

Appendix I

USFWS FISH AND WILDLIFE COORDINATION ACT REPORT



United States Department of the Interior



FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 26th Street
Vero Beach, Florida 32960

August 27, 2003

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Attention: Jon Moulding

Dear Mr. Duck:

The Fish and Wildlife Service (FWS) and the National Park Service (NPS) have prepared this Final Fish and Wildlife Coordination Act (FWCA) Report for the Final Supplemental General Reevaluation Report/Supplemental Environmental Impact Statement (GRR/SEIS), Modified Water Deliveries (MWD) to Everglades National Park (ENP), Tamiami Trail Project, Miami-Dade County, Florida. This GRR/SEIS analyzes and evaluates an array of alternatives to allow for restoration of ecological function and hydrological conditions in Northeast Shark Slough and the Rocky Glades in ENP, through the structural modification of U.S. 41/Tamiami Trail.

This Final FWCA Report is provided in accordance with the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). In conjunction with the views and recommendations of the Florida Fish and Wildlife Conservation Commission, this Final FWCA Report constitutes the report of the Secretary of the Interior as required by section 2(b) of the FWCA. This Final FWCA Report does not constitute a biological opinion under section 7 of the ESA.

The Department of the Interior (DOI) considers the full and successful restoration of Tamiami Trail to be a critical step toward restoring the hydrological and ecological connection between the Central and Southern Everglades. This effort is key to reestablishing more historic flows to ENP and Florida Bay. Eliminating the ecological and hydrological barrier of Tamiami Trail is also an essential component of the Comprehensive Everglades Restoration Plan (CERP), and will be the subject of a complex planning effort conducted under the Decartmentalization (Phase 1) component of the CERP. Thus, the project under review as a component of the MWD Project will have a considerable impact on CERP implementation over the next decade.

After a thorough review of an array of nine project alternatives, the DOI has reached the following conclusions:

Environmentally Preferred Alternative

The DOI concludes that Alternative 5A (Full Causeway), without water quality treatment and with full removal of the existing Tamiami Trail, is clearly the Environmentally Preferred Alternative without regard to fiscal constraints. This alternative plan for raising Tamiami Trail and restoring flows to ENP is the most consistent of all alternatives with the goals of the Everglades National Park Expansion and Protection Act (PL 101-229). Alternative 5A fully meets the stated goal in this Act of "*improving the abundance, diversity and ecological integrity of native plants and animals in the Park.*" Alternative 5 is also fully consistent and complementary with the goals set forth in the CERP authorized by the Water Resources Development Act of 2000 (PL 106-541). A summary of the performance assessment of Alternative 5A is provided in Chapter 10 of this report.

Environmentally Acceptable Plan

The U.S. Army Corps of Engineers (Corps) has identified Alternative 7A (3000-foot bridge without water quality treatment) as the Federally Recommended Plan. It is the position of the DOI that Alternative 7A is an environmentally acceptable plan, performing sufficiently well for all project objectives within the limits imposed by the project constraints. Alternative 7A also meets the Florida Department of Transportation (FDOT) concern for road safety by providing necessary mitigation to offset the adverse impacts to road safety associated with the projected high water following implementation of the MWD Project.

Remaining Alternatives

It is the position of the DOI that Alternatives 6A (4-mile causeway) and 9 (2.7-mile causeway), do not meet the requirements of the MWD Project due to the fiscal constraints imposed by the NPS. The DOI recommends that the remaining non-bridge alternatives, (Alternatives 1, 2, 3, 4, and 8), be eliminated from further consideration as they were not found to be compatible with the goals of the MWD Project and were found to add additional cost to future CERP restoration.

Threatened and Endangered Species

By letter dated May 22, 2003, the FWS concurred with the Corps' determination that implementation of Alternative 7A would not adversely affect the endangered wood stork (*Mycteria americana*), snail kite (*Rostrhamus sociabilis*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), West Indian manatee (*Trichechus manatus*), Florida panther (*Puma (= Felis) concolor coryi*), and the threatened eastern indigo snake (*Drymarchon corais*

James C. Duck
August 27, 2003
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couperi). As part of the Federal action, the Corps will include all construction restrictions contained in the Final FWCA Report for the wood stork, manatee, and eastern indigo snake. The Corps will also monitor snail kite nesting in the project area and will reinstate consultation if shifts in nesting occur prior to or during construction activities.

This concurrence letter fulfills the requirements of section 7 of the ESA (50 CFR section 402.13), and no further action is required at this time regarding construction of the Tamiami Trail Project. Reinitiation of consultation may be necessary: 1) if modifications are made to the project; 2) if additional information involving potential effects to listed species becomes available; or 3) if a new species is listed or if critical habitat is designated that may be affected by the project.

This concurrence is not applicable to operations of the Tamiami Trail Project for which the submission of a final operating plan is anticipated as part of the development of the Combined Structural and Operational Plan.

Integration with CERP Decompartmentalization (Part 1)

The DOI is pleased that the Corps has agreed to accelerate the Tamiami Trail Component of Decompartmentalization (Phase 1) by preparing a separate and accelerated Project Implementation Report for the Tamiami Trail Component. The DOI recommends that the Corps utilize, to the maximum extent practicable, the results of the MWD GRR/SEIS in this accelerated schedule. There is considerable interest in developing an integrated and holistic plan that minimizes the expense associated with retrofitting project features constructed under the MWD authority. We are confident that this effort will combine the technical and financial resources of both restoration authorities in order to develop an efficient, phased plan leading to a more significant and meaningful restoration, consistent with both the MWD and CERP authorities.

Real Estate Agreement with the Florida Department of Transportation

The current design of the Recommended Plan (Alternative 7A) includes provisions to mitigate FDOT's concerns regarding potential damage to the road sub-grade and overtopping the existing road surface due to the projected high water associated with the implementation of the MWD Project. The mitigation is in the form of raising the portion of the existing highway not elevated by the construction of the 3,000-foot bridge. Specifically, implementation of the Recommended Plan would elevate over 10 miles of the existing road by approximately 2 feet through the addition of fill material and asphalt resurfacing. Depending on the plan recommended in the CERP Decompartmentalization (Part 1) Project, the potential exists for portions of Tamiami Trail raised by the MWD Project to be removed as part of the CERP Recommended Plan. This could result in as much as \$16.4 million in MWD Project funding being expended on unneeded features.

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To avoid the construction of potentially unneeded features, while still meeting the mitigation requirements to assure highway safety, the DOI recommends the Corps enter into a real estate agreement with the FDOT that will ensure the safety requirements of FDOT are met until the CERP project features can be identified and implemented. The DOI also recommends that the Corps closely coordinate the development of this agreement with ENP, FWS, and the Office of the Solicitor for the DOI.

Additional Recommendations

Additional recommendations concerning the placement of the 3,000-foot bridge, threatened and endangered species conservation, wading bird conservation, hydrologic analyses, wildlife mortality reduction, wetland functional gains and losses, recreational effects, and water quality treatment are provided in the Final FWCA Report.

We solicit your comments on the analyses contained in the report, and look forward to continued close coordination with you and your staff in this project. The FWS and NPS remain confident the strategy to integrate the MWD and CERP Tamiami Trail Projects will result in the reconnection of the Central and Southern Everglades, thereby greatly facilitating the future implementation of the CERP.

