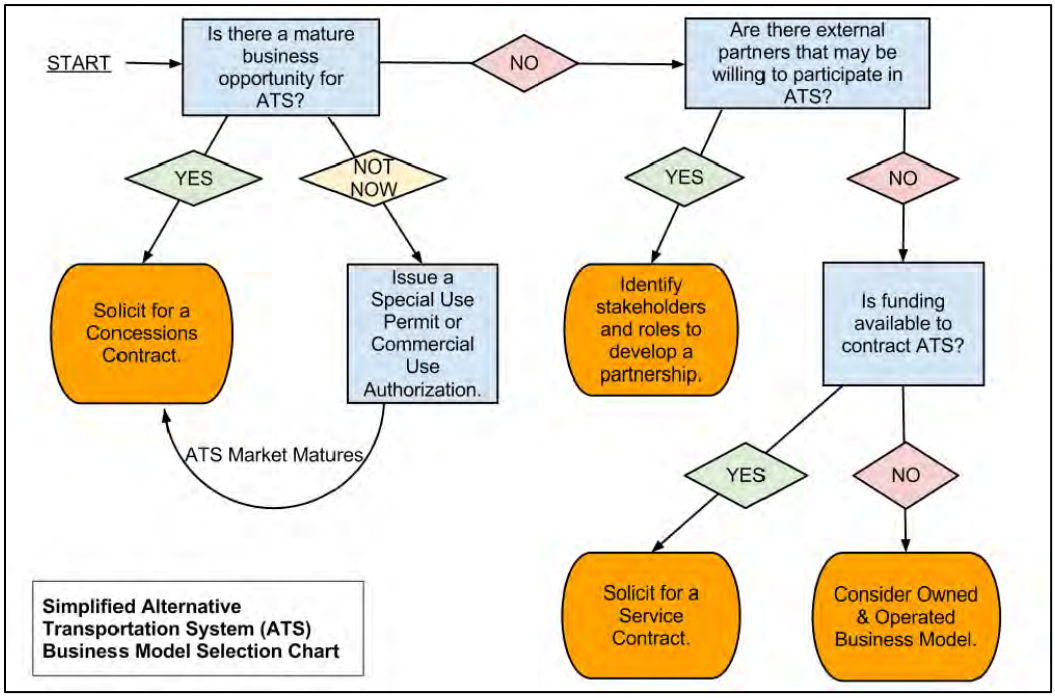
MIWA Employees
The Refuge's Friends group (MIWA) manages the gift shop located inside the VIC. On weekdays during peak season, two MIWA employees are at the VIC: the bookstore manager and a cashier. The cashier's primary role is to ring-up customers and assist customers in selecting purchases from the bookstore, but he or she will supplement the volunteers staffing the information desk as needed. On weekends and during non-peak season, only one MIWA employee is at the VIC.

Volunteers
The volunteer program at the Refuge consists of approximately 200 volunteers. On a given day during the peak season, there are anywhere from five to ten volunteers working at the VIC. Common roles of volunteers include: a volunteer to staff the information desk, a few volunteers at the VIC to assist with educational programs and school groups, a volunteer giving tours or providing informal interpretation, and a group of volunteers performing maintenance and up-keep tasks around the Refuge.

Appendix D: Transit Business Models

The Refuge considered numerous transit business models for long-term transit alternatives. See Figure 23 for a suggested process for selecting business models.

Figure 23: Transit Business Model Selection Chart[79]



For this plan, the project team contacted a number of FWS, NPS, and USFS units with transit systems operating under a variety of business models. The goal of the conversations was to better understand the successes and challenges of different business models and their applicability to long-term transit at the Refuge.

Table 35 and Table 36 summarize transit business models and the types of partnerships considered by the FWS. Opportunities and challenges for each model were determined from conversations with other federal land units as well as through TRIPTAC's *ATS Business Models Evaluation* white paper.

[79] TRIPTAC, *ATS Business Models Evaluation*, 2012, v, http://www.fedlandsinstitute.org/Documents/RepositoryDocuments/ATS_Business_Models_Eval_Final.pdf

Table 35: Transit Business Models

Business Model Definition	Opportunities	Challenges
In the current **Refuge-owned and operated** business model, the Refuge has access to and ownership of its vehicles, while volunteers drive the vehicle and provide interpretation. This model gives the Refuge control over transit maintenance, operations, and interpretation.	• Gives Refuge complete control over bus program • Low operational costs with volunteer drivers	• Capacity limited by relying on volunteers • Currently not financially self-sustaining
Under a **concession contract**, a private concessionaire would provide financial compensation to FWS in return for the right to operate a transit concession (and charge fees for the concession) within Refuge boundaries.	• Would relieve Refuge staff of many transit administrative and maintenance tasks • Could relieve the Refuge of some operations and maintenance costs • Could provide more flexibility for increasing frequency of transit service	• Contract would require some Refuge administrative work • Business opportunity unclear • Refuge would not have direct control
Formal **partnerships** involve the use of agreements between the Refuge and other public and private entities that share a common interest to support transit on Refuge lands. The responsibilities between the Refuge and its partner(s) could vary drastically depending on the agreement. (See types in Table 36 below)	• Could relieve Refuge staff of many transit administrative and maintenance tasks • Could relieve the Refuge of most operations and maintenance costs • There are a variety of agreement types to fit many partnership situations • Refuge could maintain control over interpretation	• Unclear partnership opportunities in the region
Under a **service contract**, the Refuge would pay a transit provider to operate the transit program. The identification of a reliable, recurring source of funding for a service contract is necessary. Unless the Refuge charged fees to all visitors, contingent upon the specifications of the Refuge's fee-charging authority, it will not likely have the resources to pay for a service contract.	• Transit service would be provided to visitors for free or for a fee • Could relieve Refuge staff of transit program tasks • Utilizes external expertise and resources	• Significant financial commitment from the Refuge • Requires reliable and recurring funding

Table 36: Partnership Agreements[80]

Type of Partnership	Definition
Cooperative Agreement	Formalizes a relationship between the United States Government and a state, local government, or other recipient involving a transfer of value and substantial involvement
Interagency Agreement	Utilized between Federal agency partners for the acquisition of services, supplies, materials, or equipment
Memorandum of Understanding	Documents relationships between parties that describe a framework for cooperation when nothing of value is transferred
Challenge Cost Share	Split funding responsibility and risk among partners for projects that preserve and improve Refuge resources

[80] TRIPTAC, *ATS Business Models Evaluation*, 2012, 3.

Appendix E: Refuge Signs

The multiple uses occurring on Refuge roads and trails and the seasonal changes in uses require consistent and understandable signage communicating acceptable uses. This appendix provides the foundation for a future sign plan to supplement the Transit Planning Study.

The Refuge consistently uses an "All public entry prohibited" sign throughout the Refuge to mark all areas closed to the public (see Figure 24), but signage in areas with modal or seasonal exceptions will need to provide more information to visitors. Additionally, the Refuge has identified sign pollution or "clutter" as an issue in some areas. A clear and consistent signage program for the Refuge will address the following elements:

1. Permitted uses, where appropriate;
2. Seasonal or temporal variations of uses, when necessary; and
3. Context-sensitive design.

Figure 24: Typical Refuge sign at restricted areas

Permitted Uses

The use of familiar transportation and recreation symbols on signage for roads and trails with modal exceptions will make Refuge rules easy to understand. Highlighting permitted and prohibited activities graphically will likely result in a higher compliance than by listing activities by text as these symbols are recognized internationally. Trailhead signs on public lands in Colorado, for example, display permitted ("Open to") and prohibited ("Closed to") modes using symbols on their posts.[81]

Seasonal or Temporal Variations of Uses

Additionally, mode restrictions during seasonal hunting or other regular closures must also be identified on signs in applicable areas with the dates or descriptions of closures. Trailhead signs on public lands in Colorado also provide seasonal closure information on their posts. See Figure 25 for a mock-up of a trail sign listing seasonal permitted uses, like those used in Colorado.

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[81] National Trails Training Partnership, *Trail Maintenance and Management: Travel Management Signs for Public Lands in Colorado*, accessed April 22, 2014, http://www.americantrails.org/resources/ManageMaintain/MgmtPubLandSignsCO.html

Figure 25: Trailhead Sign Example

Context-Sensitive Design

Context-sensitive design allows for transportation infrastructure, like signage, that takes into consideration its physical setting and preserves environmental resources while maintaining safety and mobility.[82] The Refuge has identified consistency and placement of signage as an issue along its roads and at trailheads. The 2014 Road Safety Audit (see Appendix J) specifically noted non-compliance with federal road standards and sign "clutter" at Refuge entrances as a safety concern.[83]

Limited spacing and a high density of signs can result in driver distraction or failure to comprehend messages and the degradation of scenic views. Table 37 lists these and other factors considered in context-sensitive signage design.

Table 37: Impacts of Signage on Visual Environment[84]

Design Aspect	Impact on Visual Environment
Longitudinal density	Medium
Spacing and density	High
Lateral location	High
Interaction with traffic signs	Medium
Flashing signs and lights	High
Size of sign and lettering	High
Primacy of information	Low

[82] Federal Highway Administration, *What is CSS*, accessed 5/17/2014, http://www.fhwa.dot.gov/context/what.cfm
[83] Elisa Kropat, *Merritt Island National Wildlife Refuge Road Safety Audit Report*, 2014, 18.
[84] American Planning Association, *Context-Sensitive Signage Design*, 2003, 182, https://www.planning.org/research/signs/pdf/appendix.pdf

Next Steps

To mitigate existing sign clutter and other concerns, the Refuge can develop a comprehensive sign plan. A sign plan is important for establishing uniform standards for Refuge-specific wayfinding and communication. The Refuge's sign plan should consider design aspects and their impacts on the visual environment.

This plan requires a number of steps, beginning with a sign inventory to identify the baseline condition on the Refuge. As of summer 2014, the Refuge identified 32 informational and guidance signs primarily for vehicle drivers on the Refuge, many of which need to be replaced.[85] Once the Refuge has completed and verified this inventory, it can develop a sign plan by:

1. **Determining the scope of the sign plan**
   The scope should focus on internal and/or external navigation to and within the Refuge. It should also specify the intended audience (by mode of visitor) and the inclusion of traffic control signs.
2. **Identifying gaps or excess in the current sign inventory**
   Previous Refuge sign inventories identified at least two signs to be added and at least eight to be removed along the Refuge's public roads. Notably, these inventories do not include signs at trailheads or within other primary visitor use areas.
3. **Prioritizing signage needs and areas for improvement**
   In addition to needs and recommendations in the current sign inventory, the Refuge may find other needs and areas for improvement it deems appropriate.
4. **Consider design needs and opportunities**
   Context-sensitive design and elimination of "clutter" are important components of the sign plan. Signs can be designed in accordance with forthcoming updated FWS national guidance or according to the Refuge's unique needs.
5. **Identifying locations for new or consolidated signs**
   Following FWS and federal road standards, the Refuge should identify locations for new or consolidated context-sensitive signage.

FWS Standards

The Refuge would implement a potential future sign plan through the purchase and installation of new signs. The 2004 *Service Sign Manual* provides guidance for procurring and installing traditional guide and interpretive signs and traffic control devices on FWS lands.

The *Sign Manual* also provides a number of recommended steps for reducing vandalism of new signs. For example, vandal-resistance hardware, like the "Vandlgard nut," can prevent signs from being loosened and removed. Installing anchor rods or cleats at the bottom of a signpost can prevent posts from being rotated or removed. The manual also reports that negatively worded signs are more frequently vadalized than positive signs.[86]

[85] Kropat, Elisa, *Informational and Guidance Signs Inventory*; *High-Relief Signs Recommended to be Replaced – SR 3*, 2014.
[86] 2004, 4-16 – 4-17, http://www.fws.gov/policy/signManual_LowRes.pdf

Appendix F: Access Control

Access control plays an important role in protecting resources and maintaining public safety in areas of the Refuge that are closed to visitors or certain modes. As the Refuge considers future changes to the modes allowed on some of its trails and roads, this appendix can help guide a discussion on access control options.

Damage to barriers is a significant concern for the Refuge as traditional chain gates are regularly cut and destroyed. While putting chains through PVC tubing (see Figure 26) has curtailed some vandalism, Refuge staff still report problems with gates being pulled out and with trespassing by pedestrians.

Figure 26: Chain Gate with PVC Tubing near Scrub Ridge trail

Barriers and gates with varying access permeability and cost can be installed in the Refuge (see Table 38 for an overview of barriers). Jersey barriers, commonly used during road construction projects, are already found throughout the Refuge on areas that do not require easy access by officials. While Jersey barriers can still be scaled by trespassers, their solid design offers the lowest permeability out of any potential barrier. Jersey barriers are not appropriate on fire access roads because law enforcement and the fire department must be able to access fire roads quickly in the event of an emergency.

Table 38: Overview of Appropriate Barriers for the Refuge

Barrier	Permeability	Cost	Notes
Removable bollards	High	Medium	Allows for bicyclists and pedestrians to easily pass through
Chain gate	Medium	Low	Current barrier; easily vandalized
Swing gate	Medium	High	Harder to vandalize; provides a visual barrier against all uses
Jersey barrier	Low	Medium	Prevents most modes; not appropriate for fire access roads

Barriers appropriate for fire access roads and other paths include the Refuges' existing chain gates, removable bollards (see visualization in Figure 27) and swing gates (see visualization in Figure 28).

Bollards are appropriate for areas where pedestrians or bicyclists are permitted, as these users are able to pass freely through spaces between the barriers. Swing gates provide more of a visual barrier against all uses than bollards, but trespassing by pedestrians is still possible.

Figure 27: Visualization of Removable Bollards

Figure 28: Visualization of a Swing Gate

Any barrier that blocks a fire access road or area that may need to be easily reached by Refuge staff needs to be able to be removed quickly and conveniently. The lock associated with the Refuge's existing universal master key, or "hog key," should be used on any new bollards and gates, providing first responders a method for quickly removing or opening barriers throughout the Refuge.

In areas with high security concerns or persistent vandalism or trespassing, the Refuge can install trespasser detection systems to relay images or video to law enforcement and fire officials. In extreme situations, sensors can be placed under a road to monitor vehicular traffic; when the sensors are activated, a battery-powered covert camera can capture footage of the trespasser. This is a high-cost option that should be considered when public safety or resource protection is severely threatened.

Appendix G: Stakeholders Involved in Development of Plan

Table 39 lists federal, state, regional, and local stakeholders involved in the development of the Transit Planning Study. Stakeholders provided feedback to the planning team through emails, phone calls, or in-person meetings in Titusville.

Table 39: Stakeholders Involved in Development of Plan

Organization	Contacts
Brevard County Environmentally Endangered Lands	Mike Knight
City of Titusville - Planning	Peggy Busacca Bradley Parrish
Delaware North	Craig George
Federal Highway Administration	Laurie Miskimins
FWS Region 4	Jo Ann Clark
Kennedy Space Center	Mario Busacca Steve Gilmore
Merritt Island Wildlife Association	Sandee Larsen
NPS Canaveral National Seashore	Myrna Palfrey-Perez Edwin Correea Bob Shannon Sean Harris
Port Canaveral	Jim Dubea
Port Canaveral	Carol Noble
Space Coast Area Transit	Jim Liesenfelt
Florida's Space Coast Office of Tourism	Thomas Bartosek Rob Varley
Space Coast Transportation Planning Organization	Leigh Holt
Titusville Area Chamber of Commerce	Marcia Gaedcke
Titusville Municipal Marina	Mark Leslie Ron Thorstad

Appendix H: Refuge Bus Policy

The following pages are an excerpt from MINWR's "14P Bus Operator Training Booklet," completed in December 2013. This booklet is used for training operators of the Ford 350 E, 14 passenger bus owned by MINWR.

The title page, table of contents, and appendix of the training booklet are not included in this appendix. Some formatting changes were made to the training booklet for both accessibility and ease of incorporation into this document.

