PROJECT NUMBER: 33867.00

6.1

ALTERNATIVE TRANSPORTATION STUDY

Sigma Trail Shared Use Path

BACK BAY NATIONAL WILDLIFE REFUGE • VIRGINIA BEACH, VIRGINIA

6.0 SIGMA TRAIL

In the first CIM, members of the public suggested a trail along Sandbridge Road as an alternative to the BBRT. For this study, its working name is the Sigma Trail (∑T), after the area where the trail would begin. Historical reference was not found, however, many sources refer to this area as Sigma. The ∑T would generally follow the alignment of Sandbridge Road as an off-road SUP facility from Lotus Drive to the Sandbridge Road crossing of the BBRT (see Figures 6.2.A – 6.2.H). The ∑T would connect to the existing FWS administrative offices and the future Visitor Contact Station, and would provide SUP facilities where none currently exist. The ∑T would provide access to BBNWR, FCSP, and Little Island Park, and eliminate the need for bicyclists and pedestrians to use the narrow lanes on Sandbridge Road.

Sandbridge Road

♦ Scoping/Planning

The study team considered alignments of the ∑T on the north and south sides of Sandbridge Road, taking into consideration factors including wetland impacts, existing land uses (including a cemetery), and connectivity.

From Lotus Drive to Colechester Road (2,600 LF±), the SUP would follow along the north side of Sandbridge Road. This section of the trail also includes a bridge (450 LF±) across Ashville Bridge Creek and associated wetlands. On the east side of the intersection of Sandbridge Road and Colechester Road, the trail would cross Sandbridge Road with a marked crosswalk. The crossing would include high visibility markings, crosswalk warning signs, and pedestrian level lighting.

From Colechester Road to the Sandbridge Road crossing of the BBRT, (9,800 LF±) the SUP would follow the south side of Sandbridge Road. This section of the trail includes segments of elevated timber pile boardwalk over wetlands (870 LF±). In addition, where the ∑T crosses Hell's Point Creek, a bridge would be provided, spanning 100' across the creek to maintain navigation by watercraft. The bridge would also provide an overlook area for stopping on the bridge for observation.

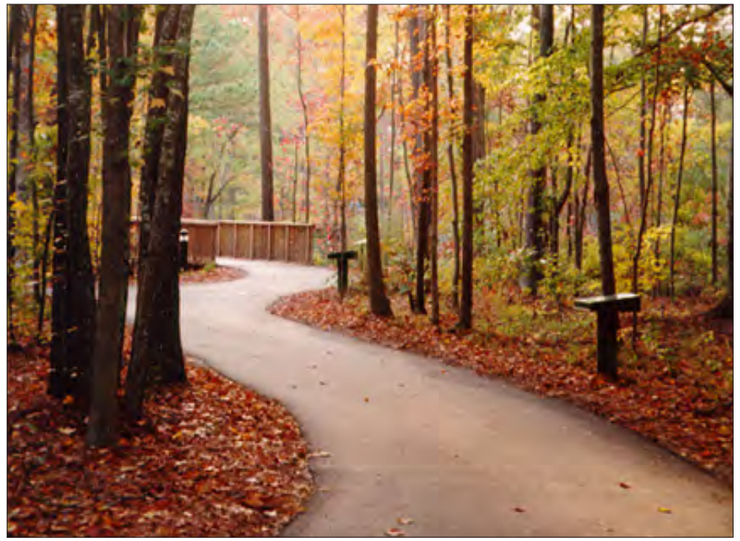
♦ Schematic Design

SUP Design Criteria

Early in the planning process, the study team developed a design criteria sheet for the ∑T, using the standards and guidance included in AASTHO, ADA, and the Recreation Access Advisory Committee.

Surfacing

Alternative surface options include unpaved paths (crushed stone, stabilized earth, etc.) and paved paths (asphalt and concrete). While unpaved paths represent the lowest trail construction cost alternative, these surfaces require wheeled users to use a greater effort to travel compared to paved surfaces and are more susceptible to erosion resulting from heavy runoff and/or flooding. Asphalt and concrete pavements provide a good all-weather quality surface for riders and help mitigate erosion concerns when compared to unpaved surfaces. Although concrete provides the longest service life, its initial construction cost is the highest, particularly when considering areas that are difficult to access. For these reasons this study assumes an asphalt surface which provides a smooth riding surface and is resistent to drainage and flooding impacts, all at a reasonable construction cost.