This Final FWCA Report represents the views and recommendations of the DOI in accordance with section 2b of the FWCA. Please contact David Ferrell of my staff at 772-562-3909, extension 224, if you have any questions regarding the contents of this Final FWCA Report.

Sincerely yours,



James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

James C. Duck
August 27, 2003
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cc w/enclosure (CD):

Service, Assistant Regional Director, ES, Atlanta, Georgia (Cindy Dohner)
Service, Jacksonville, Florida (Miles Meyer)
NPS, Regional Director, Atlanta, Georgia (Jerry Belson)
NPS/ENP, Superintendent, Homestead, Florida (Maureen Finnerty)
USGS, Miami, Florida (G. Ronnie Best)
BIA, Nashville, Tennessee (Kenneth Bailey)
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Corps, West Palm Beach, Florida (Dennis Duke)
FDOT, Miami, Florida (Barbara Culhane)
DEP, West Palm Beach, Florida (Herb Zebuth)
FWC, Vero Beach, Florida (Joe Walsh)
Miccosukee Tribe of Indians of Florida, Miami, Florida (Chairman Billy Cypress)
GEC, Incorporated, Baton Rouge, Louisiana (Mike Loden)



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4679
JACKSONVILLE, FLORIDA 32225-0469

Planning Division
Environmental Branch

APR 17 2003

Mr. James J. Slack
Field Supervisor
U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960-3559

Dear Mr. Slack:

This is in reference to Endangered Species Act Section 7 coordination for the Tamiami Trail Feature of the Modified Water Deliveries to Everglades National Park (MWD) project.

The final recommended plan is Alternative 7a, Existing Alignment with Raised Profile and 3000-foot Bridge without Water Quality Treatment, as described in the November 2001 Draft GRR Supplement.

In your Draft Fish and Wildlife Coordination Report (DCAR), dated November 15, 2001, you stated that the Corps should assess effects of the final recommended plan on the wood stork, snail kite, Cape Sable seaside sparrow, manatee, Florida panther, and Eastern Indigo snake. The Tamiami Trail project is an operationally passive project, so it will not create any new hydrologic impacts per se. Our assessment described below, therefore, involves construction effects only. Operational effects on listed species will be addressed as part of the Combined Structural and Operational Plan (CSOP) project at a later date.

Wood stork: All construction restrictions recommended on pages 94 et seq of your DCAR for the Tamiami East and West colonies would be followed during construction performed by the Corps. The Corps will notify the Florida Department of Transportation of these requirements if they ultimately construct the road raising, and recommend that they contact your office.

Snail kite: There is no known nearby kite nesting, so no restrictions were recommended for the kite. On-going nesting monitoring would continue and coordination would be reinitiated if relevant shifts in nesting occurred during construction.

Cape Sable seaside sparrow: No sparrow habitat exists within or near the project area.

Manatee: Any construction activity involving watercraft in the Tamiami Canal that could impact manatees would be accompanied by appropriate manatee monitoring.

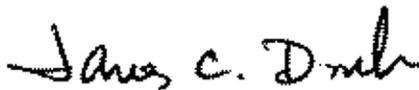
Florida panther: All construction activity would be confined to the immediate vicinity of the highway. As such, this could have a beneficial effect on the panther by deterring highway crossings, which could lead to vehicle impact causing injury or mortality.

Eastern indigo snake: Standard agreed upon construction protection measures would be applied during construction.

Considering the above, the Corps determines that implementation of the final recommended plan for Tamiami Trail would not likely have an adverse effect on the listed species considered.

Please provide us your concurrence or comments on this determination.

Sincerely,

A handwritten signature in black ink that reads "James C. Duck". The signature is written in a cursive style with a large, sweeping initial "J".

James C. Duck
Chief, Planning division



United States Department of the Interior



FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 22, 2003

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Attention: Jon Moulding

Dear Mr. Duck:

This letter acknowledges the Fish and Wildlife Service's (Service) receipt on April 21, 2003, of the U.S. Army Corps of Engineers (Corps) April 17, 2003, letter requesting concurrence under section 7 of the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). The consultation concerns the possible effects of the final recommended plan for the Modified Water Deliveries to Everglades National Park (MWD) Project, Tamiami Trail Component (Alternative 7a), on the endangered wood stork (*Mycteria americana*), snail kite (*Rostrhamus sociabilis*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), West Indian manatee (*Trichechus manatus*), Florida panther (*Puma (= Felis) concolor coryi*), and the threatened eastern indigo snake (*Drymarchon corais couperi*).

The Service previously concurred with the not likely to adversely affect conclusion in your Biological Assessment (BA), dated May 30, 2002, concerning the effects of implementing the Tamiami Trail Project on the federally listed species. In the Draft Fish and Wildlife Coordination Act Report (FWCAR), dated November 15, 2001, the Service requested that the Corps re-assess effects once the final recommended plan was determined.

The Tamiami Trail Project is a component of the MWD Project. The purpose of the project is to identify features needed to convey increased flows through Tamiami Trail as defined in the 1989 Everglades National Park Protection and Expansion Act in order to improve water deliveries to Everglades National Park and restore natural hydrologic conditions. The project area includes a 10.7-mile stretch of Tamiami Trail (U.S. 41) between the S-333 and S-334 structures in the L-29 borrow canal. Alternative 7a, the final Recommended Plan, consists of modifying the existing Tamiami Trail profile and the construction of a 3,000-foot bridge, thereby creating a conveyance channel below the road. Raising the profile of 10.7 miles of Tamiami Trail between the S-333 and S-334 structures may be required to protect the structural integrity of U.S. 41 for public safety purposes. The 3,000-foot bridge will be located between the Blue Shanty Canal and the

James C. Duck

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Coopertown concession. It is anticipated that the Tamiami Trail Component of Decompartmentalization (Part 1) of the Comprehensive Everglades Restoration Plan will include additional modifications to Tamiami Trail to further improve conveyance between the central and southern Everglades. Finally, an operational plan for the Tamiami Trail Project will be developed as part of the Combined Structural and Operational Plan (CSOP), for which planning is currently underway.

Eastern Indigo Snake

The BA states that the Corps will include the *Standard Construction Precautions for the Indigo Snake* in the project design for the Tamiami Trail Project. With the inclusion of these precautions in this Federal action, the Service concurs that the implementation of the Tamiami Trail Project will not adversely affect the eastern indigo snake. There is no designated critical habitat for the eastern indigo snake; therefore, no designated critical habitat will be affected.

Wood Stork

The BA states that the construction timing and set-back criteria as detailed in the Draft FWCAR for the Tamiami Trail Project will be incorporated into project scheduling, design, and construction. With the inclusion of these criteria in this Federal action, the Service concurs that the implementation of the Tamiami Trail Project will not adversely affect the wood stork. There is no designated critical habitat for the wood stork; therefore, no designated critical habitat will be affected.

Snail Kite

The closest known snail kite nest lies over 1 mile to the north of Tamiami Trail in Water Conservation Area 3B. The Service concurs that the implementation of the Tamiami Trail Project will not adversely affect the snail kite. There is no designated critical habitat located within the project area; therefore, no designated critical habitat will be affected.