A. Bus Operator Position Description

Organization	**Merritt Island National Wildlife Refuge** **U.S. Fish and Wildlife Service**
Position Title	**Bus operator and tour guide** **MINWR's Ford 350 E, 14 - passenger bus**
Duties and Responsibilities	• **Conduct interpretative tours while operating bus** • **Establish tour programs; write an interpretive outline and present an enjoyable and educational tour that connects to the mission of the USFWS and objectives of MINWR.** • **Properly care for, maintain, and return Refuge property.** • **Ensure shuttle bus is in safe working condition before and after tour; must immediately notify refuge staff of any problems or dysfunctions.** • **Ensure that designated MINWR phone and personal cell phone are charged, ready for use, and taken with you during bus tour.** • **Review safety procedures and guidelines outlined in the MINWR bus operator training booklet with passengers prior to departing.** • **Review and comply with driver's safety check list located on the bus before operating bus.** • **Follow state of Florida driving regulations while operator bus.** • **Follow regulations and guidelines stated in MINWR bus operator training booklet while operating bus.**
Qualifications and Requirements	• **Possess a valid U.S. driver's license.** • **Have an acceptable 3 year driving record; review by USFWS federal law enforcement officers and MINWR management.** • **Attend and pass MINWR bus operator training course annually.** • **Ability to work independently with minimal supervision.** • **Interest in learning about Refuge resources and management practices.** • **Be able to interact patiently and tactfully with visitors and answer a variety of questions.** • **Ability to endure exposure to the elements for long periods of time; sun, wind, rain, biting insects and standing.** • **Ability to walk and stand for extended periods of time on uneven terrain.**
Lines of Communication	• **MINWR Volunteer Coordinator** • **MINWR Public Use Supervisory Ranger**
Orientation and Training	• **MINWR bus operator training; annual.** • **First Aid, CPR, and AED certification; provided by Refuge.** • **USFWS background investigation (DOI Access Badge level: NACI).** • **NSC Defensive Driving Training course; online.**
Work Schedule	**Flexible, unless work is part of a scheduled project.**
Place of Work	**Driving bus on MINWR property and permissible off-site locations stated in bus operator training booklet.**
Benefits	**Volunteer will learn about the Refuge resources and have the opportunity to interact and educate visitors about them.**
Contact	**Nancy Corona; office: (321) 861-0668; e-mail: Nancy_Corona@fws.gov**

B. MINWR 14-Passenger Bus Policy

Merritt Island National Wildlife Refuge is to:

a. Design and provide annual training refresher before the start of the peak season for all new operators as well as current operators
b. Provide first aid, CPR, and AED certification for operators
c. Maintain a list of approved operators including their
    i. Attendance of annual refreshers
    ii. Up to-date certifications of first aid, CPR, and AED
    iii. Copies of signed agreements for each operator including
        1. MINWR's *Vehicle Use Agreement*
        2. Volunteer Services Agreement for Natural Resources Agencies (SF-301A)
        3. Authorization for Operation of Motor Vehicle and/or Equipment (SR 3-2267)
d. Ensure a refuge staff member reviews operator's driving record history annually to confirm by signing and dating the operator's *Vehicle Use Agreement* it meets refuge standards but not keep a copy of the record
e. Ensure that there are no more than ten approved operators at a single time
f. Provide updated emergency contact list that is to be kept inside the vehicle
g. Provide communication device (cell phone) for emergency or incident purposes to be taken on tours
h. Provide DI-135 "What Every Driver Should Do In Case of an Accident" packet to be kept inside the vehicle
i. Be responsible for general vehicle maintenance
j. Support the use and operation of the vehicle, its operators, and interpretative tours with a specific and primary focus on operations and tours that support educational opportunities regarding:
        1. Scrub Jays and their habitat
        2. Waterfowl and wetlands
        3. Endangered species

C. MINWR 14-Passenger Bus Operator Agreement

MINWR 14 PASSENGER BUS OPERATOR AGREEMENT

Purpose: The vehicle use agreement is intended to reduce the risk of accident and promote safety for the driver as well as the passengers associated with the operation of the vehicle. The term 'vehicle' in this agreement hereafter refers to the 14 passenger bus owned and operated by the Merritt Island National Wildlife Refuge (MINWR).

1. Operator Qualifications

An operator of the vehicle must

- **a)** Be a U.S. Citizen and possess a valid U.S. driver's license
- **b)** Be of age 21 years or older
- **c)** Have a minimum of three years driving experience
- **d)** Obtain a 3-year driving record from the Florida Department of Motor Vehicles, at a cost of $8 to the operator, which must meet the MINWR defined acceptable driving record standards
- **e)** Attend the new driver vehicle training and annual refresher provided by MINWR
- **f)** Be first aid, CPR, and AED certified; certification is provided by MINWR
- **g)** Sign the *Volunteer Services Agreement for Natural Resources Agencies* (SF-301a)
- **h)** Sign the *Authorization of Operation of Motor Vehicles and/or Equipment* (SF 3-2267)
- **i)** Take the *National Safety Council's Defensive Driving Training Course* ; provided online by USFWS at no cost to applicant

2. Operator Responsibilities and Operating Policies

To maintain status as an approved operator, the operator must

- **a)** Operate vehicle in accordance with all traffic laws, ordinances, and regulations and may not operate the vehicle while drowsy or under the influence of alcohol or drugs
- **b)** Report the onset of physical or mental conditions that inhibit ability to safely operate the vehicle to Refuge management; Refuge management will assess situation
- **c)** Report traffic violations and accidents that occurred while operating the vehicle regardless of damage
- **d)** Maintain the driving record standards and report suspensions and restrictions affecting their state operator's license
- **e)** Carry no more than 14 passengers
- **f)** Ensure a government issued cellphone and charger is onboard the vehicle in a known location
- **g)** Abide by policies set forth during the MINWR bus operator training, specifically driving only on approved roads

Acknowledgement: Violation of vehicle use agreement or a demonstrated careless disregard in operating the vehicle may result in the suspension or revocation of the privilege of operating the vehicle. **I hereby acknowledge the policies stated above and agree to abide by them.**

_____ _____

(Signature of Operator) *(Date)*

□ Operator has valid US driver license	Staff Signature)	(Date)
□ Operator is CPR certified	(Staff Signature)	(Date)
□ Operator is first aid certified	(Staff Signature)	(Date)
□ Operator's driving record meets standards	(Staff Signature)	(Date)

D. Acceptable Driving Record Standards

Each applicant for the bus operator volunteer position is required to obtain a three-year driving history record from their state of residency. Applicants will be reimbursed for the cost.

Each applicant's driving record will be reviewed on an individual basis annually. Unacceptable driving infractions will include the following but are not limited to:

- Driving under the influence
- Careless driving infractions
- Excessive speeding infractions; greater than 20 mph

E. Defensive Driving Training

GSA Sponsored – Defensive Driver Training

Online Defensive Driving Course

National Safety Council's Online Defensive Driving Course is a four-hour course designed to provide convenient training on a personal computer. Using state-of-the-art animation and graphics, the online defensive driving course offers an engaging, interactive learning environment for Fleet customers to analyze real driving situations, spot driving hazards, and identify the correct defenses. GSA's Office of Motor Vehicle Management offers this training free of charge to GSA Fleet customers. Upon completion, students receive a Water Marked certificate from the National Safety Council that, in many states, may be used to lower automobile insurance rates. More than 65 million drivers have learned to protect themselves on the road by taking part in National Safety Council programs. Certification expires within three years, so those who took this course in 2008 will need to take it again to maintain certification.

It's Fast, Easy, and Free!

1. Go to http://drivethru.fas.gsa.gov/
2. Click on the link for Defensive Driving Course located on the bottom left side of the screen
3. Enter FWS Customer number 01010014804G302 and (agency or private) e-mail address.
4. You will be presented with a registration page. (Ensure your pop-up blocker is disabled).

New Student - Fill in all your information, including a login ID and a password of your choice, then click on Submit. Enter Login ID and Password you just created. Note: A confirmation e-mail will be sent reminding you of the user name and password you created for access to the site at a later date. **See Example of requested information below.**

1) Click on Safety located on the My Place page.
2) Then on My Courses page, click on NSC Defensive Driving Course 9th Edition to begin the course.

Returning Student - click on this link www.safetyserve.com/gsafleet to log back in. Enter Login ID and Password

1) Click on Safety located on the My Place page.
2) Then on My Courses page, click on NSC Defensive Driving Course 9th Edition to begin the course.

NEW STUDENT –

Please fill in all "Required Fields" ✓ and click the "Submit" button at the bottom of the screen.

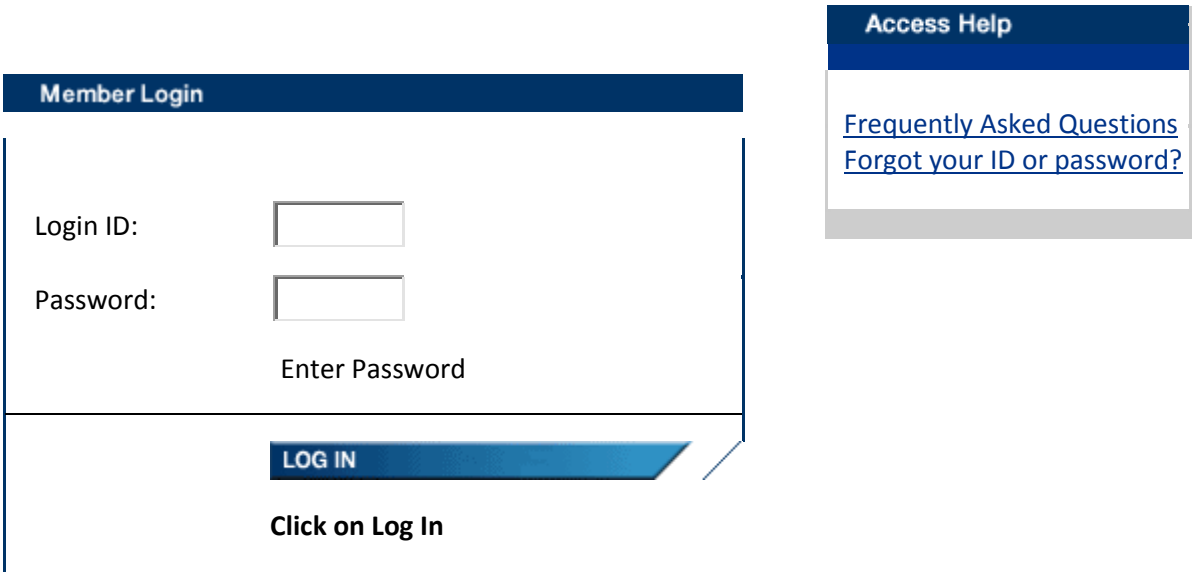
✓Required Fields	
✓**Login ID**:	*require more than 4 characters*
✓**Login Password**:	*require more than 4 characters)*
✓**Re-enter Login Password**:	
✓**First Name**:	
✓**Last Name**:	
✓**Agency Name**:	
✓**Bureau**:	
✓**Region**:	
Unique Employee Identifier:	
✓**Work Phone**:	
✓**Email**:	Will automatically fill with E-mail provided.
✓**Address 1**:	
Address 2:	
✓**City**:	
✓**State**:	
✓**Zip-Postal Code**:	
Country:	
Cert (office use only):	

Hit Submit

New students will see this when they hit submit at bottom on new employee page**.**

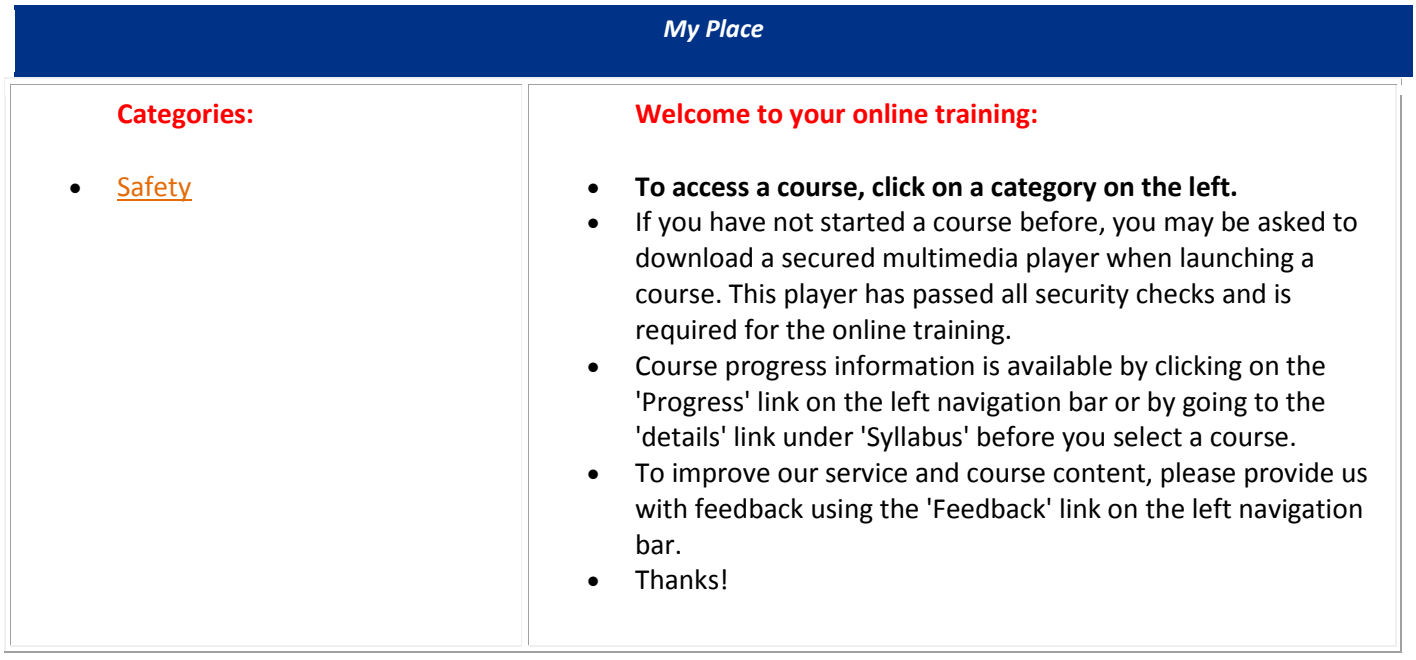
Welcome to your Online Training Center

Please enter the following information to login.



Click on Log In

NEXT PAGE



NEXT PAGE

My Courses

Click on a Course title below to begin your training -
[Note: All dates/times are in Eastern Time]

	Date Created	Date Expired	Date Accessed	Syllabus/Progress
Courses Available				
NSC Defensive Driving Course 9th Edition	9/8/2011	9/7/2012	--	details

NOTE: YOU MAY USE THE DETAILS LINK, UNDER SYLLABUS/PROGRESS, TO VIEW YOUR COMPLETION STATUS

If you cannot finish the training in one session you can close and when you log in to the NSC Defensive Driving Course it will automatically bring you back to where you stopped.

Vehicle Training Request and Documentation Form "Online defensive driving training is available through the Department of Interior Learning Management System (DOI ILearn). You can use the DOI ILearn catalog to search for "defensive driving." The course that meets DOI training requirements is named "NSC Defensive Driving II." Department of Interior Learning Management System - DOI Learn

F. Touring Roads Map

STOPPING ALONG MAIN HIGHWAYS (SR 402, SR 406, AND SR 3) IS PROHIBITED INCLUDING PULLING OFF ONTO SHOULDER.

Bus Touring Roads

- **Bair's Cove Boat Ramp**
- **Bio Lab Boat Ramp**
- **Beach Road & Beach Parking Lots; Past Fee Station**
- **Black Point Wildlife Drive**
- **Manatee Observation Deck**
- **Oak/Palm Hammock Parking Lot**
- **Parrish Park East of Max Brewer Bridge**
- **Pine Flatwoods**
- **Refuge Headquarters Area**
- **Refuge Visitor Center**
- **Sendler Education Post**
- **Scrub Ridge Trail Road / Parking Lot**
- **SR 3**
- **SR 402**
- **SR 406**

G. Rules of the Road for Non-CDL Vehicles

Please read the Illinois Rules of the Road[87] for Non-CDL Vehicles located in the appendix of this training booklet. It provides useful information for operating large vehicles.

[87] This appendix is excluded from the Merritt Island Transit Planning Study.