Asphalt Surface Trail

TABLE 6.1: SIGMA TRAIL DESIGN CRITERIA

DESIGN ELEMENT	PREFERRED	MIN/MAX
AASHTO GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES 2012 VDOT ROAD DESIGN MANUAL 2015		
SUP Width	10’	8’
SUP Bridge/Boardwalk	14’	14’
Minimum Shoulder Width (Graded)	3’	2’ (6:1)
Clear Zone		
Lateral Obstructions	3’	-
Lateral Obstructions (Smooth)	5’	-
@ Slope > (3:1)	5’[1]	-
Separation between Path and Roadway	10’	5’[2]
Minimum Radius		
Radius @ 18 mph	60’	-
Radius @ 12 mph (Minimum)[3]	27’	-
Cross Slope	1%	2%
Maximum Longitudinal Grade	5%	-
Vertical Clearance	10’	8’
OTHER DESIGN CRITERIA		
Design Vehicle	H5	
Elevation		
Nimmo Pkwy ROW	3.0’	
Sandbridge Rd	4.0’	

[1]If the distance is less than 5’ then engineering judgement should be used to determine necessity of physical barrier (fence).

[2]VDOT minimum is 3’. If the distance is less than 5’ then engineering judgement should be used to determine necessity of physical barrier (fence).

[3]Design speed lower than 18 mph may be appropriate where environmental or physical constraints exist.

Structures

The ∑T would include four timber pile boardwalks and two bridges where the path falls within low lying areas prone to elevated water levels, sensitive wetland features, and larger waterways in Ashville Bridge Creek and Hell’s Point Creek. At these various locations, the trail would transition from an at-grade trail onto either a boardwalk or bridge structure. The boardwalks would be fully timbered structures including railing, decking, stringers, with welded wire grid fence panels and steel pipes for the railings, as is now standard for similar structures throughout the City. The boardwalks would have pile supported bents repetitively spaced over the low lying and wetland areas. The bridge structures would be utilized to provide a clear span across the larger Ashville Bridge Creek and Hell’s Point Creek. These bridges would have a similar timber railing and decking, but would be supported by steel girders and concrete piers on concrete piles on each side of the creeks.

The trail structures would be designed in accordance with the 2009 AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges. The trail structures would provide a 14’ wide clear opening between railing posts. In addition to the required 90 psf pedestrian loading, the structures would also be designed to accommodate an H5 vehicle, which is roughly equivalent to a heavy duty pick-up truck.

Other Capital Needs

- Trailheads

As part of construction of the future BBNWR Visitor Contact Station on the southwest corner of the intersection of Sandbridge Road and New Bridge Road, a crossing of Sandbridge Road could be constructed to connect to the ∑T as well as to the 25/50 loops north to the BBRT. The Visitor Contact Station would be the primary trailhead for the ∑T, and would offer visitors a chance to park at this location and ride their bicycles to the Refuge. The Visitor Contact Station would provide restrooms, wayfinding, maps, and other support amenities, as would the existing Visitor Contact Station at the Refuge (which would continue to provide parking, wayfinding, and other amenities).

TABLE 6.2: SIGMA TRAIL COST ESTIMATE

ITEM		TOTAL COST
INFRASTRUCTURE		
Construction		
Site Preparation		$406,000
Earthwork		$133,000
Stormwater and Drainage		$17,600
Trail Construction (10,900 LF)		$434,300
Boardwalk (1,300 LF)		$1,590,000
Bridge (200 LF)		$727,000
Trailside Features		$297,000
Contingency (25%)		$901,300
Design (12%)		$540,800
TOTAL		$5,047,000
RIGHT-OF-WAY	AREA (ACRES)	TOTAL COST
Private: ROW	2.54	$303,400
Private: Construction Easement	1.48	$19,700
Federal: ROW	2.34	$29,900
Federal: Construction Easement	1.36	$2,000
OTHER		
Wetland Impact		2.33 Ac
Wetland Mitigation		$84,000
Permitting		$75,000
GRAND TOTAL		$5,561,000

- Wayfinding

The ∑T would include a comprehensive wayfinding and interpretive sign system. The wayfinding would guide trail users to BBNWR and FCSP, trailheads, and intermediate destinations. An important aspect of the wayfinding would be user-friendly mapping with trail distances to intermediate and final destinations.

Wayfinding Sign Example

- Stormwater

Where the SUP is asphalt on grade, drainage facilities would be incorporated into the system. With the trail in such a low-lying area, water needs to be captured or allowed to flow easily to minimize potential flood conditions. The preliminary design includes drainage features for stormwater management.