Florida Panther

A review of available Florida panther radio-telemetry data indicates that between 1991 and 2000 there were no panthers documented in the vicinity of Tamiami Trail. In 2001, Florida panther #85, a male born in March 1999 in Everglades National Park, ranged to within approximately one-half mile south of Tamiami Trail. Additionally, habitat disruption is limited to the immediate highway corridor (within 25 feet of the road shoulder), and any habitat losses due to bypass roads would be restored at project completion. The net permanent loss of wetland habitat adjacent to the highway is limited to approximately 3 acres. This habitat is considered low quality potential panther habitat due to the proximity of the highway and the infestation of exotic vegetation.

James C. Duck
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If a wide-ranging panther should transit the project area, construction activities are not expected to affect the species any more than normal vehicular traffic on the highway. Additionally, the construction of a 3,000-foot bridge would benefit panther long-term movement by providing safe passage under the highway for a distance exceeding one-half mile. The Service therefore concurs that the implementation of the Tamiami Trail Project will not adversely affect the Florida panther. There is no designated critical habitat for the Florida panther; therefore, no designated critical habitat will be affected.

West Indian Manatee

For the period of record of over 20 years, there has been only one recorded manatee utilizing the L-29 borrow canal adjacent to Tamiami Trail. The likelihood of a manatee occurring in the project area is negligible. Additionally, there is no in-water work proposed in the L-29 canal; however, the *Standard Manatee Protection Construction Conditions* should still be implemented for this project in the unlikely event that a manatee does occur within the construction areas. This will provide surveillance, management, and control that will minimize disturbance and ensure the safety of the manatee and, therefore, the Service concurs that the implementation of the Tamiami Trail Project will not adversely affect the West Indian manatee. There is no designated critical habitat within the project area; therefore, no designated critical habitat will be affected.

Cape Sable Seaside Sparrow

The closest occupied Cape Sable seaside sparrow nest lies over 10 miles south of the project area. Since this Federal action is for construction activities only, the Service concurs that implementation of the Tamiami Trail Project will not adversely affect the Cape Sable seaside sparrow. There is no designated critical habitat within the project area; therefore, no designated critical habitat will be affected.

In conclusion, based on the best available scientific and commercial information, the Service believes that construction of the Tamiami Trail Project will not adversely affect federally listed species. This concurrence letter fulfills the requirements of section 7 of the ESA (50 CFR section 402.13), and no further action is required at this time regarding construction of the Tamiami Trail Project. Reinitiation of consultation may be necessary if: 1) modifications are made to the project; 2) if additional information involving potential effects to listed species becomes available; or 3) if a new species is listed or if critical habitat is designated that may be affected by the project. Additionally, the Corps is ultimately responsible for construction effects on listed species, not the Florida Department of Transportation; therefore the Corps, in consultation with the Service, should maintain oversight of the effects of project construction on federally listed species.

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This concurrence letter is not applicable to operations of the Tamiami Trail Project for which the submission of a final operating plan is anticipated as part of the development of the CSOP.

Thank you for your cooperation and effort to conserve federally listed species. If you have any questions regarding this concurrence letter, please contact David Ferrell at 772-562-3909, extension 224, or Michael Abney at extension 283.

Sincerely yours,



James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:

ENP, Homestead, Florida (David Sikkema)
Service, Atlanta, Georgia (Cynthia Dohner)
Service, Jacksonville, Florida (Miles Meyer)
Miccosukee Tribe of Indians, Hollywood, Florida
FWC, Vero Beach, Florida (Joe Walsh)
NMFS, Miami, Florida (Mike Johnson)

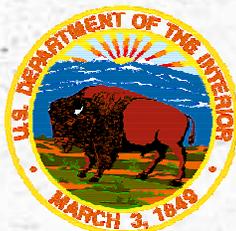
FINAL FISH AND WILDLIFE COORDINATION ACT REPORT



MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK: TAMIAMI TRAIL PROJECT MIAMI-DADE COUNTY, FLORIDA



U.S. Fish and Wildlife Service
South Florida Field Office
Vero Beach, Florida



August 2003



National Park Service
Everglades National Park
Homestead, Florida

Executive Summary

This Final Fish and Wildlife Coordination Act (FWCA) Report on the Modified Water Deliveries (MWD), Tamiami Trail Project, has been jointly prepared by the Fish and Wildlife Service (FWS) and National Park Service (NPS), and is provided in accordance with the provisions of the Fish and Wildlife Coordination Act of 1958 (48 Stat. 401, as amended: 16 U.S.C. 661 *et seq.*). This report also includes the results on on-going informal consultation between the Corps of Engineers (Corps) and FWS in accordance with Section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This report summarizes the views and recommendations of the Florida Fish and Wildlife Conservation Commission, who provided a separate FWCA Report for this project. This Final FWCA Report represents the Secretary of the Interior's views and recommendations to Congress on the Tamiami Trail Project.

The purpose of this Final FWCA Report is to provide the Corps with the recommendations of the Department of the Interior (DOI) and supporting documentation leading to the selection of a Federally Recommended Plan and Record of Decision for the Tamiami Trail Project to be released as a General Reevaluation Report/Supplemental Environmental Impact Statement (GRR/SEIS) for public review and comment in August 2003. The methods used for the selection of the DOI Recommended Plan include an evaluation of environmental and other project objectives in the context of constraints imposed by highway safety, wetland losses, wildlife mortality, and funding limitations.

Based on an evaluation of the stated environmental objectives (see Figure ES-1) of the project, inclusive of 19 separate hydrological and ecological performance measures, the DOI concludes that Alternative 5A (Full Causeway), with full removal of the existing Tamiami Trail, is clearly the Environmentally Preferred Alternative. It is the position of the DOI that this plan is the most consistent of all alternatives with the intent and stated goals of the 1989 Everglades National Park Expansion and Protection Act (PL 101-229).

Evaluations of Alternative 5A (Environmentally Preferred Alternative) in the context of the fiscal constraints imposed by NPS reveals that construction costs for Alternative 5A exceed the currently available funding by more than seven times. Therefore, the DOI is compelled to remove Alternative 5A, as well as five other alternatives, from further consideration due to fiscal constraints. Alternative 1 was also eliminated due to highway safety concerns. Should additional funding be made available, the DOI would amend the decision on the current DOI Recommended Plan to reconsider plans that clearly exhibit superior performance for the environmental objectives.