H. Day-Of Procedures

Pre-Departure

1. Keys are located in Visitor Center kitchen closet
2. Cursory check of vehicle for
    a. Inflated tires
    b. Mirrors in good working condition
    c. Windshield wipers in good working condition
    d. General dents or scratched
    e. Properly working gauges and instruments
    f. Sufficient amount of fuel for trip
    g. First kit, AED, emergency warning equipment, cell phone, and emergency contact list are aboard bus
3. Unlock emergency door
4. Before passengers board, remove any trash or left belongings

Departure & Touring

1. Pull vehicle to front of Visitor Center for boarding
2. Stand by vehicle door to assist passengers loading and take care of any issues or concerns
3. Review the following with passengers prior to departure
    a. Location of emergency exits, first aid kit, AED, fire extinguisher, and emergency contact list
    b. Convey to passengers an overview of the tour including duration and locations of tour
    c. Remind passengers that they are not stand while the bus is in motion
    d. Advise passenger to be careful when exiting the bus during tour. Specifically:
        i. Watch for other passing vehicles
        ii. Keep an eye for general wildlife; specifically fire ant mounds when you step
        iii. While on dikes, be mindful of the edge of the road

4. Good practices while driving and touring
    a. Keep vehicle door closed while in motion and close door when at stopping points
    b. Be mindful of the width of the road when stopping or pulling over. Only pull over where it is safe, the road is wide enough, and when other vehicles are still able to pass
    c. Do not stop and pull over when driving along the main highways: SR 402, SR 406, and SR 3

Post Tour

1. Pull-up to front of Visitor Center to unload passengers
2. Stand by vehicle door to assist passengers when exiting bus
3. Check bus for any left belongings and remove all trash
4. Report any vehicle issues or low fuel to Refuge staff member
5. Return empty bus to gravel, overflow parking lot at Visitor Center
6. Return keys to proper locations

I. Emergency and Incident Procedures

I. Emergency Procedures

- A contact list of names and numbers to remain on the vehicle at all times. This list will indicate who to call and in what order.
- A report must be complete for any incident. If it is the only resulting damage is a scratch, an in-house report must be filed.
- Acts determined to be negligent may result in revocation of driving privileges.
- Below are general procedures if an incident occurs.
    1. EMERGENCY: Foremost, call 911 for emergency incidents.
    2. JURISDICTIONAL LAW ENFORCEMENT: Be cognizant of what law enforcement district you are in when the incident occurs. If you are at Parrish Park, make sure to call the City of Titusville police. If you are on Refuge property, be sure contact Kennedy Space Center Security.
    3. REFUGE LAW ENFORCEMENT: For all significant incidents, and any incident involving another vehicle, you must contact a Refuge law enforcement officer.
    4. REFUGE STAFF: After emergency services, Refuge law enforcement, and appropriate jurisdictional law enforcement are contacted, contact Refuge Public Use Staff.

II. Mechanical Breakdowns or Failures

- A roadside emergency kit will be located in the vehicle to be used if the vehicle becomes disabled. Assess situation and determine proper warning devices to use from turning on emergency flashers to setting out reflective warning signs. A general rule of thumb is to place emergency warning devices 100 feet in both directions from the vehicle towards approaching traffic.
- Do not attempt to fix any mechanical breakdowns including but not limited to changing tires.

- If possible, drive disabled vehicle to a safe area. Contact Refuge Public Use Staff and USFWS law enforcement. Assess situation to determine if it is safer for passengers to remain on the bus or get off.

III. Emergency Contact List

(To remain on vehicle)

I. Emergency Procedures

Step 1:

Emergency on Refuge property (Ambulance, Security, Fire) call:
Kennedy Space Center Dispatch: 321-867-7911.

Step 2:

Contact USFWS law enforcement officers after calling KSC dispatch. Leave detailed voice message if no answer.

Jane Whaley: 321- 403-7634 (Cell)
321-861-2805 (Office)

Phil Amoroso: 321- 403-9182 (Cell)
321- 861-2379 (Office)

Step 3:

Contact designated Public Use Supervisor. If no answer, leave detailed message.

Nancy Corona: 321-863-9625 (Cell)
321-861-0668 (Office)

Sandy Mickey: 321-403-7631 (Cell)
321-861-2384 (Office)

Visitor Center Desk: 321-861-0669
Headquarters Receptionist (Monday – Friday): 321-861-0667

Emergency off Refuge property: Call 911
Brevard County Titusville Police: 321-264-7801
Brevard County Sheriff's: 321-264-5100
Volusia County Sheriff's Dispatch: 386-423-3888 - New Smyrna Beach

II. Procedures for non-emergency injury or property damage

All injuries and damage to property must be reported immediately to MINWR law enforcement and MINWR management.

Step 1:

Call USFWS law enforcement officers. Leave a detailed voice message if no answer.

Jane Whaley: 321- 403-7634 (Cell)
321- 861-2805 (Office)

Phil Amoroso: 321-403-9182 (Cell)
321- 861-2379 (Office)

Step 2:

Contact designated Public Use supervisor. If no answer, leave detailed message.

Nancy Corona: 321-863-9625 (Cell)
321-861-0668 (Office)

Sandy Mickey: 321-403-7631 (Cell)
321-861-2384 (Office)

Visitor Center Desk: 321-861-0669
Headquarters Receptionist (Monday – Friday): 321-861-0667
FWC Dispatch: 407-275- 4150 (Florida Fish and Wildlife Conservation Commission)

J. Tour Program Approval Form

Merritt Island National Wildlife Refuge
14-Passenger Bus Program Approval Form

Name:

Contact information:

Today's Date: Date of Use (at least 2 weeks in advance):

Description of program below, please include the following:

- How the program supports the refuge's goals of either 1) scrub jays and their habitat 2) waterfowl and wetlands 3) federally-listed threatened or endangered species. Few other programs will be approved.
- Program purpose and goal
- Precise program route and stops
- Date, time, and duration of program
- Frequency of program

Sandy Mickey: Sandra_Mickey@fws.gov or 321-861-2384

Lavne Hamilton: Lavne Hamilton@fws.gov or 321-861-0667

K. Vehicle Specifications

Fuel tank capacity	40 gallons
Vehicle height	107” / 8’ 11”
Vehicle length	255” / 21’ 3”
Vehicle width	107.5” / 8’ 11.5” (mirror to mirror)
Recommended tire pressure	Front (65PSI) / Rear (60PSI)

Appendix I: Parking Needed at Visitor Center

Parking Needing for Current Activities

Table 40: Current Visitor Center Parking Conditions

Description	Value	Notes
Number of visitor parking spaces at Visitor Center	46	
Average daily number of visitors	266	
Estimated average number of vehicles at Visitor Center per day	106.4	2.5 visitors per vehicle
Estimated average number of hours spent at Visitor Center	0.5	
Hours Visitor Center parking lot open	7	
Estimated average number of parking spots needed per day	7.6	Number of vehicles / (Hours Visitor Center open / Hours spent at Visitor Center)

Table 41: Estimated Parking Needed at VIC During Peak and Off-Seasons

Description	Value	Notes
Peak Season (January)		
Estimated average number of visitors per day	500	
Estimated average number of vehicles at Visitor Center per day	200	2.5 visitors per vehicle
Estimated average number of hours spent at Visitor Center	0.75	
Hours Visitor Center parking lot open	7	
Estimated average number of parking spots needed per day	21.4	Number of vehicles / (Hours Visitor Center open / Hours spent at Visitor Center)
Off-Season (November)		
Estimated average number of visitors per day	120	
Estimated average number of vehicles at Visitor Center per day	48	2.5 visitors per vehicle
Estimated average number of hours spent at Visitor Center	0.5	
Hours Visitor Center parking lot open	7	
Estimated average number of parking spots needed per day	3.4	Number of vehicles / (Hours Visitor Center open / Hours spent at Visitor Center)

Table 42: Current Transit Program Estimated Required Parking

Description	Value	Notes
Hours in parking spot for transit	3.5	
Current average number of passengers/tour	12	
Total number of parking spaces need	4.8	2.5 visitors per vehicle

Table 43: BPWD Conditions

Description	Value	Notes
Peak daily visitation	562.5	
Off-season daily visitation	312.5	
10% of peak daily visitation	56.3	
10% of off-season daily visitation	31.3	
15% of peak daily visitation	84.4	
15% of off-season daily visitation	46.9	

Parking Needed for Enhanced Transit Program

Table 44: Estimated Parking Needed for Enhanced Transit, 10% of Current BPWD Visitation

Description	Value	Notes
Peak Season (January)		
Estimated number of daily passengers	68.3	Current number of transit riders + 10% of BPWD Visitation
Hours in parking spot for transit	3.5	
Number of private vehicles	27.3	2.5 passengers per vehicle
Estimated average number of parking spots needed per day	13.7	Number of private vehicles / 2
Off-Season (November)		
Estimated number of daily passengers	43.25	Current number of transit riders + 10% of BPWD Visitation
Hours in parking spot for transit	3.5	
Number of private vehicles	17.3	2.5 passengers per vehicle
Estimated average number of parking spots needed per day	8.7	Number of private vehicles / 2

Table 45: Estimated Parking Needed for Enhanced Transit, 15% of Current BPWD Visitation

Description	Value	Notes
Peak Season (January)		
Estimated number of daily passengers	96.4	Current number of transit riders + 15% of BPWD Visitation
Hours in parking spot for transit	3.5	
Number of private vehicles	38.6	2.5 passengers per vehicle
Estimated average number of parking spots needed per day	19.3	Number of private vehicles / 2
Off-Season (November)		
Estimated number of daily passengers	43.3	Current number of transit riders + 15% of BPWD Visitation
Hours in parking spot for transit	3.5	
Number of private vehicles	17.3	2.5 passengers per vehicle
Estimated average number of parking spots needed per day	8.65	Number of private vehicles / 2

Parking Needed for Mandatory Transit

Table 46: Estimated Parking Needed for Mandatory Transit

Description	Value	Notes
Peak Season (January)		
Number of vehicles on BPWD between 10 AM and 4 PM	146	
Length of stay (hours)	3	
Total spaces needed (off peak)	48.7	Number of vehicles / length of stay
Off-Season (November)		
Number of vehicles on BPWD between 10 AM and 4 PM (year-round average)	99	
Length of stay (hours)	3	
Total spaces needed (off peak)	33	Number of vehicles / length of stay

Appendix J: Refuge Road Safety Audit

The following document evaluates key public use areas for bicycle, pedestrian, and vehicle safety conflicts, assesses current conflicts experienced, and reviews plans for proposed bicycle facilities to mitigate future potential conflicts. It was completed in November 2014.

Merritt Island National Wildlife Refuge

Road Safety Audit Report

November 2014

U.S. Department of Transportation
Federal Highway Administration
Office of Federal Lands Highway

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

Paul S. Sarbanes Transit In Parks
Technical Assistance Center
UNDERSTANDING RESOURCES SOLUTIONS

This document was prepared for the Federal Transit Administration by the Paul S. Sarbanes Transit in Parks Technical Assistance Center

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AUTHOR

This document was authored by Elisa Kropat, Public Lands Transportation Scholar (2013-2014) at Merritt Island National Wildlife Refuge, a program partially sponsored by the Paul S. Sarbanes Transit in Parks Technical Assistance Center (TRIPTAC).

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INTRODUCTION

The purpose of the Merritt Island National Wildlife Refuge bicycle and pedestrian Road Safety Audit (RSA) is to evaluate key public use areas for bicycle, pedestrian, and vehicle safety conflicts, assess current conflicts experienced, and review plans for proposed bicycle facilities to mitigate future potential conflicts.

BACKGROUND

OVERVIEW OF THE REFUGE

Located on a 35-mile long barrier island on Florida's eastern coast, Merritt Island National Wildlife Refuge (the Refuge) protects hundreds of sensitive species and their habitat, and attracts approximately a million visitors each year to enjoy wildlife-based recreation. The Refuge houses the second largest population of the endangered scrub jay species, serves as a resting location for more than 300 migratory bird species along with waterfowl and shore birds, and provides refuge for 93 federally- or state- listed plant and animal species. The Refuge uses a variety of management techniques to support the wildlife and its habitat including prescribed burns, water level manipulations in impoundments, and mechanical or chemical treatments for exotic species.

In 1963, the Refuge was established as an overlay of the National Aeronautics and Space Administration's (NASA) John F. Kennedy Space Center (KSC). A unique cooperative agreement, signed between the U.S. Department of the Interior and NASA, provided for NASA to retain land ownership while establishing a buffer for space-related activities as a wildlife refuge managed by U.S. Fish and Wildlife Service. Today, the Refuge is responsible for managing 140,000 acres of KSC's non-operational lands including secure and non-secure (public) areas. The Refuge also works closely with National Park Service's Canaveral National Seashore (the Seashore), which is located along Merritt Island's eastern oceanic coastline. Approximately 34,000 acres of land is shared by the Seashore and the Refuge. In this shared area, the Refuge manages habitat and wildlife and the Seashore preserves cultural resources. (Refer to Appendix A for a map of the shared boundaries.)

The Refuge is located in the rapidly growing central Florida metropolitan region, which is within an hour's drive of Orlando and associated tourist attractions. A variety of visitors come to the Refuge due to its estuarine biodiversity, its world-class saltwater and freshwater fishing, and its designation as a globally important bird area.

REGIONAL BICYCLE TRAILS

Planning and providing for a network of bicycle trails is a priority of Florida local and state governments and in Refuge long-range plans. Due to the expansion of bicycling facilities in the communities surrounding the Refuge, determining and addressing safety conflicts within the public use areas of the Refuge is vital to Refuge planning. The table below highlights a sampling of current bicycle projects that may have an impact on bicycling to or within the Refuge.

Table 1 – Local, Regional, and State Bicycle Projects

Local	*Eco-Heritage Trail*	In 2012, the Titusville Environmental Commission published an *Eco-Heritage Trails and Bike Path Plan* proposing a bike-able loop through the City of Titusville[1] connecting 25 heritage sites that are of ecological, historical or cultural significance including the Refuge.
Local	*Titusville to Edgewater Trail*	The Florida Department of Transportation (DOT) and the Space Coast Transportation Planning Organization are in the planning phases of a 60-mile bicycle trail that would connect the City of Titusville to the City of Edgewater with 22 miles of the alignment through the Refuge.
Regional	*East Coast Regional Rail Trail*	Florida DOT is in the planning phases of a 45-mile multi-use trail along will serve as a final leg of the state wide Coast-to-Coast bike trail terminating in the City of Titusville. Ground breaking occurred in October of 2013 in Titusville.
State	*Coast-to-Coast Trail*	A Florida State sponsored project to close the gaps in a 275-mile trail connecting Florida's western coast in St. Petersburg to its eastern coast in Titusville and the Refuge/Seashore. The East Coast Regional Rail Trail and part of the Titusville to Edgewater Trail are proposed trails to closed identified gaps in the Coast-to-Coast Trail.

CURRENT BICYCLING ACTIVITY ON THE REFUGE

Bicycling is permitted on the Refuge with restrictions on location and times. KSC restricts bicycles on the main roads (State Route 402 and State Route 3, see Figure 3) Monday through Friday during commuting hours; 06:00AM-09:00AM and 03:00PM – 06:00PM. Signs communicating the restricted hours are located at each entrance (see Figure 1). KSC police officers will escort bicyclists off of the main roads with imposed restrictions if seen bicycling during restricted times but do not frequently ticket bicyclists.

Figure 1 – Kennedy Space Center Bicycling Restriction Sign

The Refuge allows bicycles on all roads they maintain that are open to the public. There are not specifically bicycle designated trails but roads that only permit 'non-motorized' vehicles. The Refuge reports frequent inquiries about places to bike on or around the Refuge.

Bicyclists are frequently observed on the Refuge, primarily on the weekends. An official bicycle count was not conducted as part of this RSA. The Seashore park rangers anecdotally reports having 200 bicyclists enter the southern district of the Seashore on an annual basis. (Bicyclists entering the southern district of the Seashore must first pass through the Refuge.) At the time of this RSA there were no bicycle rental shops located within the City of Titusville.

[1] The City of Titusville is the gateway community for the Refuge

Figure 2 – Bicycling on Refuge Examples
(Image on the left is on State Route 406 and image on the right is on State Route 402 near the Refuge's Visitor Information Center)

SITE LOCATIONS

The scope of this study is limited to the Refuge's defined primary public use zone[2]; a region of the Refuge where visitor resources are concentrated. The RSA focused on four specific areas of the Refuge: 1) main roads, 2) proposed bicycle trails, 3) the Visitor Information Center campus, and 4) Black Point Wildlife Drive. Each area is described in this section.

DESCRIPTION OF SITE LOCATIONS

MAIN ROADS

Three main roads provide the primary access to and around the Refuge as shown in Figure 3. These roads are also used by visitors to the Seashore and employees of KSC. The 25 miles of main roads are paved, two lane highways with 12 foot wide lanes and no shoulder; refer to Table 2 for more roadway characteristics. The speed limit ranges from 35 mph to 55 mph. KSC maintains State Route 402 and State Route 3 while the Refuge maintains State Route 406. KSC and the State are in discussions to have the State take over maintenance of these roads, but the timeline and management implications for this transfer are still undetermined.