♦ Cost Estimate

The construction cost estimate for the ∑T is based on current local 2015 unit prices and actual costs for recent similar projects. Costs for the trail would generally entail clearing, grading, paving, timber pile boardwalk, bridge abutments and spans, pavement markings, signs, and stormwater management. This planning-level cost is intended for use in capital budgeting and funding; it includes a 25% contingency and does not include utility relocation costs.

♦ Benefit Analysis

As depicted in Table 6.3, the ∑T either mostly meets or completely meets most of the MOEs, and slightly meets one MOE. The scores represent averaged values from the TAC screening and final screening described in Chapters 3 and 4.

Visitor Mobility

- Reduce Traffic Congestion

By linking to the future Visitor Contact Station, the ∑T SUP would give the FWS a viable opportunity to encourage visitors to get out of their cars and use the trail to access the Refuge. This would represent a measurable change in the transportation options for visitors. Nevertheless, the reduction in vehicle trips into the Refuge and along Sandpiper Road will likely be modest. The study team estimates that 50-150 people will use the ∑T SUP daily, with 30-90 of these being refuge visitors. Along with other bicycle/pedestrian improvements described herein, this facility could contribute to a 10% change in mode split (people who would ordinarily drive to the refuge opting instead to use the ∑T). During peak season, an average 255 cars enter Back Bay Refuge daily, so the proposed facilities could reduce that number by 25 cars per day.

- Enhanced Visitor Mobility, Accessibility and Safety

The SUP would provide a high benefit to visitor mobility, by providing a direct off-road link along the narrow Sandbridge Road. Currently, no such facility exists, and existing infrastructure limits the number of people who visit BBNWR and FCSP by bicycle or on foot. The trail would also reduce the number of bicycles traveling on narrow, rural roads.

- Improve Visitor Education, Recreation and Health Benefits

The SUP would provide a high benefit to the visitor experience by offering an active transportation option and eliminating the stress of driving certain segments of the trip. The trail wayfinding could provide interpretive information about the Refuge during the trip. The system also expands the reach of the Refuge experience to users not currently able to access the park. The SUP would convey safety benefits, by providing an off-road option for bicyclists and pedestrians where none now exists along the narrow Sandbridge Road.

Environmental Benefits

- Protection of Sensitive Natural, Cultural and Historical Resources

The overall environmental benefits of the SUP would be positive. By visually extending the Refuge experience, and by providing access through and adjacent to sensitive wetlands, the SUP would rely on viewshed preservation, and would provide an active tool to support such preservation. The SUP would impact slightly more than two acres of wetlands, which would need to be mitigated, but it will have no other impacts to natural, cultural or historic resources as a part of the project.

- Reduced Pollution

The SUP will contribute to improving water quality by including stormwater treatment measures as part of the design and construction of the path. The trail would remove some vehicles from the road, reducing impacts of vehicle emissions and noise.

- Operational Efficiency and Financial Sustainability of Alternatives
  - Effectiveness in meeting BBNWR Goals

BBNWR goals are identified in the September 2010 Comprehensive Conservation Plan. By providing a sustainable and non-motorized means of access to the Refuge, the SUP would support BBNWR goals for habitat preservation, and would support goals for enhanced opportunities for wildlife viewing and appreciation of natural resources and conservation.

  - Financial Plan - Development and Operational Costs

Construction of the SUP would require substantial capital investment. The facility would rely on use of existing ROW to the extent possible, but would require some ROW acquisition. The ΣT SUP has been designed at schematic level to avoid and minimize wetland impacts. The operability of the trail would require maintenance in the form of clearing vegetation and obstructions, repaving, and bridge and boardwalk maintenance, as well as police patrol and enforcement activities.

The Rails-to-Trails Conservancy Northeast Regional Office has published a maintenance and operations guide that provides guidance and case study examples for a wide range of trail projects. It is a valuable resource for types, frequency, and cost of maintenance and operational activities. Based on examples cited, annual trail O&M costs will likely fall in the $7,000 to $9,000 per mile range; the ΣT would require an annual approximate cost of $22,000 to maintain.

  - Potential Funding Sources

Section 11.1 of this report identifies a range of potential sources that could be used to help fund the ΣT SUP. In particular, the Transportation Alternatives Program (TAP), Congestion Mitigation and Air Quality Improvement Program (CMAQ), and the Federal Lands Access Program (FLAP) offer high potential for funding this type of improvement.