Alternatives retained by DOI were further evaluated for performance to the other, non-environmental, project objectives. Based on these evaluations and in consideration of the relative costs for construction, Alternative 7A was selected as the DOI Recommended Plan. This decision was also made in recognition of future modifications to Tamiami Trail, anticipated as a result of the implementation of projects associated with the Comprehensive Everglades Restoration Plan (CERP). Additionally, the DOI does not recommend at this time any proposed alternatives designed to provide water quality treatment facilities. The DOI concludes that the proposed designs of these water quality features result in the unnecessary destruction of wetlands

Tamiami Trail Alternative Plans Performance for Environmental Objectives

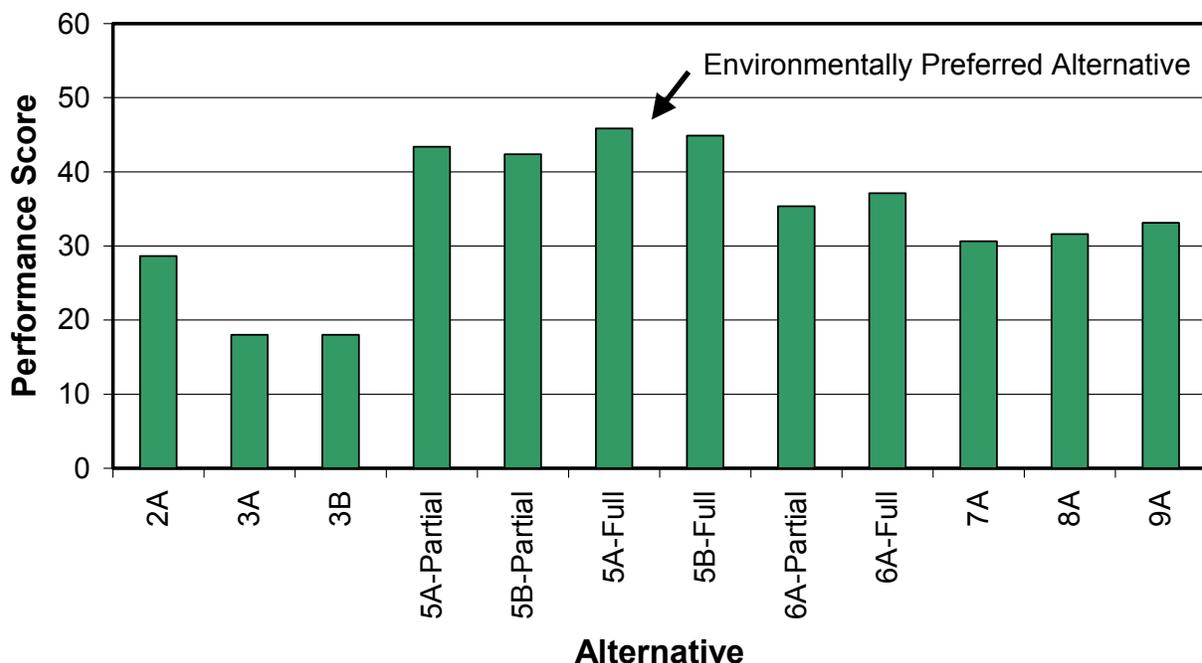


Figure ES-1: Performance for environmental objectives for Tamiami Trail alternative plans.

which can be avoided through implementation of alternative designs when the land associated with the L-29 canal and L-29 levee become available as a result of the implementation of CERP projects.

The DOI further concludes that the implementation of the Alternative 7A as a MWD Project component must be eventually augmented with additional modifications to Tamiami Trail to attain the level of restoration the DOI ultimately desires. These additional modifications can be attained through implementation of the CERP Project Decentralization (Phase 1). Given the authority now provided by the CERP, the DOI strongly recommends the Corps, in conjunction with DOI, jointly recognize the following when considering all proposed modifications to Tamiami Trail:

1. Only limited funding is provided by the MWD Project for modifications to the Tamiami Trail at this time.
2. Full restoration of natural flows to Northeast Shark Slough (NESS) and Everglades National Park (ENP) may only be accomplished through the implementation of MWD Project features coupled with the restoration potential of the CERP, once the seepage control features for the projected high water levels in NESS are fully mitigated.

3. Additional funding and restoration capability is authorized by the CERP Decentralization (Phase 1) for Tamiami Trail, and future modifications may occur to Tamiami Trail using the CERP authority in order to augment the MWD project features by increasing the ecological connectivity between the water conservation areas and ENP, thereby restoring a more natural sheetflow regime.
4. Final CERP features for Tamiami Trail have not yet been identified, and any proposed modifications will be analyzed in a public forum consistent with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*).
5. Without prejudging the results of the Project Implementation Report required by the Water Resources Development Act of 2000, the intent of the MWD Tamiami Trail GRR/SEIS and the recommendations contained in this Final FWCA Report are to maximize the compatibility and avoid retrofitting of the MWD Project features with future CERP features.
6. The intent of the MWD Tamiami Trail GRR/SEIS and the recommendations contained in this Final FWCA Report are to have a clear design for MWD onto which a CERP design can follow.
7. A need exists to accelerate the identification and implementation of the CERP project modifications for Tamiami Trail to better coordinate the planning and eventual construction of the features associated with the combined authorities of MWD and CERP.

The DOI also strongly encourages the Corps to pursue all means available to prevent the construction of any features of Alternative 7A that, at present, may be eliminated upon CERP implementation. Specifically, Alternative 7A would raise approximately 10 miles of the existing highway by approximately two feet through the addition of fill material and asphalt resurfacing. Depending on the plan recommended in the CERP Decentralization (Phase 1) Project, the potential exists for portions of Tamiami Trail raised by the MWD Project to be removed as part of CERP recommended plan. This would result in as much as \$16.4 million in MWD Project funding being expended on unneeded features.

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CHAPTER 1 - PURPOSE, SCOPE, AND AUTHORITY

Introduction

The Fish and Wildlife Service (FWS) and the National Park Service (NPS) have prepared this Final Fish and Wildlife Coordination Act (FWCA) Report as cooperating agencies for the U.S. Army Corps of Engineers' (Corps) General Reevaluation Report (GRR) and Supplemental Environmental Impact Statement (SEIS). This GRR and SEIS supplement the Corps' 1992 General Design Memorandum (GDM) and Final Environmental Impact Statement, Modified Water Deliveries (MWD) to Everglades National Park (ENP), Miami-Dade County, Florida. The GRR and SEIS analyze and evaluate several alternatives to facilitate the restoration of ecologic function and hydrologic conditions in Northeast Shark Slough (NESS) and the Rocky Glades, as well as provide a flood mitigation system to address impacts to the Eight and One-half Square Mile Area (8.5 SMA) resulting from the implementation of the MWD Project. The South Florida Water Management District (SFWMD) is the local sponsor for this project. This Final FWCA Report is provided in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (48 Stat. 401; U.S.C. 661 *et seq.*). Coupled with the views and recommendations of the Florida Fish and Wildlife Conservation Commission (FWC), these Final FWCA Reports constitute the Secretary of the Interior's Report to Congress on the proposed modifications to the MWD Project in accordance with Section 2(b) of the FWCA.

This Final FWCA Report provides the Department of the Interior's (DOI) views and recommendations pertaining to eight general alternatives, including several variations of these alternatives, proposed for implementation of the Tamiami Trail component of the MWD Project. Chapter 1 describes the purpose, scope, and authority for the Tamiami Trail component of the MWD Project. Contained within this chapter is an explanation of the authority for the MWD Project, a general description of the original 1992 design, as well as the responsibilities and decisions for each of the agencies having a role in the implementation of the Project. This chapter also details the objectives of the Tamiami Trail project component and the performance measures that were used in the evaluation sections of the report. The DOI completed an analysis of the Tamiami Trail alternatives based on these performance criteria under the legislative authorities discussed. Chapters 2, 3, and 4 describe the project's location and the natural resources of particular concern to the FWS and NPS. Chapters 2 and 3 contain an explanation of the existing and future without project conditions. Chapter 4 provides an explanation of the alternatives being considered for implementation. Chapters 5, 6, 7, 8, and 9 include all technical evaluations conducted by DOI. These evaluations focus on the hydrologic analyses, wetland function assessments, wildlife mortality, endangered species evaluations associated with each of the proposed alternatives, and effects on recreational activities. All of these analyses are included on the performance measures specified in Chapter 1. Chapter 10 includes evaluations of the alternatives, contained within this portion of the document are numerous matrices that served as the evaluation tool used by DOI in comparing the alternatives. Chapter 11 summarizes the views and recommendations of the FWC. Chapter 12 contains DOI's recommendations and final position. DOI's

final position is based on the complete set of performance measures, including most of the Corps' performance measures, using the legislative authorities provided by DOI as outlined in Chapter 1.