State Route 402 and State Route 3 are used by KSC commuters and experience their peak volume during weekday morning and afternoon commute times. Saturdays are also a peak day for State Route 402 due to visitors to the Seashore. A concentrated but smaller user group is the commercial fishermen who typically use the Refuge roads at dawn and mid-afternoon daily as they come and go for the day. Refer to Figures 4 through 6 for an image of each roadway.

Table 2 - Main Roads Characteristics

Road (Owner)	Posted Speed	Mileage	Road (Travel Lane) Width	Pavement Marking Width	Surface
SR 402 (KSC)	55 mph	6 miles	24 (12) feet	4inches	Asphalt
SR 3 (KSC)	55 mph	15 miles	24 (12) feet	6 inches	Asphalt
SR 406 (Refuge)	35 / 55 mph	4 miles	24 (12) feet	4 inches	Asphalt

[2] U.S. Fish and Wildlife Service, *Merritt Island National Wildlife Refuge Visitor Services Plan*. 2008. Figure 7.2 Public Use Zones, VSP-67.

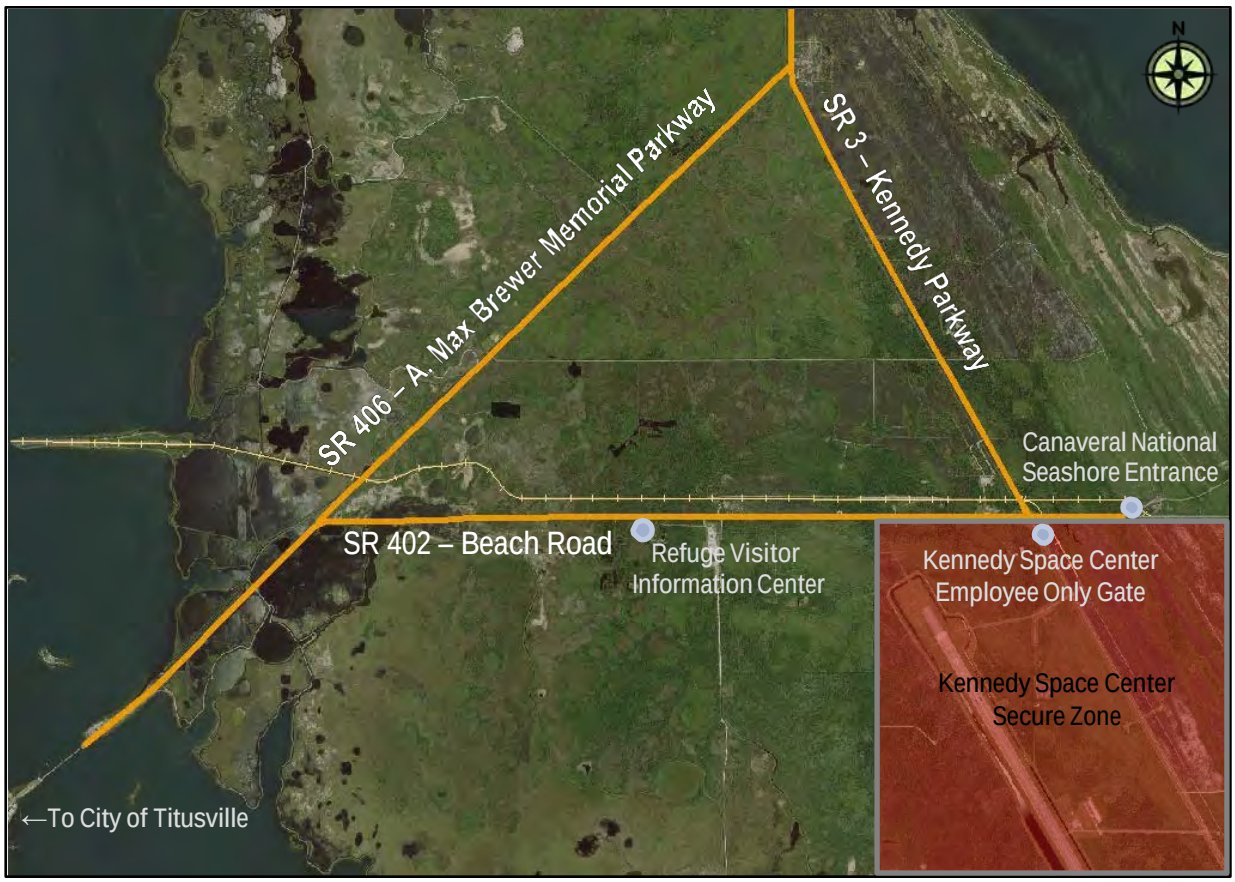


Figure 3 – Refuge Main Roads Aerial Map

Figure 4 – State Route 402 Roadway

Figure 5 – State Route 3 Roadway

Figure 6 – State Route 406 Roadway

FUTURE BICYCLE TRAILS AND CROSSINGS

Proposed bicycle facilities include five roadway crossings, which are outlined in Table 3 and referenced in Figure 7. The trail highlighted in orange in Figure 7 shows a state sponsored bike trail (see section *Regional Bicycle Trails - Titusville to Edgewater Trail*) and the trail highlighted in green are existing unpaved refuge roads that the Refuge would like to develop into a designated bike trail. The Visitor Information Center campus would serve as an origin and destination point for cyclists. Recommendations proposed by the team will take into consideration the future potential increase of bicycling on the Refuge due to the development of bicycle trails.

Table 3 – Bicycle Roadway Crossings Included in the Road Safety Audit

SR 406	SR 3	SR 402
1. At entrance from Titusville 2. At Visitor Information Center	3. At signalized intersection of SR 3 & SR 402	4. At power line right of way 5. At railroad tracks

Figure 7 – Proposed Bicycle Trail and Crossing Map

VISITOR INFORMATION CENTER CAMPUS

The Refuge's Visitor Information Center (VIC), located along State Route 402, could become a hub for bicycling activities. The complex is set back about a quarter mile from the main road via a two lane, paved, curved road; refer to Table 4 for more roadway characteristics. Within the complex, there are several parking lots including an employee lot, a visitor lot, and an overflow gravel lot separated by curb areas as shown in Figure 8. In 2013, the average daily visitation to the VIC was 266 visits per day. The RSA will evaluate the current infrastructure at the VIC and provide recommendations to better accommodate bicycles and pedestrians, which may serve as preliminary planning ideas for the new visitor center planned for 2018.

Table 4 - VIC Entrance Road Characteristics

Posted speed	Mileage	Width	Surface	VIC Visits
n/a	0.28 miles	24 ft (two lanes) 14 ft (one lane)	Asphalt	Average Daily Visits: 266

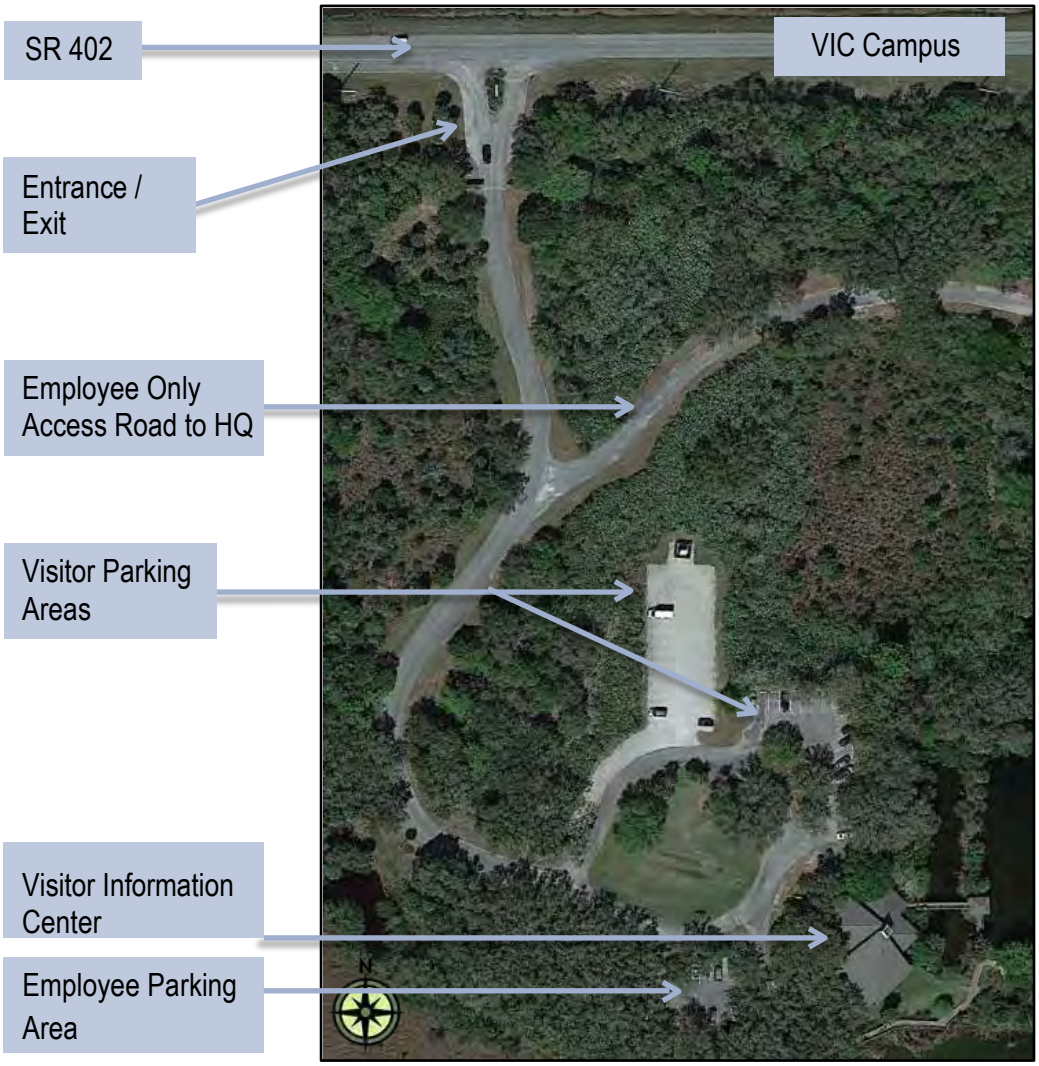


Figure 8 - Visitor Information Center Complex Aerial Diagram

BLACK POINT WILDLIFE DRIVE

Black Point Wildlife Drive (Black Point) is the Refuge's main auto-touring route (Figure 9) attracting visitors to its renowned birding and as such, the Refuge has maintained the road and provided various amenities including numbered pull offs and public restrooms. The drive is seven miles long with traffic flow restricted to one-way and a posted maximum speed limit of 15 mph; refer to Table 5 for more roadway characteristics. During the 2013 January peak season, the drive saw an average of 213 vehicles per day. Bicycles are currently permitted to use Black Point Wildlife Drive; however the Refuge staff expressed concerns over bicycle-vehicle conflicts due to distracted driving and wildlife viewing. Walking is not commonly observed on the drive.

Table 5 - Black Point Wildlife Drive Characteristics

Posted speed	Volume	Mileage	Width	Surface
15 mph	Annual Sum: 50,900 veh Daily Average: 140 veh	6.3 miles	14 ft	Gravel

Figure 9 - Black Point Wildlife Drive Aerial Diagram

CRASH HISTORY

Several attempts were made to obtain crash reports (or data) for the road areas included in the RSA. In discussions with Refuge law enforcement officials, it was identified that KSC generally responds to incidents 'on the pavement,' or State Routes 402, 406, and 3. Refuge law enforcement responds to incidents off the pavement, the Refuge owned roads. During the field review, discussion with KSC law enforcement officials indicated the Florida Highway Patrol (FHP) would also be called in for incidents on the main roads (State Routes 402, 406, and 3) that resulted in fatalities.

What agencies kept records of the crash reports proved difficult to find. Prior to the field review, the RSA team contacted the FHP, KSC, and the Florida Department of Transportation Department of Highway Safety and Motor Vehicles (FDOT DHSMV)[3].

Although there is not an extensive history of crashes in the public use areas of the Refuge, law enforcement officials and Refuge staff observe numerous 'near-hits' and potential risks due to driver behavior and roadway conditions. Driver behaviors, as witnessed by the RSA team and noted by law enforcement officials, include speeding, inattentive driving, stopping in the travel lane, and vehicles pulled off to the side of the road with a limited shoulder. Refuge and KSC law enforcement officials cite that a majority of crashes involve a single vehicle and are either due to encounters with wildlife or inattentive driving and also involve high speeds. KSC officers report weekly wildlife related incidents and while not noted as a top crash contributing factor, having a couple DUI arrests per month. Table 6 shows common types of incidents.

Table 6 - Common Types of Incidents

Type of Incident	Cause	Common Road Users
Run off the road	Inattentive and distracted driving	Visitors, tourists
Wildlife vs. vehicle	Due to hog, deer, alligator crossings/encounters	KSC employees
Roll-overs	Speed related	KSC employees

The FHP and FDOT DHSMV returned three incident reports to the RSA team. There were two incidents in 2007 and one 2009 as described in Table 7. The FDOT DHSMV website indicates crash data from 2012-present is still being processed. However, given the few returned for the 2007-2011 timeframe, this area may only be experiencing 1-2 incidents a year.

Table 7 - Crash Data

Year	Road	Location	Number of Vehicles	Fatalities	Cause & Description
2007	SR 402	Two miles west of intersection with SR 3:	2 vehicles	None	Head on collision with run off road: First driver 'drove left of center,' resulting in a chain reaction of swerving, then head on collision with a second driver, and then a third driver going off the road.
2007	SR 402	At intersection of SR 402	2 vehicles	None	Side Collision; Vehicle travelling north on SR 3 attempted to turn west onto SR 402 at the signal. Driver disregarded the traffic signal and turned into a vehicle traveling south on SR 3
2009	SR 402	East of intersection with SR 406	1 vehicle	None	Careless driving: Driver fell asleep and ran off the road.

[3] FDOT DHSMV's website states it has statutory responsibility for statewide crash data collection and dissemination.

Speeding is a frequent behavior of road users on the Refuge and the most common ticketing offense. Both Refuge and KSC law enforcement officials write tickets on the Refuge, however KSC patrols the main roads on a daily basis (primarily during commuting times) while the Refuge law enforcement officials patrols the main roads intermittently and enforces regulations on other Refuge roads and waterways. A KSC police officer patrols the public use area of the Refuge during KSC employee commuting times and comments on writing six to seven speeding tickets daily. Table 8 shows the number of speeding and illegal passing maneuvers ticketed by a Refuge law enforcement officer in 2013 (the table does not account for number of tickets written by KSC law enforcement officials).

Table 8 - Offenses Ticketed by Refuge Law Enforcement in 2013

	SR 402	SR 406	SR 3
Speed Citations	29	11	7
Passing on Double Yellow Line	4	-	3

Since 2007, KSC police officers are contracted employees and do not have state jurisdiction, they therefore do not have the authority to write state citations. The sole repercussion KSC employees receive from tickets issued by KSC Protective Services are internal violations or fines that go on their personnel record. Citations issued by Refuge law enforcement officials have a minimal fine and no points added to a personal driving record. This poses limited repercussions and incentives for KSC employees and frequent Refuge visitors, such as commercial fishermen, to drive within the speeding and passing regulations.

Both the KSC and Refuge law enforcement officials have expressed concerns regarding bicyclists on the main roadways due to the lack of shoulder and high speeds. KSC police officers will escort bicycles off of Refuge if bicycling during restricted times.

Requests were made to KSC staff, however no additional data or reports were returned at the writing of this report. On-site discussions with KSC law enforcement officials indicated more data or crash reports might still be with the KSC reporting system.

ROAD SAFETY AUDIT TEAM MEMBERS AND PARTICIPANTS

TEAM MEMBERS AND OTHER PARTICIPANTS

The RSA team members include representatives from the Federal Highway Administration (FHWA) and the Paul S. Sarbanes Transit in Parks Technical Assistance Center (TRIPTAC). Other participants include representatives from the Merritt Island National Wildlife Refuge (MINWR), Kennedy Space Center, the National Park Service (NPS), and Metro Consulting Group. See Table 9 for a complete list.