TABLE 6.3: MEASURES OF EFFECTIVENESS - SIGMA TRAIL

MEASURES OF EFFECTIVENESS - SIGMA TRAIL	SCORE
VISITOR MOBILITY	
Reduce Traffic Congestion	0
Enhanced Visitor Mobility, Accessibility and Safety	3
Improve Visitor Education, Recreation and Health Benefits	3
ENVIRONMENTAL BENEFITS	
Protection of Sensitive Natural, Cultural and Historical Resources	2
Reduced Pollution	0
OPERATIONAL EFFICIENCY AND FINANCIAL SUSTAINABILITY OF ALTERNATIVES	
Effectiveness in meeting BBNWR Goals	3
Financial Plan - Development and Operational Costs	2
Potential Funding Sources	2
CONSTRUCTION/OPERABILITY	
Project Phasing and Sequence Limitations Project Phasing and Sequence Limitations	2
Limitations on Transportation Operation	3
SCORING SYSTEM: 0-DOES NOT MEET CRITERIA, 1=SLIGHTLY MEETS CRITERIA, 2=MOSTLY MEETS CRITERIA, 3=COMPLETELY MEETS CRITERIA	

- Constructability/Operability
  - Project Phasing and Sequence Limitations

    The project involves work in and around wetlands, and includes bridges, but the study team has designed the path to avoid and minimize impacts. Site access along Sandbridge Road will facilitate construction access.

  - Limitations on Transportation Operation

    The SUP involves minimal limitations on transportation operations. These primarily involve crossings of existing driveways and roadways. Final plans and construction sequencing will require measures to maintain vehicular access and minimize transportation impacts.

- Conclusion

The ∑T SUP represents a significant investment in the area's overall transportation system, and would convey substantial benefits in meeting the goals of this study, BBNWR, and the City in general. The SUP would provide an important link between developed areas and the destinations at BBNWR, FCSP, and Sandbridge. By connecting residential neighborhoods, commercial attractions, the resort area, and the Refuge and FCSP, the ∑T would offer a viable transportation alternative. As described, this would be achieved in an environmentally sustainable manner. Overall the facility would dramatically improve visitor mobility and experience.

TABLE 6.4: SIGMA TRAIL PROJECT SCHEDULE

PROJECT MILESTONES	PROJECT SCHEDULE SIGMA TRAIL (∑T) SUP															
	YEAR 1				YEAR 2				YEAR 3				YEAR 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Procure Funding																
Design Services																
Permitting																
ROW Acquisition																
Utility Relocation																
Construction																

Project Schedule Notes:
1. ROW is required from Federal Government and private property owners.

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6.2.A

ALTERNATIVE TRANSPORTATION STUDY

Sigma Trail Shared Use Path

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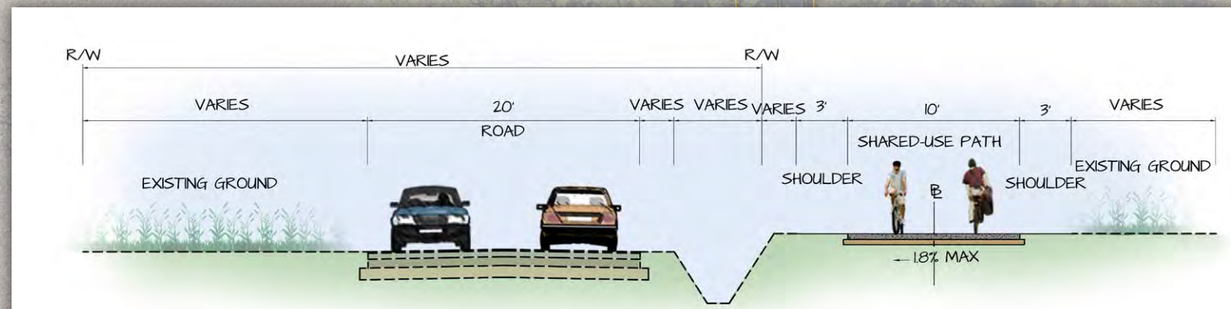
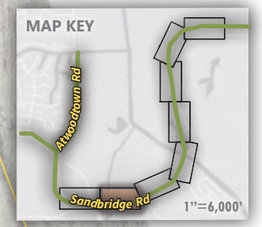