Purpose and Scope of Work

The purpose of this project is to maximize hydrologic and ecologic restoration through the evaluation of alternatives for the Tamiami Trail (US 41) which accommodate increased flows in NESS associated with the restoration of these wetlands through implementation of the MWD Project.

Authority

This project is authorized by Public Law (PL) 98-181 (The Supplemental Appropriations Act, November 30, 1983), PL 99-190 (ENP Protection and Expansion Act, December 13, 1989), and PL 101-229, Sections 102 and 104 (ENP Protection and Expansion Act, December 13, 1989: MWD to ENP).

Modified Water Deliveries Project

Following severe ecological impacts in ENP from droughts in the early 1960's, Congress passed the River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act of 1970 (PL 91-282), which established a Minimum Water Delivery to ENP. The delivery schedule called for an allocation of 260,000 acre-feet annually from Water Conservation Area (WCA)-3A via the S-12 structures into NESS to ENP in accordance with a monthly schedule based on water stages in WCA-3A. Through the intervening years, it became apparent that this method of water deliveries to ENP was both unnatural and oftentimes damaging to ENP resources. Excessive amounts of water were still released during flood conditions and the minimum deliveries were insufficient in meeting the park's needs during low water conditions.

As a result of continued damage to ENP resources, the Supplemental Appropriations Act of 1984 (PL 98-181) authorized the Secretary of the Army to conduct an experimental program for delivering water to ENP to protect and enhance its unique natural resources. This authorization permitted modification to the schedule of water deliveries from the Central and Southern Florida (C&SF) Project to ENP. However, direct compliance with the language and intent of PL 98-181 was not possible within the timeframe mandated by the Act.

The authorization to continue the experimental water deliveries program was subsequently extended by Congress throughout the years. A General Plan was prepared to develop a strategy for implementation of the authorization and was approved by the Assistant Secretary of the Army (Civil Works) in 1985. The General Plan recommended the preparation of a GDM and Environmental Impact Statement (EIS), addressing a MWD plan necessary to improve water deliveries to ENP.

On December 13, 1989, the ENP Protection and Expansion Act became law (PL 101–229). This Act added NESS and the East Everglades to ENP. It also authorized the Secretary of the Army, in consultation with the Secretary of the Interior, to design and construct modifications to the C&SF Project. The purpose of these modifications was to improve delivery of water into ENP and, to the extent practicable, restore the natural hydrologic conditions. The Secretary of the Army was to base the modifications upon the findings of the Secretary of the Army’s experimental program for delivering water to ENP, which Congress originally had authorized in 1984 (PL 98–181). This Act directed the Secretary of the Army to set forth the proposed modifications to the C&SF Project in a GDM entitled “Modified Water Deliveries to Everglades National Park.”

1992 General Design Memorandum and Needs for Design Reevaluations

When the Corps released the GDM and EIS in 1992 addressing the modifications to the C&SF Project, the GDM specified modifications consisting of two general components: (1) conveyance and seepage control features and (2) the 8.5 SMA flood mitigation features. Since the completion of the 1992 GDM, considerable redesign work has occurred for these MWD components. In December 2000, the Corps issued a Record of Decision (ROD) for the selection of an alternative plan for the 8.5 SMA flood mitigation component. The Corps also completed a Value Engineering document in January 2001 identifying an alternative design to the original conveyance and seepage control features. These modifications to the 1992 GDM also underscore the need to conduct evaluations of the Tamiami Trail in a manner to ensure compatibility with the revised designs of the MWD Project components.

The conveyance components proposed in the GDM were designed to redirect water from WCA-3A and 3B into NESS under normal conditions of flow. The Corps also determined that the conveyance components of the project would raise water levels within WCA-3B and NESS. Consequently, the Corps also recognized that this would result in an increase in the stage within the L-29 canal and potential impacts on the Tamiami Trail. However, the modifications recommended by the Corps for improving Tamiami Trail were restricted to those portions of the roadway adjacent to the S-334 spillway. Specifically, the 1992 GDM called for elevating the S-334 structure’s spillway (located at the eastern end of Tamiami Trail) from 14.0 feet to 17.4 ft-NGVD, and elevating 1,500 feet of the highway on each side of S-334 (for a total of 3,000 feet) from 10.6 to elevations varying up to 17.4 ft-NGVD, in order to protect the highway from increased stages in the L-29 borrow canal, which were projected to rise periodically to 10 ft-NGVD. Improvements to the S-334 spillway would allow for water levels to increase to 14.5 ft-NGVD under Standard Project Flood conditions west of the structure while still maintaining the tailwater stage on the east side of the structure at 5.0 ft-NGVD.

In addition, significant progress has been made in the collection and analysis of hydrologic and biological data from Everglades research resulting in more effective scientific modeling analysis. New information regarding shifts in vegetation composition and dominance, hydropatterns, and transportation, and assimilation of nutrients in south Florida ecosystems has been discovered. These scientific and engineering advancements have allowed a greater understanding of

the restoration requirements of the ecosystem and also merit the reevaluation of the structural and operational features of existing projects such as the MWD Project.

Tamiami Trail Component of the Modified Water Deliveries Project

The portion of Tamiami Trail evaluated in this Final FWCA Report is an 11-mile stretch of the road between the L-31N canal and the L-67 extension canal, located immediately south of the L-29 canal (Figure 1.1).

Goals of the Tamiami Trail Component of the Modified Water Deliveries Project

The overall goal for the Tamiami Trail Project is to maximize hydrologic and ecologic restoration through modifications to the existing roadway to allow for more natural flow conditions in a manner that is compatible with the restoration requirements of the 1989 ENP Protection and Expansion Act. It is also desirable to ensure compatibility with ongoing restoration projects, such as the C-111 Project and future components of the Comprehensive Everglades Restoration Plan (CERP). Recognizing this overall goal, several objectives have been identified for the Tamiami Trail Project.

Listed below are the Objectives and Performance Measures for the Tamiami Trail component of the MWD Project. DOI will utilize these Objectives and associated Performance Measures to select an environmentally preferred alternative and to provide DOI recommendations in the Draft and Final FWCA Reports for the Tamiami Trail Project.

Tamiami Trail Component of the Modified Water Delivery Project Objectives and Performance Measures

At the December 4-5, 2000, interagency meeting, considerable effort was expended to reach consensus on a set of Project Objectives and related Performance Measures for the Tamiami Trail Project. The DOI provided considerable input during this process. Below is the final set of Objectives and Performance Measures selected as most appropriate by DOI. The Objectives have been divided into Environmental Objectives and Other Project Objectives. DOI will use these criteria to rank and select a preferred alternative and to provide other recommendations in the Final FWCA Report.