Table 9 - Road Safety Audit Team Members and Participants

Road Safety Audit Team Members		
Name	Title	Organization
Elissa Goughnour	Transportation Engineer	TRIPTAC (Vanasse Hangen Brustlin, Inc.)
Norah Ocel, P.E.	Highway Safety Engineer	FHWA – Eastern Federal Lands
Isbel Ramos-Reyes	Highway Safety Engineer	FHWA – Eastern Federal Lands
Laurie Miskimins	Transportation Planner	FHWA – Central Federal Lands
Natalie Villwock-Witte, Ph.D., P.E.	Research Engineer	TRIPTAC (Western Transportation Institute)
Elisa Kropat, M.C.E., E.I.T.	Public Lands Transportation Scholar	TRIPTAC (Merritt Island National Wildlife Refuge)
Other Road Safety Audit Participants		
Layne Hamilton	Project Leader	MINWR
Jane Whaley	Supervisory Law Enforcement Officer	MINWR
Candice Stevenson	Refuge Operations Specialist	MINWR
Sandy K Mickey	Supervisory Park Ranger	MINWR
Robert Schmidt	Special Agent, Criminal Investigations	KSC Protective Services
A.P. Collins	Police Officer, Traffic Division	KSC Protective Services
Joseph Fay	Police Officer, Traffic Division	KSC Protective Services
Myrna Palfrey-Perez	Superintendent	NPS Canaveral National Seashore
Shawn Harris	Facility Manager	NPS Canaveral National Seashore
Art Thompson	Traffic Planner	Metro Consulting Group

POTENTIAL PARTNERS NOT IN ATTENDANCE

Due to the complex nature of road/land ownership and maintenance on the Refuge, it is important to maintain communication with regional partners, and work together to improve safety. The following organizations should be considered when conducting future RSA's or safety related efforts:

- Space Coast Transportation Planning Organization
- City of Titusville – Planning Department
- Kennedy Space Center – Master Planning Department

ASSESSMENT FINDINGS

This section outlines positive roadway features, site-wide roadway concerns and countermeasures, and specific concerns and countermeasures for individual areas. Details of the recommended countermeasures and reasons behind concerns for all of the assess areas are outlined in the *Site Wide* section while specific identified concerns and countermeasures are listed for each road, crossings, or visitor use area separately.

POSITIVE FEATURES

The RSA team identified the following positive features in regards to safety and minimizing conflicts and incidents on the Refuge.

1. An adequate clear zone along main roadways; promotes visibility
2. Reflective pavement markers (RPM's) on main roadways; promote visibility of travel ways for drivers especially during poor visibility conditions
3. Pavement is in good condition
4. Wide, 6" pavement markings and RPM's on State Route 3; promotes visibility of travel lanes
5. Pull-off numbering system on Black Point Wildlife Drive; helps with directional guidance
6. Proactive in safety measures for non-motorized users; (i.e. conducting the RSA, development of separate right-of-way bike trail, enforcement and repercussions for speeding and other violations)
7. Has a working cooperative relationship with local federal and regional partners and neighboring jurisdictions

DETAILED ISSUES AND COUNTERMEASURE SUMMARY

SITE WIDE

This section outlines observed roadway concerns and related countermeasures across the study site-wide. Individual concerns for each road are outlined in following sections.

Safety Concerns

1. A lack of recovery area

Throughout the study area the RSA team noted the lack of a recovery area referring to the lack of shoulders, edge of pavement drop off, and steep roadside grades (Figures 10 -12). With the prevalence of inattentive driving and wildlife crossings, there is a risk of drivers swerving or over-correcting which may cause them to run off the road. Non-motorized users often use roadway edge for bicycling. When shoulders or separate facilities are not present, cyclists may choose to travel in the travel lane. Drivers may attempt to pass cyclists resulting in vehicles traveling in the opposing traffic's lane, or cyclists riding off

the road. Additionally, roads without shoulders and tapered pavement edges may experience grated deterioration and destabilization over time.

Figure 10 - Lack of Shoulders along Roadways Example

Figure 11 - Edge of Pavement Drop-Off Example

Figure 12 – Steep Roadside Grades Example

2. Inconsistent and non-compliant signage

Signage on the Refuge is inconsistent and is non-compliant with MUTCD[4] standards. There are numerous examples of signs with reduced or minimal retro-reflectivity and general degradation (Figure 13) and sign heights that are above or below the appropriate height (Figure 14). Sign clutter is prevalent at the two entrances to the Refuge where signs are spaced closed together with inconsistent format and a significant amount of information is presented on a single sign.

Figure 13 - Non-Compliant, Degraded Signs Examples

[4] MUTCD – Manual on Uniform Traffic Control Devices

Figure 14 – Non-Compliant Sign Height Examples

3. High vehicle speeds and significant speed differential among road users

Post speed limits are at 55mph with a few pockets of 45 mph and 35 mph and according to law enforcement officials, speeding is prevalent on the Refuge. Due to the variety of road users, there is also a significant speed differential posing several potential risks including the risk for fatal injuries if a crash were to occur involving a cyclists or pedestrian and passing on a two-lane highway at designated and undesignated locations. The through- users, such as KSC employees and Seashore visitors, travel at speeds greater than tourists and Refuge visitors who are either unfamiliar with the roads or are sight-seeing, looking for wildlife along the roadside.

4. Wildlife related incidents

Refuge and KSC law enforcement officials cite wildlife vs. vehicle incidents as a common cause of accidents. The width of maintained mowing alongside the roadways aids in spotting wildlife, however, inattentive driving and nighttime conditions (lack of lighting and nocturnal animals) may lead to wildlife related incidents. (Currently, there is not crash data to verify a trend in nighttime crashes.) A wildlife crossing sign is located along State Route 402 near Refuge entrance. Common nocturnal wildlife includes bobcats, deer, and hogs.

5. Weather and environmental conditions causing poor visibility

Although poor visibility due to weather is not reported as a common cause of incidents, it may also lead to issues. Fog, sun-glare, and heavy rainstorms are commonly occurring

weather conditions that lead to impaired visibility on the Refuge. Early morning fog is experienced by drivers during morning commuting times (Figures 15 & 16). The main road to the Refuge from the City of Titusville is an east-west directional road resulting in sun-glare issues during morning and afternoon commuting times. Major thunderstorms are common during the summer months and heavy rains result in poor visibility.

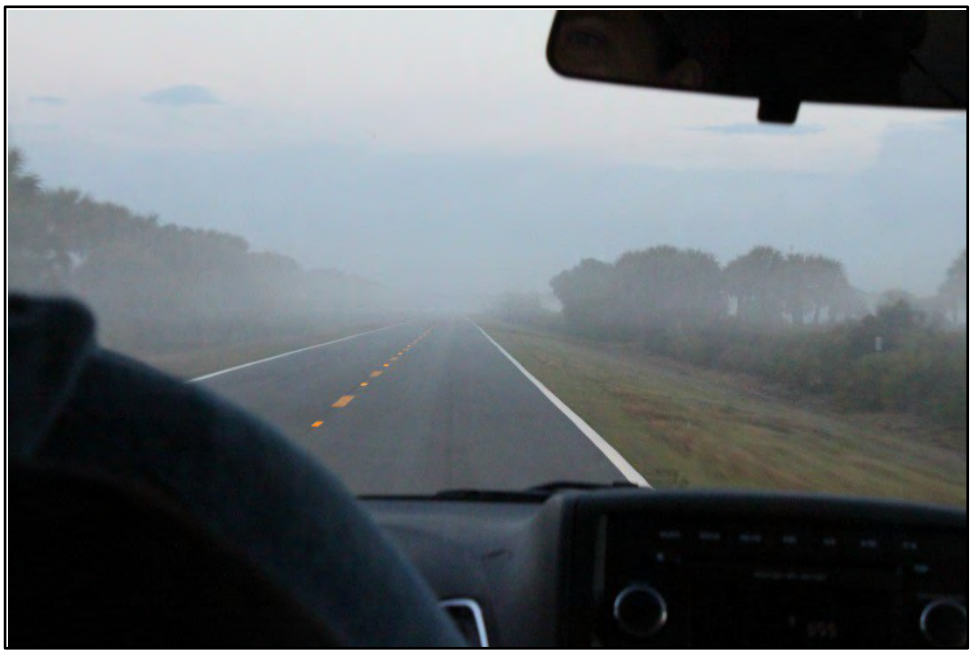


Figure 15 - State Route 3 Early Morning Fog Example

Figure 16 – State Route 402 Early morning Fog Example

6. **Inattentive driving**

   Refuge and KSC law enforcement officials cite inattentive driving as a common cause of incidents. Visitors may pay more attention to wildlife than the roadway and other vehicles. KSC employees who are familiar with the smooth surface and straight alignment of the roads may contribute to driver's lack of attentiveness. In addition, the use of hand held devices both by drivers who are familiar and comfortable with the roadway along with visitors who may be using them for navigation, may distract drivers away from the roadway.

7. **Lack of ability for visitors to communicate their location when in need of assistance**

   The expansiveness of the Refuge and lack of road name signs may reduce the ability of visitors and those unfamiliar with the area to accurately communicate their location to emergency dispatchers/law enforcement when in need of assistance. Refuge road signage is inconsistent and frequently non-existent. Storms can roll in quickly and unexpectedly leaving visitors unprepared for such events and new visitors may not be cognizant of the Refuge's size. Participants in the kick-off meeting and law enforcement officials reported this a common issue for cyclists who may misjudge distances and be unprepared for minor incidents such as a flat tire.

8. **Need for updated law enforcement citation and crash reporting methods and availability or ability to access crash data**

   Refuge and KSC law enforcement officers currently use paper reporting methods for traffic stops and incident reports. Afterwards, the information is manually inputted into an electronic database and reporting system. This process can result in data loss. From RSA team efforts to locate or access crash data, an identified concern is the availability and ability to access crash data in order to understand crash trends on Refuge roads. (See section *Crash History* for more information on the efforts to obtain crash data.)

9. **Ensuring maintenance of roadside vegetation for visibility purposes**

   In order to promote visibility along the roadways and provide places for law enforcement officers to perform traffic stops or visitors to pull-off the road, the vegetation along the roads should be constantly and adequately maintained.

Countermeasures

1. Addition of shoulders to main roadways

The addition of four-foot shoulders would mitigate concerns by:

- providing an area for cyclists to ride outside of the travel lane,
- creating a recovery or buffer area for motorists to avoid conflicts in the travel lane without driving off the roadway,
- and reduce the need for maintenance by providing a buffer area for edge of roadway cracking to occur before entering the travel way.

2. Addition of a Safety Edge$_{SM}$ to main roadways

Abrupt road edges can make it difficult for vehicles to return to the paved surface. A common practice is to lay the pavement with a 30° Safety Edge$_{SM}$ to assist vehicles in returning to the road surface. See Figure 17 for an example.

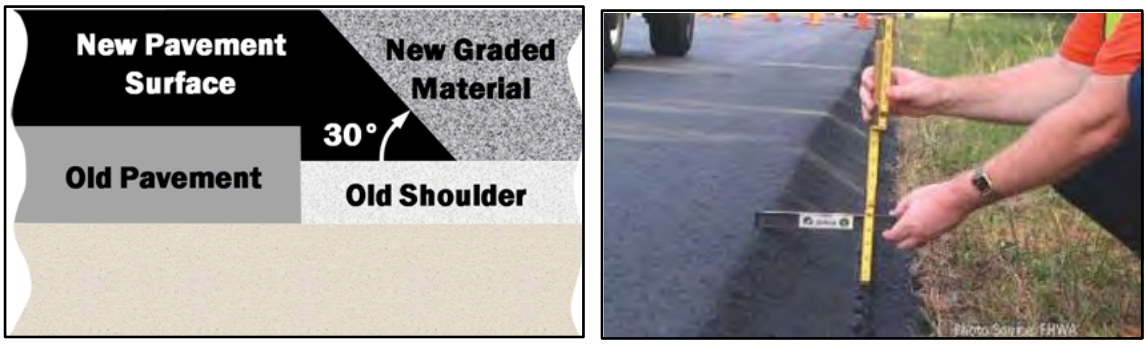


Figure 17 – Diagram of Safety Edge$_{SM}$
(Source: http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_010.htm)

3. Signage, pavement marking, and way-finding plan

To help with visibility, speeding, and guidance the following countermeasures are suggested.

3A. Provide way-finding signs by installing combined state route number and local road name signs on main roads and local road name signs to key visitor use areas.

3B. Install mile markers along the main roadways to help the motorists communicate their location and general way-finding.

3C. Upgrade pavement markings on main roadways to the current practice of 6" wide lane markings and install reflective pavement markers to help with visibility of the travel lanes, especially during nighttime and inclement weather conditions. Wider pavement markings may also serve to calm traffic by visually reducing the roadway width to drivers.

3C. Conduct a sign inventory to 1) identify signs that are non-compliant with MUTCD standards and 2) reduce sign clutter by prioritizing messaging and combining messaging on signs where it is appropriate and effective. A comprehensive signage plan can be used to identify signs that should be removed, upgraded/replaced, or modified to ensure MUTCD compliance and effective messaging.

4. Collaborate with KSC Protective Services on an employee education campaign

It is noted that KSC currently conducts an educational campaign to remind drivers of the KSC's regulations and repercussions for speeding and cell phone use however, consider expanding the campaign and including incentives relaying costs of vehicle damage. Having a project champion is key to an educational campaign's success.

5. Investigate potential for upgrading to electronic crash reporting methods

Using GPS devices or electronic methods to record incidents at the scene results in more accurate reporting locations for incidents and prevents data loss during the transfer of a written report to an electronic database. Consistent and accurate crash reporting methods helps pinpoint safety concerns and conflicts to better determine measures to mitigate and prevent future incidents.

In order for crash data to be more accessible and available for crash analysis and development of countermeasures, establish an Interagency Agreement (IAA) or Memorandum of Agreement/Understanding (MOA/MOU) with KSC and other neighboring jurisdictions to better facilitate the transfer of crash data.

6. Ensure vegetation is maintained through mowing operations to provide continual visibility for drivers

Maintained and mowed roadsides promote visibility for drivers, provides space for drivers to pull-of the road if circumstances dictate, and allows police officers to safely patrol speed.

Prioritization of Identified Issues by RSA Team

The RSA team rated each site-wide issue in terms of its frequency (how often the issue occurs on the roads) and its severity (degree of damage or injury due to an incident induced by the issue). Table 10 shows the rating system method and categorization of the site wide issues. Table 11 summarizes the results by listing each issue's resulting score in descending order.

Table 10 - Identified Issues Prioritization Table

FREQUENCY RATING	SEVERITY RATING			
	Minor *(1)*	***Moderate*** *(2)*	***Serious*** *(3)*	***Fatal*** *(4)*
Frequent *(4)*	**Moderate-High** Inconsistent Signage	**High** Update law enforcement citation and crash reporting methods	**Highest** Lack of recovery area; Inattentive driving	**Highest** High vehicle speeds; significant speed differential among road users
Occasional *(3)*	**Moderate** Wildlife incidents; weather/ environmental related conditions	**Moderate-High** -	**High** -	**Highest** -
Infrequent *(2)*	**Low** Ability to communicate for help when needed	**Moderate** Maintenance of roadside vegetation for visibility	**Moderate-High** -	**High** -
Rare *(1)*	**Lowest** -	**Low** -	**Moderate** -	**High** -

Table 11 – Summary Prioritized List of Identified Issues and Risk Rating Score

Prioritized List of Identified Issues	Risk Rating Score	Risk Rating Category
High vehicle speeds and significant speed differential among road users	16	*Highest*
Lack of recovery area	12	*Highest*
Inattentive driving	12	*Highest*
Update law enforcement citation and crash reporting methods	8	*High*
Inconsistent signage	4	*Moderate-High*
Maintenance of roadside vegetation for visibility	4	*Moderate*
Wildlife incidents	3	*Moderate*
Weather/environmental related conditions	3	*Moderate*
Ability to communicate for help when needed	2	*Low*

Minimum score: 1 / Maximum score: 16

The 'high vehicle speeds and significant speed differential among road users' issue is placed in the *fatal* severity rating category and in the *frequent* frequency rating category achieving the maximum risk rating of sixteen (fatal [4] x frequent [4]). The ability to communicate for help when needed received the lowest risk rating of one. Four out of the nine site-wide issues received a risk rating in the *high* or *highest* category. The road owners may use this scoring method to assist in decision making and implementation of suggested countermeasures.

MAIN ROADS – STATE ROUTE 402, 406, 3

This section describes each main roadway and outlines the identified concerns and countermeasures. Many concerns and countermeasures are applicable to site-wide identified concerns and more than one main road. Therefore, not every identified concerns or countermeasure is fully described if it was explained previously. Guidance is given on where explanations can be found within the report.