TYPICAL SECTION



WETLAND LEGEND

- Palustrine Emergent Wetlands
- Palustrine Forested Wetlands
- Palustrine Open Water
- Palustrine Scrub Wetlands
- Estuarine Open Water
- Maintained Ditch

Wayfinding

10' Asphalt Shared Use Path

3' Graded Shoulder

Proposed Right-of-Way

Construction Easement

14' Boardwalk

INSET

Banks Ln

Sandbridge Rd

Colechester Rd

TBD

Margaret L. Blanton

Jan Paul Kucharczk

James E. Brickhouse, Jr. & Marlane T. Brickhouse

Larry B. Sanders & Marny B.Sanders

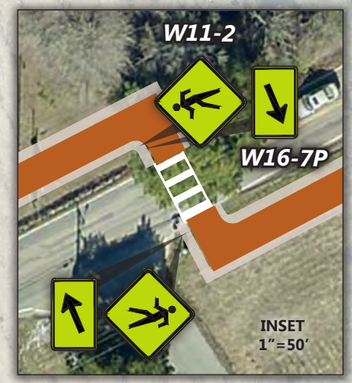
David L. Winfree & Teresa L. Winfree

The United States of America

Carol Adrian Smith & George Tony Smith

Susan S. Midgett & Daniel Wayne Gibbs

Charles Thomas Cayce & Leslie G. Cayce



Trail Crossing:

- High Visibility Crosswalk Markings
- Crosswalk Warning Signs
- Pedestrian Level Lighting

Posted Speed Limit: 35 MPH

SCALE IN FEET
0' 50' 100'

Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

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6.2.B

ALTERNATIVE TRANSPORTATION STUDY

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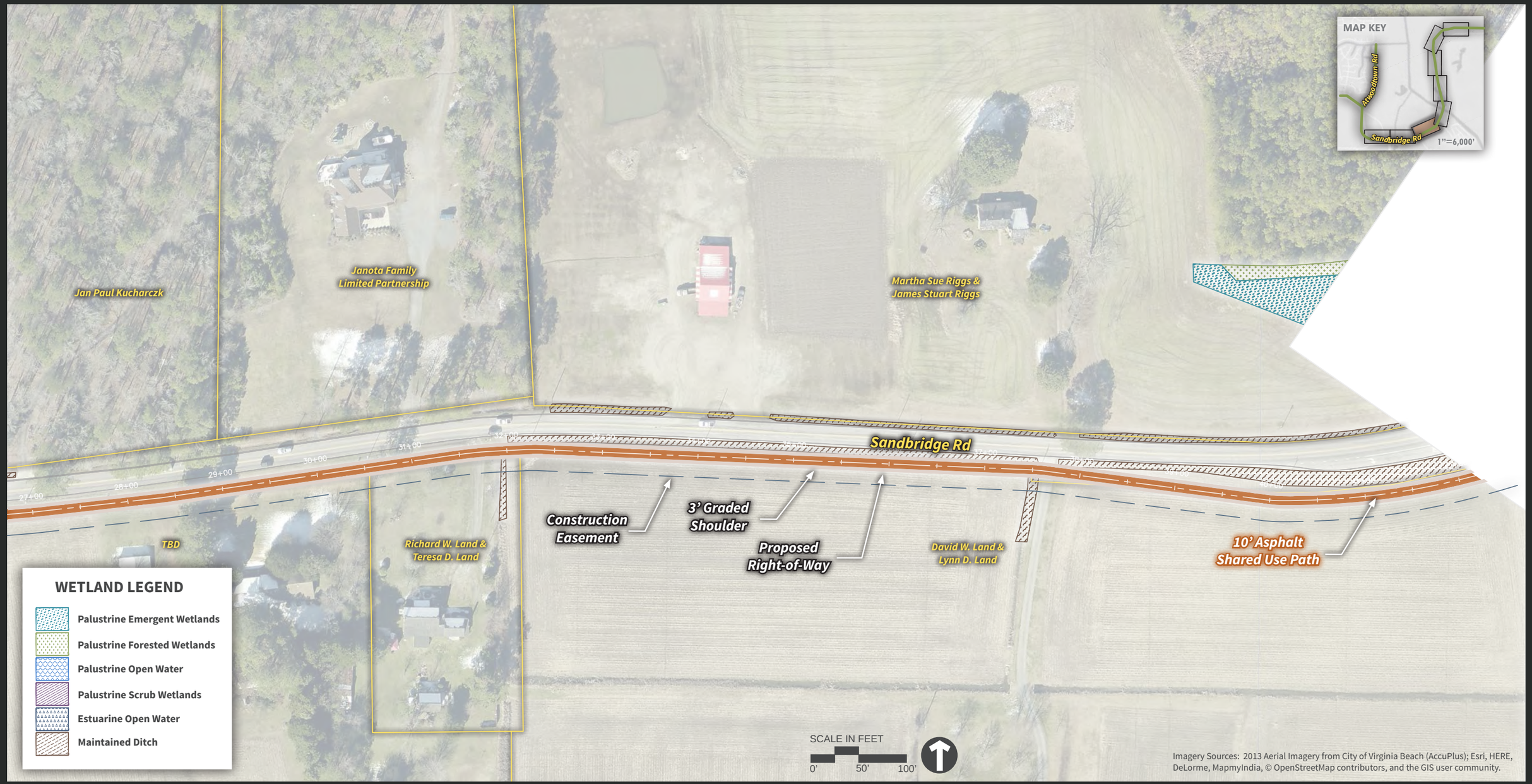

Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

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6.2.C

ALTERNATIVE TRANSPORTATION STUDY

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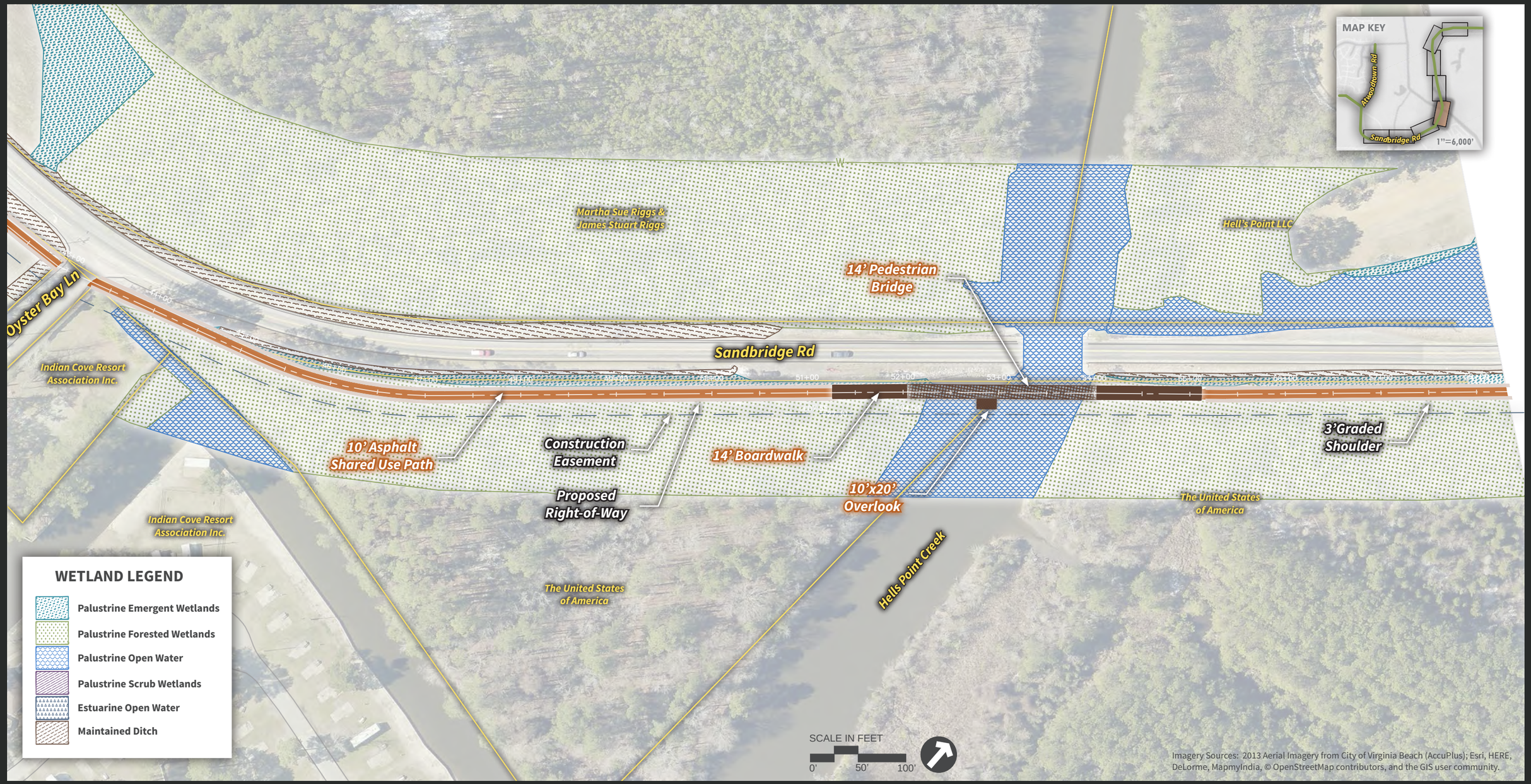