Environmental Objectives are project objectives that DOI considers to potentially provide significant environmental enhancement consistent with the project authorizing legislation or other statutory requirements. Other Project Objectives are objectives that DOI considers to have the potential to maximize the overall benefits of the project but do not contribute significantly to environmental enhancement or restoration. Performance Measures are qualitative or quantitative criteria of how well a given objective has been met.

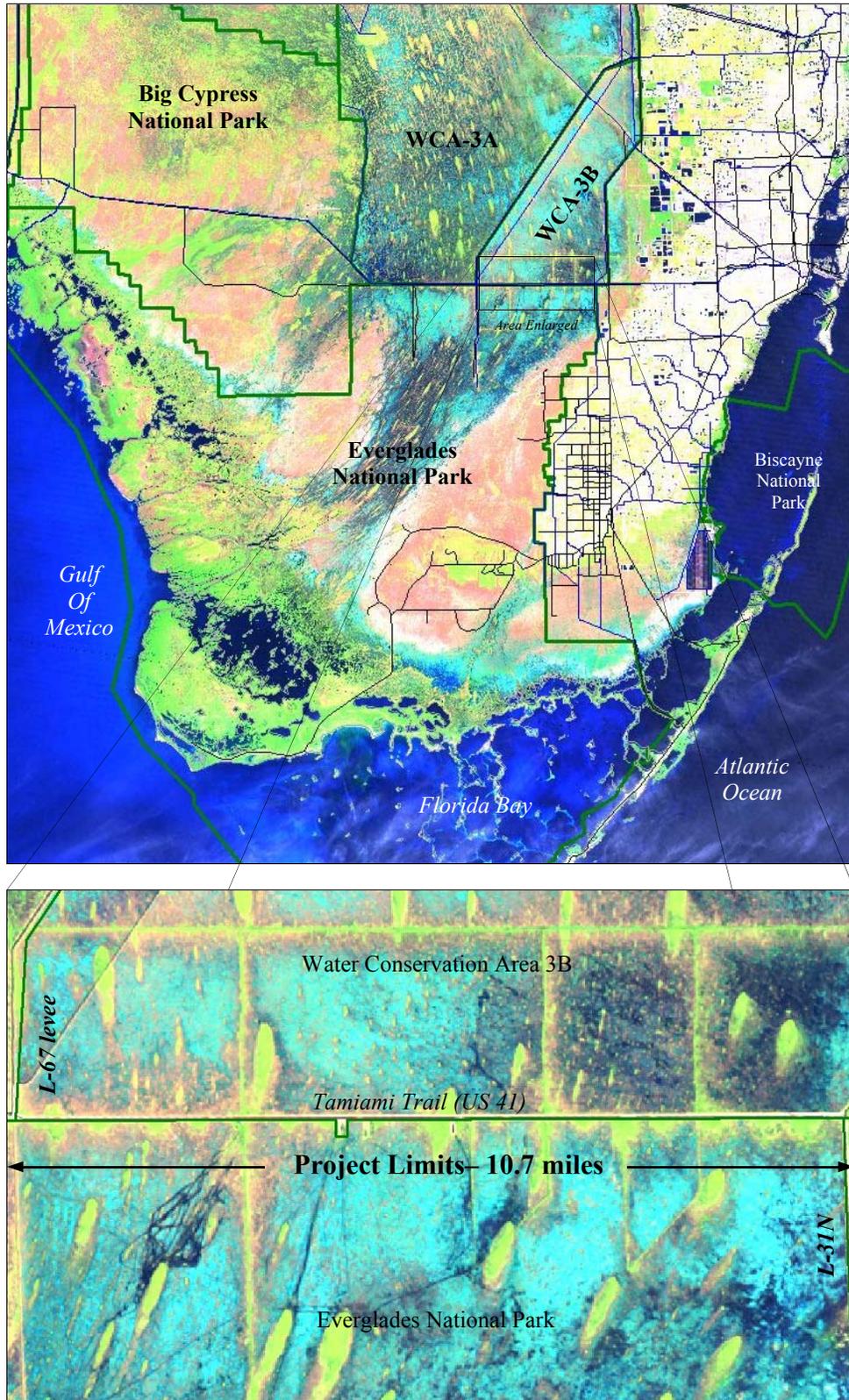


Figure 1.1. Regional and detailed project area map.

Environmental Objectives and Performance Measures

1. Minimize adverse effects to federally listed species (snail kite [*Rostrhamus sociabilis*], wood stork [*Mycteria americana*], Cape Sable seaside sparrow [*Ammodramus maritimus mirabilis*], Florida panther [*Felis concolor coryi*], eastern indigo snake [*Drymarchon corais couperi*]) in accordance with the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*) through implementation of the Standard Protection Measures for the Eastern Indigo Snake and quantification of the following:
 - A. Linear feet of impact to the primary and secondary zones of the eastern wood stork colony.
 - B. Linear feet of impact to the primary and secondary zones of the western wood stork colony.
 - C. Linear feet of impact to snail kite nesting locations.
 - D. Number of days of construction restrictions in the primary and secondary zones of the eastern wood stork colony due to nesting and fledging.
 - E. Number of days of construction restrictions in the primary and secondary zones of the western wood stork colony due to nesting and fledging.
2. Meet the Reasonable and Prudent Alternatives (RPA) for the Cape Sable seaside sparrow (CSSS) as specified in the FWS Biological Opinion (BO) of February 1999.
 - A. Design flow passing under the eastern section of Tamiami Trail (between the S-334 and the L-67s) meets 60 percent of the regulatory portion of the rainfall formula derived total flows across the Tamiami Trail.
3. Minimize adverse effects to State-listed endangered or threatened species of special concern consistent with State Statutes.
 - A. Impact to Frog City Wading Bird Colony Buffer Zone.
 - B. Distance from the Frog City Wading Bird Colony.
4. Allow for restoration consistent with the 1989 ENP Protection and Expansion Act.
 - A. NESS Stage: Maintain the level and frequency of stage as modeled by the 8.5 SMA MODBRANCH model D13R 1995 simulation (D13R_C111_356_1995_95ops).
 - B. Water Deliveries to ENP: Maintain a discharge capacity equivalent to historical (1939-1963 bridge flows) 1/10 year event, or 4458 cubic feet per second (cfs) (equivalent to about a 1/200 year event according to the South Florida Water Management Model (SFWMM) D13R derived return frequencies).
 - C. Area with affected flow magnitude.
 - D. Difference between average velocity at the road and average velocity in the marsh.
5. Enhance and restore ecological function.
 - A. Wetland function units gain or loss.
 - B. North/South connectivity between WCA-3B and ENP for aquatic fish and wildlife.
 - C. Exotic and nuisance vegetation removed.
 - D. Reduction in wildlife mortality.

6. Minimize permanent loss of wetlands in ENP and WCA-3B.
 - A. Wetland permanently lost in ENP.
 - B. Wetlands permanently lost in WCA-3B.