State Route 402

State Route 402, also known as Beach Road, is a six-mile road providing access through the Refuge, to a KSC employee only entrance gate and the Seashore. The Refuge VIC and headquarters buildings are located along State Route 402. The posted speed limit is 55 mph except for a 45 mph zone in the vicinity of the VIC. Since State Route 402 is a primary route for KSC employees to commute to the space center, NASA retains ownership of this road and is responsible for maintenance. This road is subject to KSC imposed bicycling restrictions as described in section *Current Bicycling Activity on the Refuge.* See Figures 18 and 19 for photographs of State Route 402.

Figure 18 – Intersection of State Route 406 and State Route 402 During Daytime

Figure 19 - State Route 402 at Dawn

Table 12 outlines the identified concerns and related countermeasures for State Route 402. Upgrading pavement markings, adding shoulders, and adding a Safety Edge$_{SM}$ may improve conditions of the road. Instituting traffic calming measures may alleviate the speeding issues and may reduce conflicts between the various road users.

Table 12 - State Route 402 Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Degraded pavement markings	Consider upgrading pavement markings to 6" width (See *Site Wide Countermeasures #3C* on *Pavement Markings*)
ii.	Prevalence and ability for run-off the road related incidents	Consider adding shoulders and Safety Edge$_{SM}$ (See *Site Wide Countermeasures# 2* on *Addition of Safety Edge*)
iii.	High speeds	Consider instituting traffic calming measures (See *Future Bicycle Crossings – #2 Crossing SR 402 at VIC)*

State Route 406

State Route 406, also known as A. Max Brewer Memorial Parkway, is a four-mile road that is owned and maintained by the Refuge. This road is primarily used by Refuge visitors to access its popular auto-touring route, Black Point Wildlife Drive, and commercial fishermen to reach the northern part of the Refuge. Traffic volume on State Route 406 is lower than State Route 3 and State Route 402 and the posted speed limit is 35 mph near the intersection with State Route 402 and increases to 45mph for the majority of the road. See Figures 20 and 21 for photographs of State Route 406.

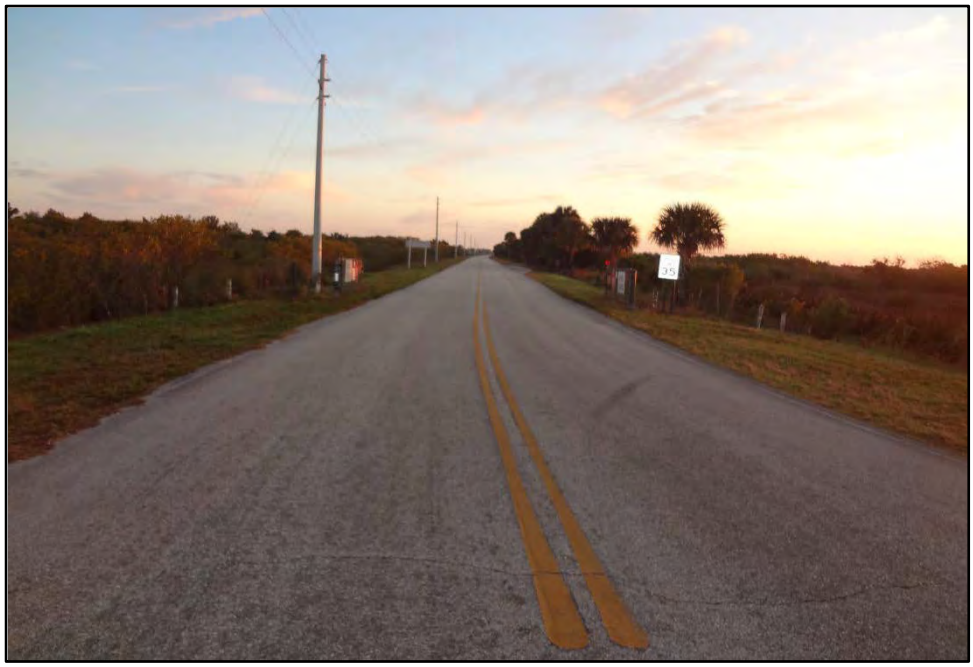


Figure 20 - State Route 406 in Late Afternoon

Figure 21 - State Route 406 at Night

Table 13 outlines the identified concerns and related countermeasures. Upgrading pavement markings and adding shoulders and a Safety Edge$_{SM}$ may improve conditions of the roadway. A primary concern for this roadway is the skewed intersection with State Route 3 shown in Figure 22. The large radius of this intersection can lead to higher speed turns. The combination of drivers that may not come to a stop and limited sight distance in opposing traffic directions may lead to crashes. Figure 23 shows a mock-up drawing of using pavement markings to create a perpendicular intersection, which would reduce the speed at which drivers are able to make the turn comfortably.

Table 13 - State Route 406 Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Degraded pavement markings	Consider upgrading pavement markings to 6" width (See *Site Wide Countermeasures #3C* on *Pavement Markings*)
ii.	Prevalence and ability for run-off the road related incidents	Consider adding shoulders and Safety Edge$_{SM}$ (See *Site Wide Countermeasures# 2* on *Addition of Safety Edge*)
iii.	Skewed intersection with SR 3	Consider using pavement markings to create a more perpendicular intersection; see Figure 23

Figure 22 - State Route 406 and State Route 3 Skewed Intersection

Figure 23 - State Route 402 and State Route 3 Perpendicular Intersection Pavement Markings Mark-Up

State Route 3

State Route 3, also known as Kennedy Parkway, is a 15-mile road owned and maintained by KSC. This is the primary road in the northern section of the Refuge and is used by KSC employees to commute to the space center. This road was resurfaced in the summer of 2013, re-striped with 6" pavement lane markings, and equipped with reflective pavement delineators. While Refuge and KSC law enforcement officials note that they have observed a reduction in incidents due to improved pavement conditions, the improved conditions may have also lead to an increase in speeds. This road is subject to KSC imposed bicycling restrictions. See Figures 24 and 25 for photographs of the roadway.

Figure 24 - State Route 3 Roadway During Daytime

Figure 25 - State Route 3 Roadway at Dusk

Table 14 outlines the identified concerns and related countermeasures for State Route 3. Although the signalized intersection at State Route 3 and State Route 402 appears to be functioning with minimal conflicts, as observed by the RSA team, a signal may no longer be warranted due to the low volumes and single-directional traffic flow. The intersection appears to experience its highest volume during KSC commuting times. During the morning commute, traffic either makes right turns from State Route 402 to State Route 3 or southbound through

movements on State Route 3 and the reserve occurs during afternoon commutes with left turns from State Route 3 to State Route 402 and northbound through movements on State Route 3 (See Figure 26). A roundabout may be a more appropriate intersection given the demand. The existing intersection footprint may be sufficient for a roundabout and a roundabout would allow for the existing flow while reducing wait and idling times. The signal heads also appear to be outdated and would benefit from replacement with the addition of a bike and pedestrian signal to allow for cyclists riding to the Seashore.

High speeds and wildlife crossings are observed or reported conflicts on State Route 3. Due to the extensive length of State Route 3, blanket countermeasures for reducing wildlife crossings incidents or high speeds may not be effective. Analyzing crash data may reveal specific areas where countermeasures could be targeted.

Table 14 - State Route 3 Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Signalized intersection with SR 402	1) Consider reviewing signal warrant as other types of intersections maybe more effective 2) Consider other upgrades and improvements to allow for future bicycle path connections and crossings
ii.	Wildlife crossings	1) Analysis of wildlife related incidents, to determine common locations or times of day in order to implement targeted mitigation measures
iii.	High speeds	1) Analysis of citation reporting to determine problem locations and counter with targeted enforcement

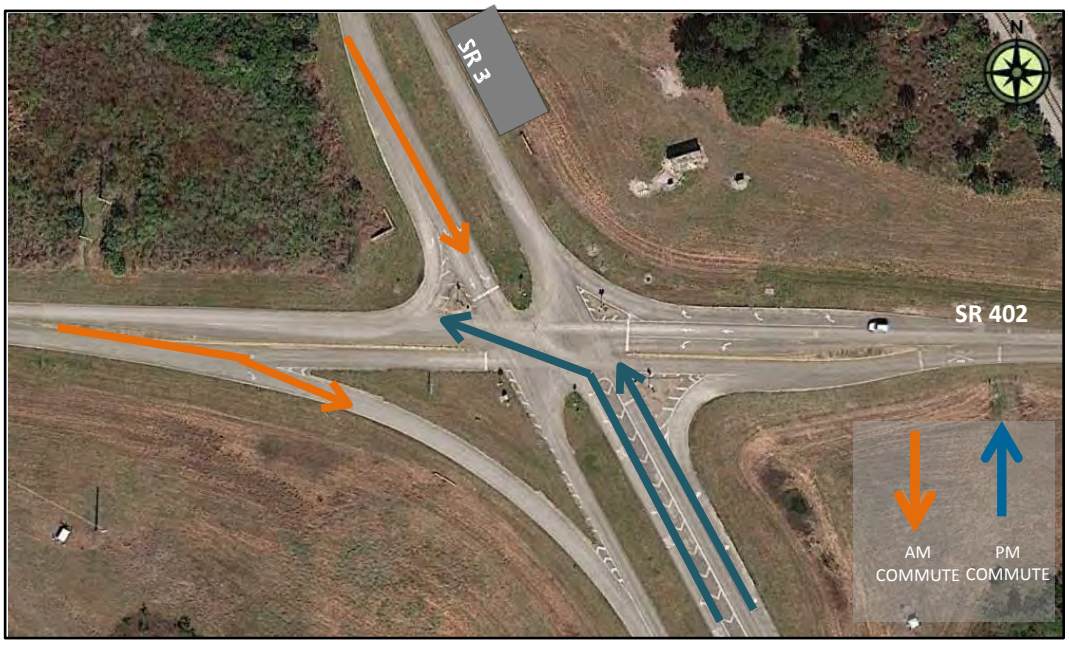


Figure 26 - Turning Movements at State Route 402 and State Route 3 Intersection during Commuting Periods

FUTURE BICYCLE TRAILS AND CROSSINGS

The RSA team reviewed the layout of the proposed bike trail and five potential roadway crossings, as shown in Figure 7, across the main highways for pedestrians and bicyclists. (See section *Site Locations – Future Bicycle Trails and Crossings* for background information on the bicycle trails.) The primary concerns for the proposed crossings are as follows:

1. **Ability to provide a law enforcement presence on the trail**

   Currently, the Refuge has two full time law enforcement officers who also must cover 6 other Refuges in the Merritt Island National Wildlife Refuge complex and at times, can be up to five hours away. The law enforcement officers expressed concern that they would be unable to properly patrol and monitor new bike trails to ensure proper use of the trails and safety for the trail users.

   Countermeasures:

   1A. Establish a Pathway Ambassador Program

   Establishing a volunteer based pathway or trail ambassador program[5] may provide additional support and a Refuge presence on the trail, which would promote safety and proper use of the trail. Pathway ambassador programs established on other federal lands have provided the following services: assisting visitors with directions, providing interpretation, offer information about proper use of the trail, report inappropriate behaviors to the Refuge staff, and also any minor first aid or bicycle repair.

   1B. May require additional law enforcement support

   With an expansion of visitor services at the Refuge, such as the construction of the trail, additional law enforcement staff may be needed to provide efficient and effective support on the Refuge for its visitors.

2. **Quality of experience for users**

   To effectively draw cyclists from the main roads to the proposed trail, amenities and quality experiences should be provided on the trail.

   Countermeasures:

   2A. Review visitor experience opportunities on potential path alignment

   Ensure the proposed trail alignment will provide a quality visitor experience such as attractive vistas and informative interpretation.

3. **Vehicle speed and yielding at trail crossings**

   Law enforcement officials indicated that high speeds and aggressive driving and passing maneuvers are common, particularly on State Route 402. These behaviors were also

[5] Grand Teton National Park has recently established a pathway ambassador program. Visit this link for more information: http://www.nps.gov/grte/parknews/pathway-ambassadors.htm.

witnessed by the RSA team. The current speeds along the main roadways are not compatible with a marked crosswalk. As shown in Figure 27, there is an 85% chance of pedestrian fatality if involved in a crash with a motor vehicle traveling at 40 mph. Both pedestrians and bicyclists lack the protection provided by motor vehicles. As such, speeds at potential crossing locations and driver behavior pose a significant risk to both pedestrians and cyclists.

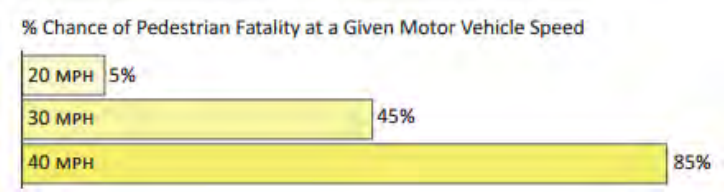


Figure 27 - Pedestrian Fatality Rate Based on Speed of Vehicle
(Source: UK DOT, 1987; http://safety.fhwa.dot.gov/local_rural/training/fhwasa010413/nonmotorize.pdf)

Countermeasures:

3A. Reduce speed at crossings

If the refuge would like to pursue marked trail crossings, measures to address speed should be implemented first. Table 15 from *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations* provides crosswalk marking guidance. Two lane roads with speeds less than 35 mph is a candidate site, however, at 40 mph the risk of crashes involving pedestrians and bicyclists increases and facility enhancements should be considered. The Federal Highway Administration's *Non-Motorized User Safety: A Manual for Local Rural Road Owners*[6] provides additional crossing measures.

Table 15 - Crosswalk Marking Guidance for Road Ways (9,000 vehicles per lane)
(Source: From Zepper et. al., 2005)

Roadway Type (Number of Travel Lanes and Median Type)	Speed Limit (MPH)		
	<30	35	40
2 Lanes	C	C	P
3 Lanes	C	C	P
Multilane (4 or More Lanes) With Raised Median	C	C	P
Multilane (4 or More Lanes) Without Raised Median	C	P	N

C = Candidate site for marked crosswalks.
P = Possible increase in pedestrian crash risk may occur if crosswalk markings are added without other pedestrian facility enhancements.
N = Marked crosswalks alone are insufficient, and pedestrian crash risk may increase when providing marked crosswalks alone. Consider using other treatments, such as traffic signals with pedestrian signals where warranted or other substantial crossing improvements to increase crossing safety.

Other treatments that can be used to enhance a crossing are described in Table 9 in Appendix A.

[6] A PDF version of the FWHA report on *Non-Motorized User Safety: A Manual for Local Rural Road Owners* can be found on their website: http://safety.fhwa.dot.gov/local_rural/training/fhwasa010413/

3B. Provide marked crosswalk or high visibility crosswalks

If crosswalks are warranted, the following countermeasures are recommended. Specific countermeasures for each crossing are addressed in the following sections.

i. Standard crosswalk pavement markings
ii. Warning signs placed at crosswalk and in advance of crosswalk
iii. Communicate safety measures to trail users
iv. Additional measures to include
    a. Pedestrian hybrid beacons
    b. Transverse rumble strips
    c. Speed pavement markings

See the section on 2. *Crossing State Route 402 at Visitor Information Center* for more guidance on speed reduction and marked crosswalk measures.

1. *Crossing State Route 406 at Refuge entrance from the City of Titusville*

The trailhead for the proposed Titusville to Edgewater Trail is located at the entrance to the Refuge and across from the combined Refuge and Seashore information kiosk and parking lot. This parking lot could serve as origin point for visitors to park their vehicle and ride on the trail. A marked crossing from the parking area to the trailhead would be beneficial to trail users.

Table 16 outlines identified concerns and related countermeasures. All three identified concerns are supportive of the others. Creating a more formal gateway may reduce speeds as visitors enter the Refuge and the gateway treatment may also include a median refuge island[7] to divide the wide crossing and create traffic calming.