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6.2.D

ALTERNATIVE TRANSPORTATION STUDY

Sigma Trail Shared Use Path

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6.2.E

ALTERNATIVE TRANSPORTATION STUDY

Sigma Trail Shared Use Path

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6.2.F

ALTERNATIVE TRANSPORTATION STUDY

Sigma Trail Shared Use Path

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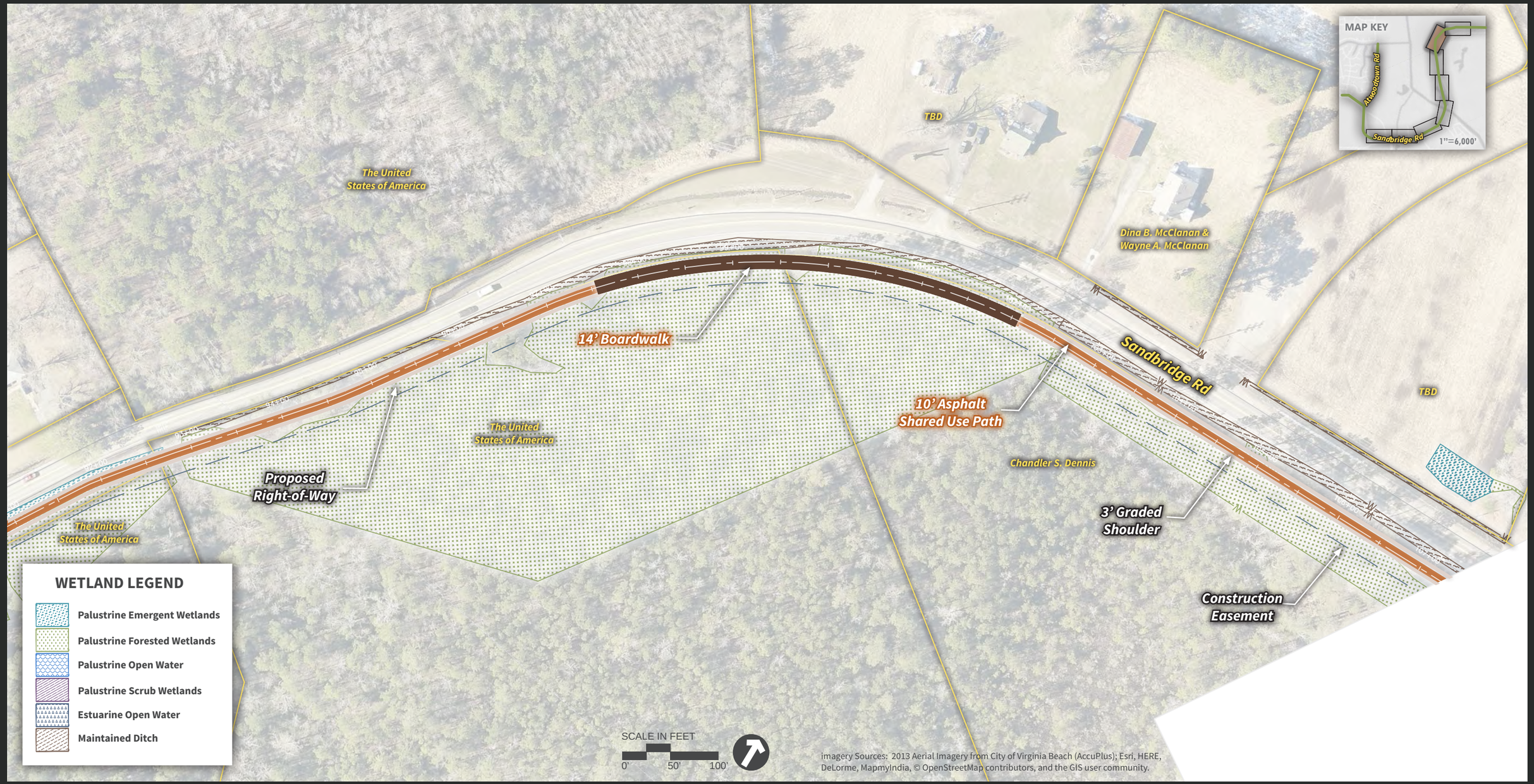