Other Project Objectives and Performance Measures

1. Ensure no reduction in authorized flood control benefits.
 - A. Acres with altered flood protection.
2. Maximize compatibility with future restoration actions.
 - A. Cubic yards of fill requiring removal to achieve completely unobstructed flow path (including removal of L-29 levee).
 - B. Ability to accommodate additional flow capacity required by currently authorized CERP project features.
 - C. Ability to accommodate flow volume of 245,000 acre-feet as described in Sec. 601G of Water Resources Development Act (WRDA) 2000.
3. Maximize consistency with other Modified Water Deliveries components.
 - A. Ability to meet implementation schedule (satisfies RPA requirements).
 - B. Construction duration and implementation time (construction completed by 2005).
4. Minimize impacts associated with construction.
 - A. Total duration of construction as measured in months.
 - B. Allows for turbidity control.
5. Minimize adverse socio-economic effects.
 - A. Noise impacts to the Miccosukee Tiger Tail Camp.
 - B. Noise impacts to the Miccosukee Osceola Camp.
 - C. Provide access to Miccosukee Tiger Tail Camp.
 - D. Provide access to Miccosukee Osceola Camp.
6. Minimize recreational effects.
 - A. Miles of available bank fishing.
 - B. Number of accessible boat ramps.
 - C. Miles of available culvert outfall fishing.
 - D. Sightseeing opportunities (1 poor-5 excellent).
 - E. Maximum months of disruption due to construction.

Corps of Engineers' Responsibilities and Decisions for Identification of Alternative Design

As described above, the 1989 ENP Protection and Expansion Act authorized and directed the Corps (through the Secretary of the Army) to design and construct modifications to the C&SF Project. The purpose of the modifications is to improve the delivery of water into ENP and, to

the extent practicable, take steps to restore ENP's natural hydrological conditions. In order to meet the requirements of the 1989 Act, the Corps has determined that modifications must now be made to the Tamiami Trail to ensure that the components of the MWD Project can be operated in a manner that is consistent with the project purpose.

Before the Corps can implement any proposed modifications to the C&SF Project, those modifications must be evaluated and disclosed under the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq.*). Due to its responsibilities for designing and constructing modifications to the C&SF Project, the Corps has assumed the lead agency's role for the analysis of proposed modifications to the Tamiami Trail under NEPA. In the role as lead agency, the Corps determined the proposed modifications potentially would have a significant effect on the human environment and the NEPA analysis would have to be documented in a SEIS.

As the lead agency, the Corps has the ultimate responsibility for the content of the SEIS. However, the SEIS is supposed to use the environmental analysis and recommendations of cooperating agencies with jurisdiction by law or special expertise to the maximum extent possible, consistent with the Corps' own responsibilities as lead agency (Section 1501.6(a)(2) of NEPA). If the lead agency leaves out a significant issue or ignores the advice and expertise of a cooperating agency, the EIS may be found later to be inadequate. This FWCA Report contains the results of the FWS' and NPS' primary environmental analyses and recommendations regarding hydrological and ecological effects of the alternatives on ENP and fish and wildlife resources in the study area.

As discussed previously, the Corps released a GDM, Final EIS, and ROD on the MWD Project in 1992. Since the project was authorized in 1989 and the design approved in 1992, various concerns about the discharge capacity and elevation of the Tamiami Trail have arisen necessitating reconsideration of the Tamiami Trail component of the MWD Project. Much of the concern with the 1992 GDM design resulted from new information resulting from the extensive hydrologic modeling done in conjunction with the development of the conceptual plan for the CERP. This regional-based modeling enabled a more accurate characterization of the restoration requirements of the ecosystem.

Upon completion of this supplemental NEPA analysis, the Corps will issue a ROD after full consideration of all viewpoints. The ROD will identify the alternative selected by the Corps for implementation.

Department of the Interior's Responsibilities and Decisions for Identification of Alternative Design

Authority for the involvement of the DOI in the SEIS originates from various laws, agreements, and regulations. Each of these laws, agreements, and regulations are described below.

1989 ENP Protection and Expansion Act and Interagency Agreement for Project Implementation

The 1989 ENP Protection and Expansion Act authorizes the Secretary of the Army, in consultation with the Secretary of the Interior, to design and construct modifications to the C&SF Project. Consultation with the Secretary of Interior is needed because the specific purpose of the MWD Project is to benefit ENP's ecological resources, including federally listed threatened and endangered species. Since the MWD Project is dependent on the Tamiami Trail Project to be completely functional, DOI is providing this FWCA Report to represent the Department's position and recommendations on the Tamiami Trail Project.

The Endangered Species Act

The ESA specifically requires consultation and coordination between the Corps and the FWS. The ESA requires Federal agencies to consult with the FWS and National Marine Fisheries Service regarding any effects that a federal action may have on federally listed threatened or endangered species or those proposed for listing as threatened or endangered. Section 7(a)(2) states that each Federal agency shall, in consultation with the Secretary of the Interior, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a federally listed species or result in the destruction or adverse modification of designated critical habitat. In fulfilling these requirements, each agency is to use the best scientific and commercial data available. This section of the ESA sets out the consultation process, which is further implemented by regulation (50 CFR §402).

The FWS has determined several species listed as threatened or endangered occur or potentially occur in the study area. They include the snail kite, wood stork, Cape Sable seaside sparrow, Florida panther, and eastern indigo snake.

Fish and Wildlife Coordination Act

The FWCA mandates coordination with the Corps regarding fish and wildlife resources. Both NPS and FWS have collaborated to provide this Final FWCA Report because many of the fish and wildlife resources associated with the project are within ENP. The purpose of the FWCA is to recognize the contribution of these resources to the nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to provide that the conservation of fish and wildlife receives equal consideration and be coordinated with other features of water-resources development programs. The Secretary of the Interior, through the FWS, is authorized to assist and cooperate with Federal, State and public or private agencies and organizations in the conservation and rehabilitation of fish and wildlife resources. The FWCA provides that whenever the waters of any stream or other body of water are proposed to be impounded, diverted, the channel deepened or otherwise controlled or modified, the Corps shall consult with the FWS and the agency administering the fish and wildlife resources of the State. The consultation shall consider conservation of wildlife resources with the view of preventing loss of and damages to such resources as well as providing for development and improvement in connection with such water resources development.

Any reports and recommendations of these fish and wildlife agencies shall be included in authorization documents for construction or for modification of projects. The Corps shall give full consideration to the reports and recommendations of these fish and wildlife agencies and include such justifiable means and measures for wildlife mitigation or enhancement as the Corps finds should be adopted to obtain maximum overall project benefits.

The National Environmental Policy Act

To facilitate the required consultation and coordination with DOI, the Corps has included both agencies (FWS and NPS) as cooperating agencies for the SEIS under the authority of NEPA. In addition to the responsibilities described above, the Council on Environmental Quality's (CEQ) regulations and guidelines for implementing NEPA confer specific rights and responsibilities to agencies functioning as cooperating agencies in the NEPA process. A cooperating agency is any agency, other than a lead agency (Corps in this case), that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action that might significantly affect the quality of the human environment. Where cooperating agencies have their own decisions to make and they intend to adopt the EIS and base their decisions on it, one document should include all of the information necessary for the decisions by the cooperating agencies. The Secretary of the Interior, through ENP and the FWS, intends to make a recommendation to the Corps on the project and alternatives analyzed in the SEIS.