Table 16 - Bicycle Crossing 1. Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Lack of trailhead and gateway	1) Evaluate current signage and consolidate signs 2) Consider establishing a gateway with landscaping to visually communicate to visitors that they are entering federal land, which may also serve as a traffic calming device
ii.	High speeds	1) Consider working with the City of Titusville to extend the lower speed limit through the location of the future crossing and up until the Refuge entrance. (see Figure 28) 2) Consider installing traffic calming measures such as: 1. the use of pavement makings to define and visually narrow the roadway, 2. a median refuge island which serves as a traffic calming measure but can also allow for a shorter roadway crossing distance for path users, and 3. a more substantial gateway treatment at the entrance to the Refuge that would give a sense of presence to the Refuge
iii.	Width of crossing	1) Consider using pavement markings to define and visually narrow the roadway 2) Consider installing a median refuge island, which jointly serves as a traffic calming device and a pedestrian/cyclists crossing measure. (see Figure 29)

Besides adding infrastructure to reduce speeds, consider working with the City of Titusville to create a lower speed zone in the area immediately preceding the Refuge entrance. Currently the speed limit over the Max Brewer Bridge is 30 mph, it transitions to 40 mph through the City's Parrish Park, and eventually increased to 45mph east of the bridge before Refuge property where the speed limit is 55mph (Figure28). Extending the lower speed limit through Parrish Park and into the Refuge may not only be beneficial for the high recreational activity that occurs as Parrish Park but also for the crossing and reducing speeds as visitors enter the Refuge.

[7] For more information on pedestrian refuge medians, visit: http://safety.fhwa.dot.gov/ped_bike/tools_solve/medians_trifold/

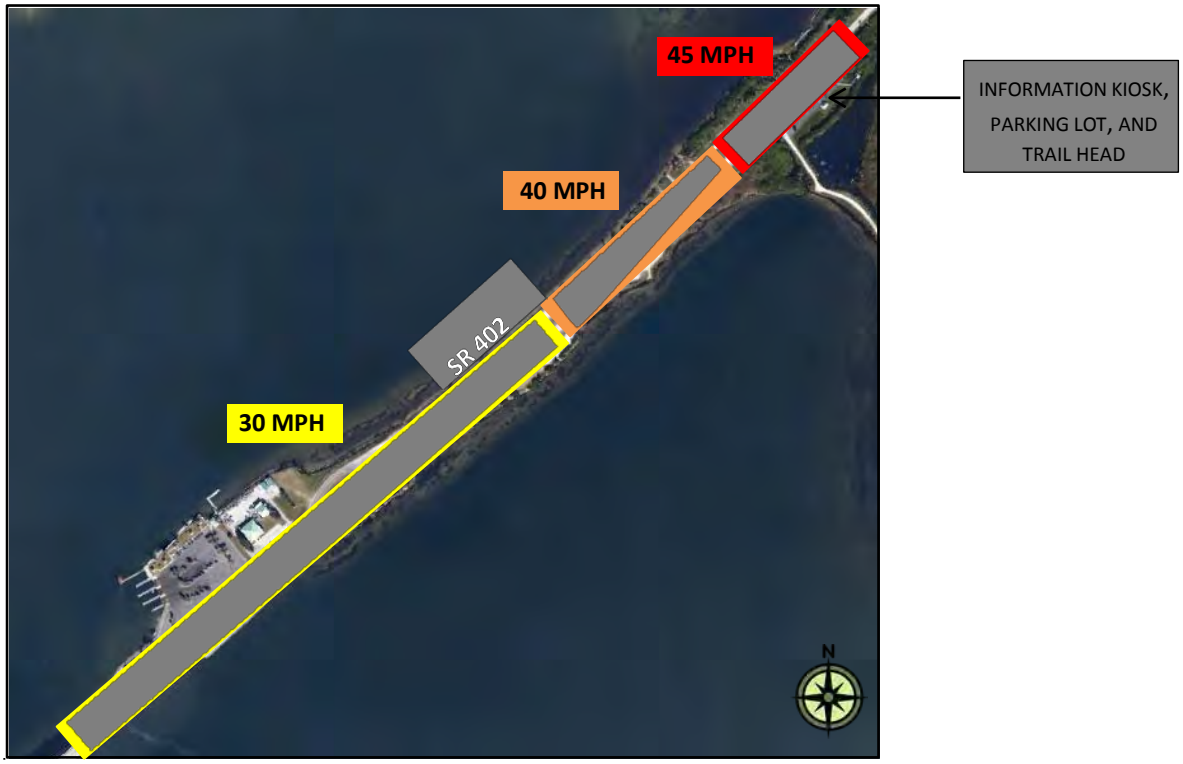


Figure 28 - Posted Speed Limit Zones Prior to Refuge Entrance

Figure 29 shows a mock-up of a median refuge island suggested under the third countermeasure. The island depicted in the center serves as a traffic calming device, a refuge for trail users crossing from the parking lot to the trail head, and can include signage and landscaping to provide a gateway. An alternative to the median refuge island is to consider installing a second parking lot on the same side of the trail head.

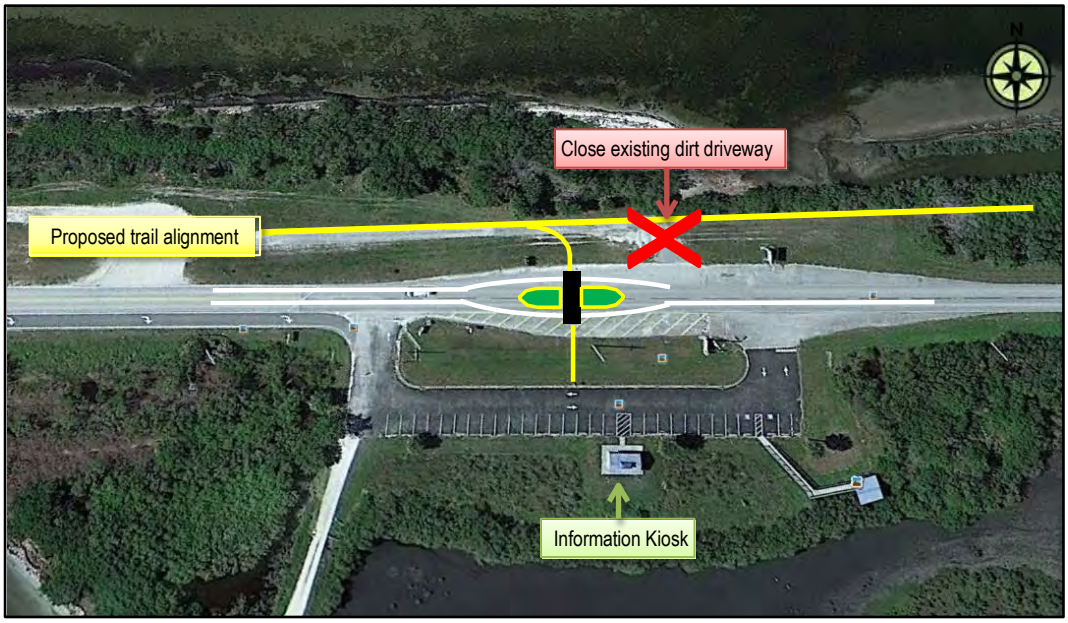


Figure 29 - Conceptual Drawing of Gateway Treatment and Refuge Median at Refuge Entrance

2. Crossing State Route 402 at Visitor Information Center

The VIC is a primary destination point for visitors and may serve as a hub for bicycle activity (an origin and destination for uses of future bicycle trails). Table 17 outlines the identified concerns and related countermeasures.

Table 17 - Bicycle Crossing 2. Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	High vehicle speeds	Consider implementing speed reductions measures to create a slower speed zone in the vicinity of the VIC
ii.	Vehicle yielding to pedestrians and cyclists in the crosswalk	Consider installing a marked crosswalk and evaluate compatibility of supplemental crosswalk measures such as warning signs and pedestrian hybrid beacons

The primary concern for cyclists and pedestrians at this location are vehicle speeds that are frequently above the posted speed limit of 45 mph, compounded by vehicle yielding. Appropriate and effective advanced warning and visibility of the crosswalk to drivers is needed. The RSA team recommends the following possible countermeasures.

1. **Install speed reduction measures**

   Some examples include:

   1A. Consider installing speed feedback signs (Figure 30) that may enforce driver compliance of current posted speed and create a slower speed zone. These signs are shown to be effective in targeted areas[8].

   1B. Relocate the east bound and west bound 55 mph speed limit sign that are currently near the VIC. Currently, these signs are highly visible to drivers while in the 45 mph zone and relocating these signs out of visible range, may prevent drivers from increasing their speed while inside the 45 mph speed zone and where a future crossing may be located.

   1B. Consider installing pavement speed limit marking at the east and west approaches to the VIC. These pavement markings are shown in Figure 31.

   1C. Use targeted enforcement methods in the area of the VIC. Law enforcement officials currently patrol the area, particularly during commuting hours. However, it may reinforce the message that speeds are a concern if KSC and Refuge law enforcement officials

Figure 30 – Speed Feedback Sign Example

Figure 31 - Pavement Speed Limit Marking Example
(Source:http://safety.fhwa.dot.gov/local_rural/training/fhwasa010413spmgmt/)

[8] For more information on speed management, visit: http://safety.fhwa.dot.gov/local_rural/training/fhwasa010413spmgmt/

can conduct targeted enforcement in the zone but during and outside of regular commuting hours.

2. **Conduct a formal speed study to determine if speed reduction measures are successful**

3. **Evaluate the compatibility of supplemental crosswalk measures**

Figure 32 - Example of a Pedestrian Hybrid Beacon
(Source:http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_012.htm)

An example of a supplemental crosswalk measure is a pedestrian hybrid beacon. Pedestrian hybrid beacons are additional warning measures beyond a standard marked crosswalk (Figure 32). These devices are pedestrian activated signals that are applicable to circumstances where vehicle speeds are too high for a safe pedestrian crossing. These devices may be effective in providing a safe crossing for bicyclists and pedestrians on the Refuge.

If a pedestrian hybrid beacon is considered, the crosswalk would need to be placed at least 100 feet from the current VIC entrance[9]. Figure 33 shows a conceptualization of a trail from the VIC, the crossing location over State Route 402, and the connection to proposed trails.

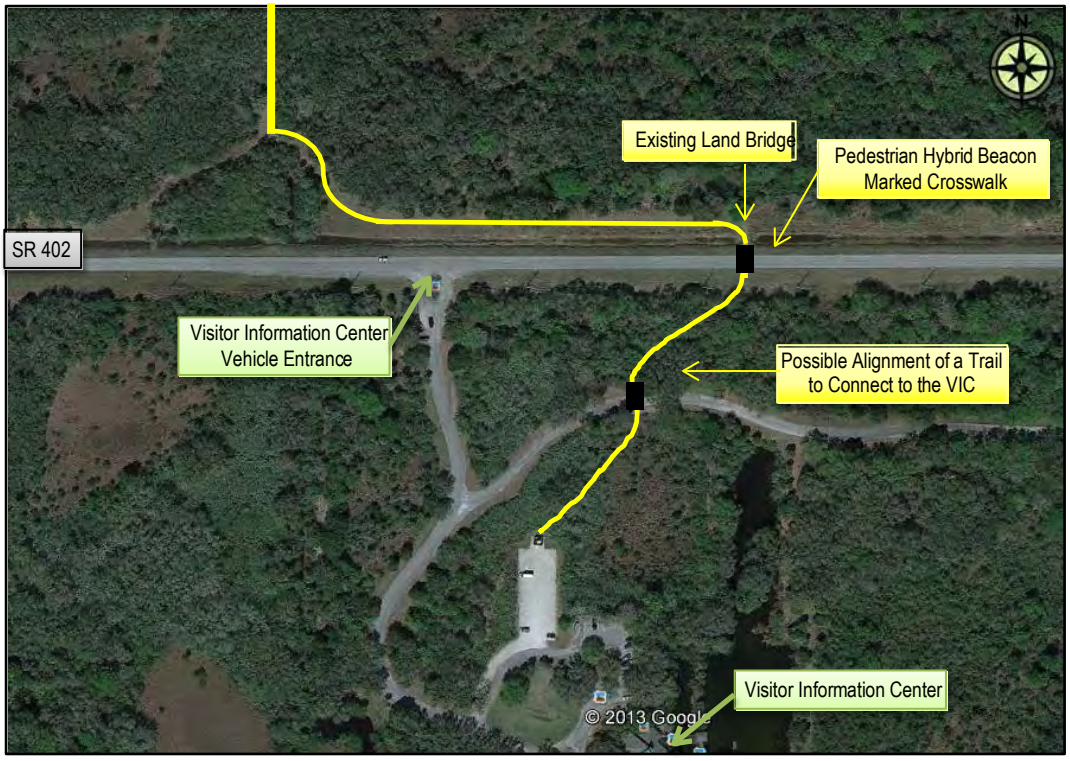


Figure 33 - Conceptual Alignment of a Trail Connecting the VIC to Proposed Trails

[9] Refer to Chapter 4F of the MUTCD on guidance on placement of a pedestrian hybrid beacon

3. Crossing at the State Route 3 and State Route 402 intersection

Providing for a bicycle and pedestrian crossing at the State Route 3 and State Route 402 signalized intersection creates a means for visitors to bike to the Seashore. Table 18 outlines the identified concerns and countermeasures for this intersection. The RSA team suggests that the connection between the trail and SR 402 be placed west of the intersection and provide a bike and pedestrian signal at the intersection to allow bicyclists to traverse the intersection with the traffic flow. This will promote visibility of the bicyclists and the expectation of bicycles crossing for drivers. An alternative would be to continue the propose rails with trails bike path along the railroad to where the railroad intersects with Beach Road east of the signalized intersection. See Figure 34 for a diagram.

Table 18 - Bicycle Crossing 3. Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Anticipation of bicyclist crossing by drivers	Align trail so that bicycles cross with the flow of traffic; have bicyclist meet up with SR 402 west of signalized intersection
ii.	Lack of infrastructure for a bicycle crossings / outdated signal	Consider installing a ped/bike signal and review signal warrant (See section *Main Roads- State Route 3* for further recommendations on this intersection.)

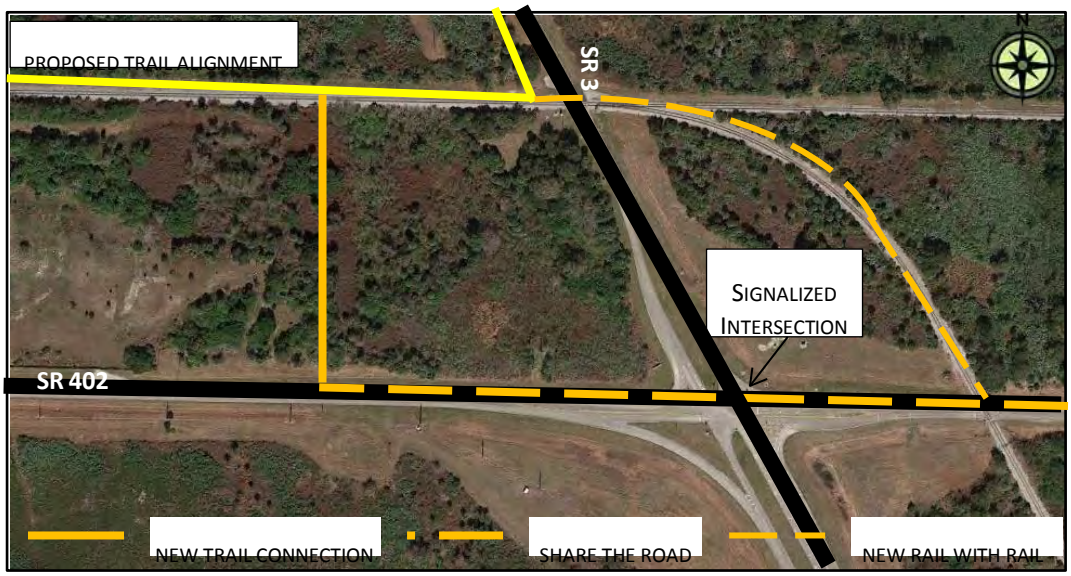


Figure 34 - Crossings at Signalized Intersection Mock Up

4. Crossing State Route 406 at the railroad tracks

The crossing over State Route 406 is part of the proposed alignment for the Titusville to Edgewater trail. State Route 406 experiences less volume than State Route 3 or State Route 402, has lower posted speeds, and less aggressive driving was not noted at this location. Therefore, speeding and vehicle yielding are not identified safety concerns for this crossing. See Figure 35 for a photograph of the crossing.

Figure 35 – Photograph of Crossing State Route 406 at railroad tracks

Table 19 outlines the identified concerns and related countermeasures at this bicycle trail crossing. The countermeasure suggests having the trail cross the railroad tracks to create the crossing on the north side of the tracks. This will promote visibility for drivers to see trail users crossings and also provide a better sight distance for the crossing trail users. See Figure 36 for a diagram.