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6.2.G

ALTERNATIVE TRANSPORTATION STUDY

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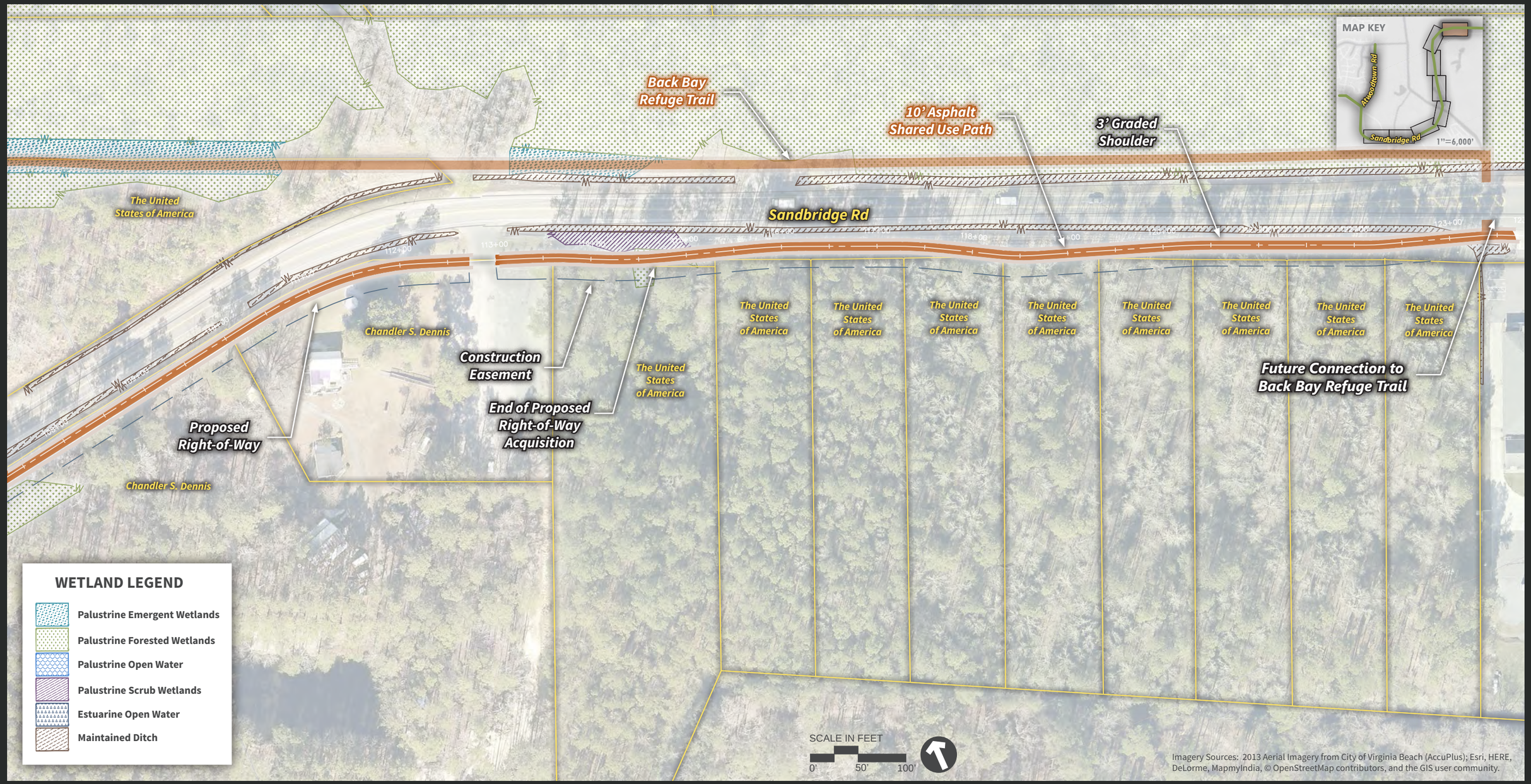

Imagery Sources: 2013 Aerial Imagery from City of Virginia Beach (AccuPlus); Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

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6.2.H

ALTERNATIVE TRANSPORTATION STUDY

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