Table 19 - Bicycle Crossing 4. Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Feasibility of crossing with existing infrastructure and need for a perpendicular crossing to the flow of traffic	Consider having bicyclists cross the tracks west of SR 406 and create crossing over SR 402 on the north side of the tracks

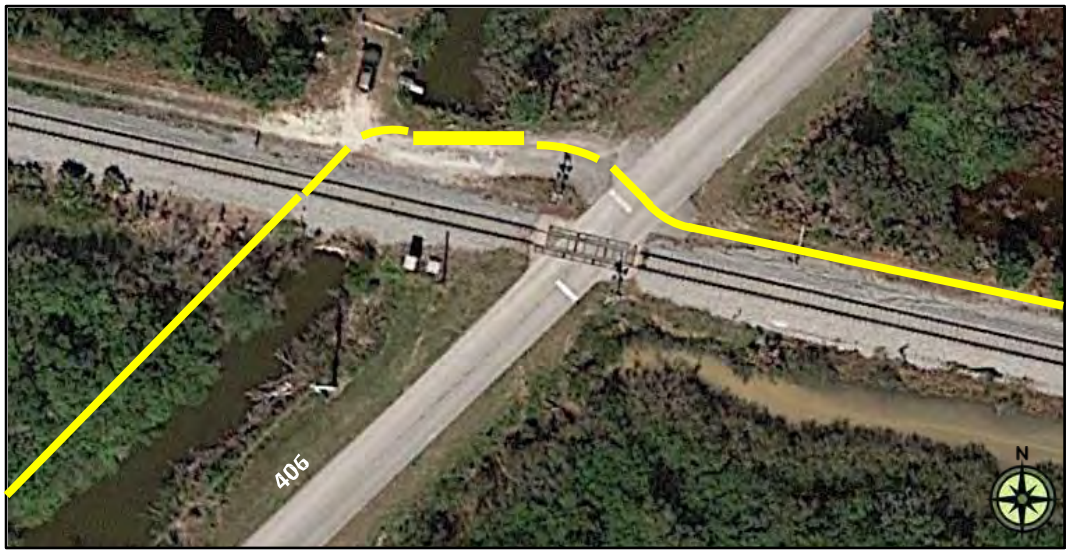


Figure 36 - Crossing over State Route 406 Alignment Mock-Up

5. Crossing State Route 406 at the power line right-of-way

There were several positive features noted regarding the proposed crossing of State Route 406. The crossing is placed away from the State Route 402 and State Route 3 intersection. In the event that a vehicle has to stop for crossing pedestrians or cyclists, there is room for a queue of vehicles to build between the intersection and the crossing. Also, high traffic volume, speeding, or inadequate sight distance were not observed concerns at this crossings. Figure 37 shows State Route 406 heading eastbound preceding the proposed crossing.

Figure 37 - Crossing State Route 406 at the Power Line Right of Way

Table 20 outlines the identified concerns and related countermeasures. The recommending countermeasure is further explained previously in this document; see section *Main Roads – State Route 406*.

Table 20 - Bicycle Crossing 5. Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Skewed intersection at SR 406 and SR 3	Consider using pavement markings to create a t-intersection (see section *Main Roads – State Route 406*)

VISITOR INFORMATION CENTER CAMPUS

With an increase in bicycling on and around the Refuge, the Refuge management foresees the VIC becoming a hub for bicycling and a base for an on-site concessionaire providing bicycle rentals. Recent congressionally appropriated funds have provided the means to replace the current VIC and the Refuge is undergoing fund-raising activities to redesign the VIC campus. The recommendations outlined in Table 21 may be useful in planning appropriately and effectively for accommodating bicycles at the VIC.

Table 21 - VIC Campus Safety Concerns and Countermeasures

	Safety Concerns	Countermeasures
i.	Sight distance at VIC exit	1) Trim vegetation in median at VIC entrance 2) Relocate stop bar
ii.	Considerations for future pedestrian and bicyclist accommodations	1) Consider space needs of a future bicycle vendor including parking 2) Consider separate trail paralleling entrance road for bicyclists 3) Ensure safety, regulatory, and wayfinding information is presented to bicyclists

The combination of vegetation and location of the stop bar at the VIC exit prevent the driver from adequately seeing traffic from the east bound direction as they are exiting. Figure 38 is taken from the drivers view point when stopped at the pavement stop bar. Current sight distance caused the driver to drive past the stop bar before making their turn. Trimming the vegetation and moving the stop bar towards State Route 402 will provide better sight distance.

Figure 38 – Driver's View from Location of Stop Bar at VIC Exit

The countermeasures outlined under the second safety concern are items to consider with an increase in bicycling. Currently, parking at the VIC accommodates visits to the VIC but not long term parking for visitors to use the VIC as a beginning point and visiting the refuge using alternative transportation means such as bicycling. If visitor behaviors change and visitors are encouraged to park at the VIC and then bike to parts of the Refuge, either with personal bicycles or through a bike rental, providing parking and space for a vendor's operations should be considered. Constructing a separate path, paralleling the VIC entrance road, would provide a safe means for bicyclists to travel between State Route 402 and the VIC reducing conflicts between bicyclists and vehicles. This countermeasure is appropriate if bicycling increases and especially if there is an increase in families bicycling.

BLACK POINT WILDLIFE DRIVE

The team did not observe any immediate or significant safety concerns or bicycle-vehicle conflicts on Black Point Wildlife Drive. To address bicycles riding the wrong way on the drive, a concern expressed by the Refuge staff, the RSA team suggests the following:

1) Place more effective signage at entrance to communicate to bicyclists to ride with traffic flow,

2) Conduct a law enforcement campaign during peak times to enforce rule.

CONCLUSIONS

The benefits of conducting a bicycle and pedestrian Road Safety Audit at Merritt Island National Wildlife Refuge was foreseen as useful for Refuge planning due to current bicycle-vehicle conflicts on the main roads and key visitor use areas as well as due to the development of numerous bicycle trails around and within the Refuge. The primary safety concern expressed by the Refuge staff and regional partners is the safety of bicyclists riding on the main roads with high vehicle speeds, frequently over the speed limit, and a limited to no shoulder. While incidents involving bicyclists and vehicles on the public use area of the Refuge have not been reported, law enforcement officials and other staff observed numerous 'near-hits'.

Visitation to and around the Refuge is primarily dependent upon a vehicle. The Refuge does not have a specific, designated bicycle trail but roads are available that have been closed to motor vehicles where cyclists could ride and experience the Refuge without conflicts with vehicles. However, there is no direct bicycle access to these roads.

During the audit, the RSA team noted numerous positive features including: continual maintenance of an adequate clear zone along the main roadways, the resurfaced and upgraded State Route 3 with 6" wide pavement markings and reflective pavement markers as well as the pavement condition of State Routes 402 and 406, the Refuge's cooperative relationship with regional partners and federal land neighbors, and lastly, their proactive approach in safety measures for non-motorized users such as the RSA, the development of a separate right-of-way bike trail (in the planning stages), and the enforcement of the speed limit and other violations.

Reviewing existing and potential conflicts for bicyclists and pedestrians as well as vehicles, the RSA team highlighted the following concerns as ones to prioritize:

i. High vehicle speeds and a significant speed differential among road users
ii. A lack of a recovery area along the main roads
iii. Inattentive driving of the road users either due to Refuge visitors viewing wildlife or the driving behaviors of the commuting KSC employees
iv. Outdated law enforcement citation and crash reporting methods

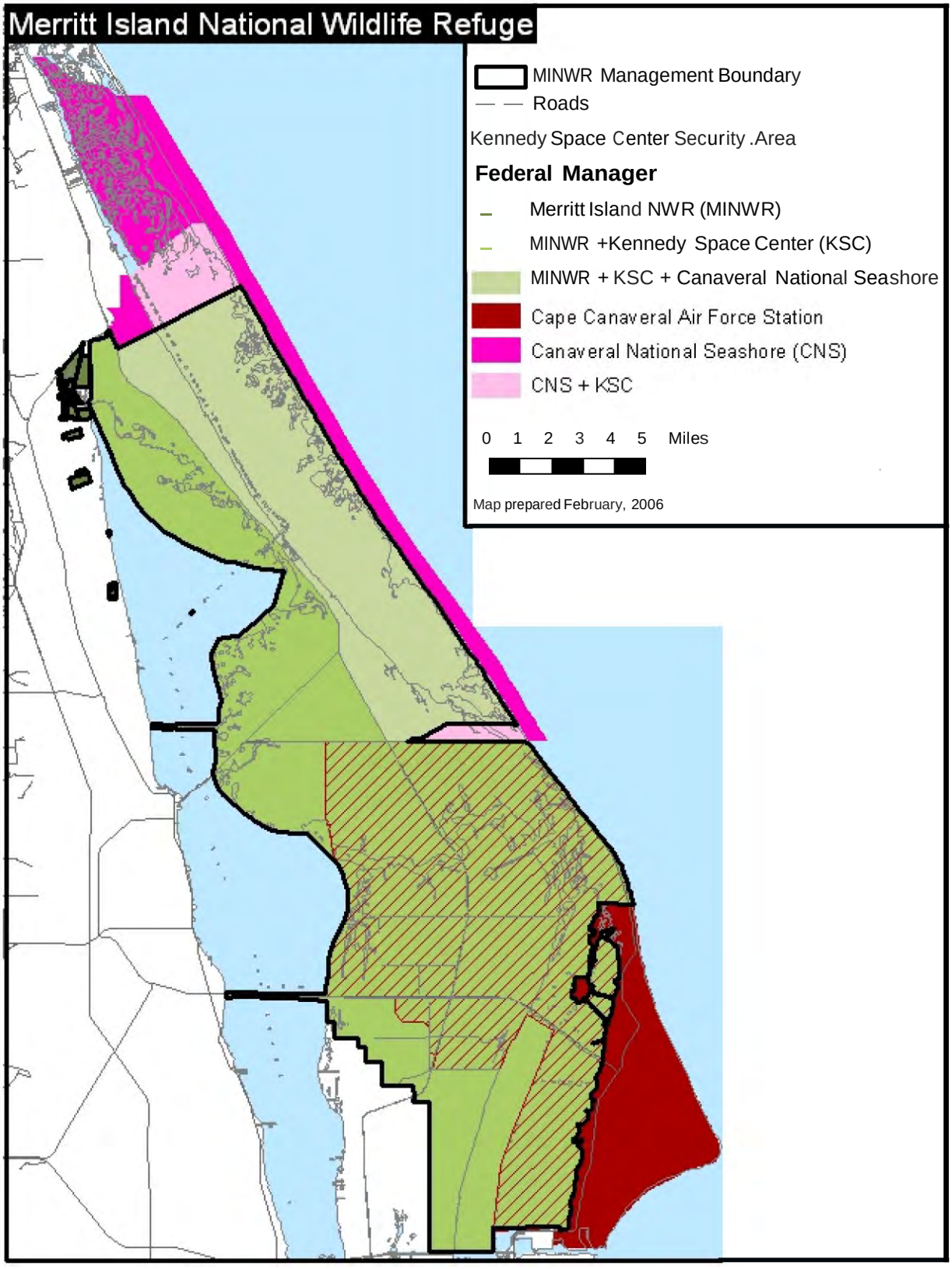
The risk rating, which takes into consideration an issue's frequency as well as its severity, for each of these concerns rated eight or higher where the maximum score achievable is sixteen. (Note the team identified five other priority issues that received a risk rating of four or less.) These four concerns would be areas for the Refuge and regional partners to focus on. The RSA team suggested the following countermeasures for these concerns: implementing speed reduction measures and traffic calming as well as targeted law enforcement for speeding, the addition of four foot shoulders and a Safety Edge$_{SM}$ to the main roadways, an expansion of KSC's educational campaign on safe driving habits, and electronic crash reporting methods including equipping law enforcement with GPS devices (to more accurately pin point the location of incidents) as well as agreements to better facilitate the sharing of crash data. While inattentive driving and wildlife related incidents are noted as commonly occurring problems on the Refuge roads, further analysis of crash data and incidents may reveal specific areas or times of day of where or when incidents occur and as a result, targeted countermeasures could be suggested.

Developing separate bike trails may alleviate the current bicycle-vehicle conflicts and instituting speed reduction measures may aid in reducing vehicle speeds and promoting safe crossings for trail users.

APPENDIX

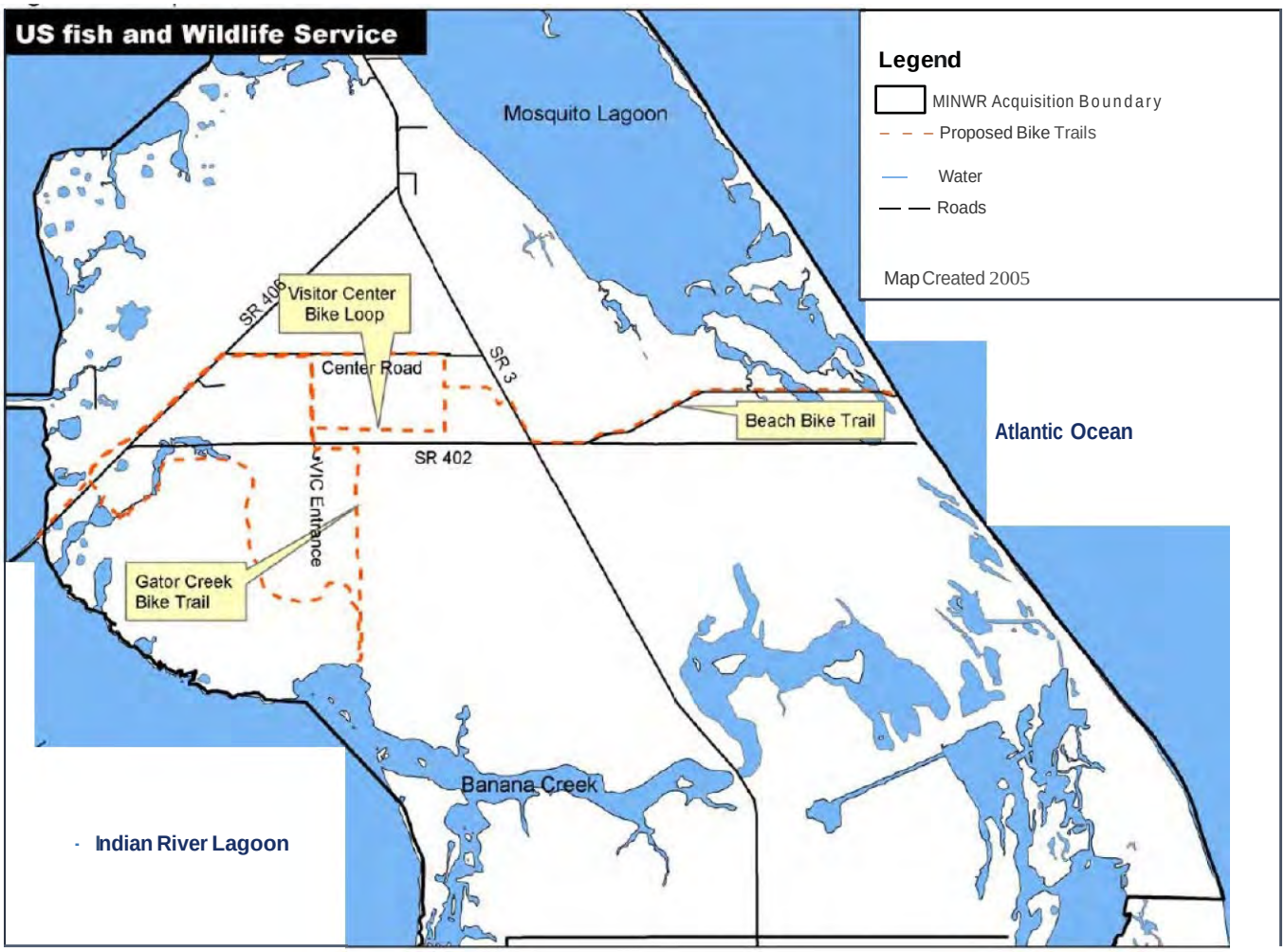
A. Merritt Island National Wildlife Refuge Management Boundary and Shared Management Boundaries

Source: U.S. Fish and Wildlife Service, Merritt Island Notional Wildlife Refuge Comprehensive Conservation Plan, 2008. Figure 3



B. Merritt Island National Wildlife Refuge Proposed Bike Trails

Source: U.S. Fish and Wildlife Service, Merritt Island National Wildlife Refuge Visitor Services Plan, 2008. Figure 7.1 (Page 64)



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