Water Resources Development Act of 2000

Title VI, Sec 601 of the WRDA 2000 authorizes 15 projects of CERP; 4 Pilot Projects, 10 Initial Projects, and 1 adaptive management project. Projects were selected based on their ability to 1) provide immediate water quality and flow benefits; 2) use land already purchased; 3) link ongoing projects; and 4) maximize Federal investments. Included as one of the initial projects is the modification to the Tamiami Trail (Sec 601. subsec. b, paragraph 2, subpar. C, item viii), requesting that the eastern portion of the Tamiami Trail be raised and outfitted with bridges.

All Pilot Projects are subject to the constraints outlined in sub-paragraph D of the same section. Specifically, in regards to modifying the Tamiami Trail, no appropriation will be made which would construct the WCA-3A Decompartmentalization and Sheetflow Enhancement Project until the completion of the MWD Project.

Executive Orders

Executive Orders (EOs) 11988 (Floodplain Management) and 11990 (Protection of Wetlands) require Federal agencies to evaluate the likely impacts of actions to floodplains and wetlands. The objectives of the EOs are to avoid, to the extent possible, the long-term and short-term adverse impacts associated with occupancy, modification, or destruction of floodplains and wetlands and to prevent development and new construction in such areas wherever there is a practicable alternative.

CHAPTER 2- AREA SETTING

Project Location

Tamiami Trail (U.S. Highway 41) lies in the area of the Eastern Everglades biogeographical subregion and is located in southwest Miami-Dade County (see Figure 1.1, Chapter 1). The project area includes approximately 11 miles of the eastern portion of U.S. 41 between the S-334 Structure on the east and the S-333 Structure on the west. The area is bounded by WCA-3B on the north and ENP on the south. U.S. 41 is directly proximal to ENP to the south and the L-29 Canal and Levee to the north.

Description of Study Area

The study area, historically a mosaic of sawgrass prairies and emergent marshes interspersed with tree islands, lies at the headwaters of NESS. ENP lands within the study area to the south of Tamiami Trail are pristine natural areas consisting of sawgrass prairie interspersed with hardwood hammock tree islands. Immediately to the north of Tamiami Trail lies WCA-3B, which also consists of pristine Everglades habitat. Except for several north-south ditches excavated in WCA-3B by agricultural interests in the early 1900's, the landscape is relatively pristine and is managed by the FWC as a Wildlife Management Area.

Wetlands within the study area are infested to varying degrees with exotic vegetation such as Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina* spp.), *Melaleuca quinquenervia*, common reed (*Phragmites australis*), and Napier grass (*Pennisetum purpureum*). Exotic infestation is most evident along the perimeter of the U.S. 41 corridor and adjacent disturbed areas where dredge and fill activities have taken place.

There are two Miccosukee Indian camps in the study area, one on the south side of Tamiami Trail (Osceola Camp) and the other on the north side of the L-29 Canal (Tiger Tail Camp). In addition, the Airboat Association of Florida site will remain active after the project is completed.

History of Tamiami Trail

In 1915, under the authority of the newly formed Central Highway Commission, Dade County tax assessor Captain J.F. Jaudon spearheaded a plan for a road connecting Tampa and Miami. The project became known as the Tamiami Trail.

At the time, Florida's policy on road development forced communities to sell bonds as the means of financing construction projects within their districts. Consequently, districts with small populations were unable to raise adequate funds for completing construction within their boundaries, a problem which by 1921 forced the abandonment of large sections of the trail.

Frustrated by the lack of financial support a group, nicknamed the "Tamiami Trail Blazers", set out to cross the incomplete trail with the intention of raising support and proving that a west-east route could be realized. Support came shortly after from Barron Collier, a wealthy advertiser from Tennessee and owner of 900,000+ acres in southwest Florida. Mr. Collier offered forth \$350,000 and the use of his construction company, and once again the project steamed forward.

Constructed on the trail proved to be a formidable task. Using a walking dredge (Figure 2.1); a machine capable of digging a 24 x 12-ft deep canal, construction progressed at an average speed of 1.1 miles per month through peat, muck, and limestone. Accompanying the dredge were mobile shelters to house workers and supplies, and blasting rigs for drilling holes and placing dynamite (Figure 2.2). The excavated debris would then be piled to form a roadbed 3 to 6 feet above the surrounding landscape.

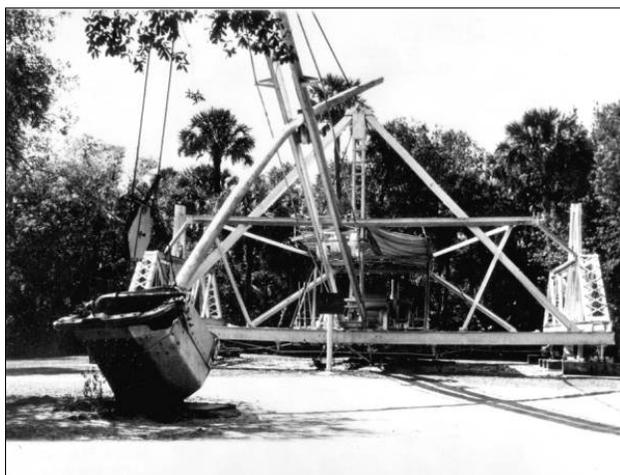


Figure 2.1. Walking Dredge



Figure 2.2. Blasting Rig 1924

The Tamiami Trail was officially opened in 1928, complete with scarlet tunic clad motorcycle patrolmen and archway (Fig 2.3). A motorcade of 500 dignitaries was the first to travel from Tampa to Everglades City, then onward to Miami; a trip which prior to the completion of the trail would have taken 2 days by boat.

To overcome the constraint the road caused to water flow, a major engineering effort was undertaken in the mid-1940's with the construction of 38 bridges (21 within the MWD project area). Each bridge measured 45-ft long and was spaced 1/2 mile apart. These bridges were replaced in the early 50's with the current system of culverts.

Recently, the Tamiami Trail Scenic Highway Corridor Advocacy Group successfully lobbied for a State Scenic Highway designation for a 50-mile portion of the Tamiami Trail in Collier County. This designation was followed by the Federal designation of National Scenic Byway.



Figure 2.3. Tamiami Trail Archway 1928 marking the Collier-Dade County line

Hydrological Description

Prior to the construction of the C&SF features, water deliveries to Shark Slough occurred through unimpeded sheet flow. Figure 2.4 illustrates the distribution of flows to the Shark Slough of ENP based on the available period of record. Prior to completion of the C&SF Project features in the WCA's, more than half (57 percent) of the water deliveries were made to NESS. Following the completion of L-67 and L-29, much of the water was directed to Northwest Shark Slough (NWSS) and the percent discharge to NESS dropped to 25 percent for the Period of Record 1963-1997.

Figure 2.5 illustrates the shift to the west of water releases across Tamiami Trail during this period. During the wet season, this distribution has resulted in drier than natural conditions in NESS and wetter conditions in NWSS. The hydrologic conditions following implementation of the CERP as represented by the D13R simulation of the SFWMM, shows that the removal of the L-29 levee and borrow canal combined with opening up the road to north-south flows will result in a more natural distribution of flows to ENP. Under the MWD Project (Tamiami Trail Component), the road will be opened up to north-south flows but the canal and levee (with 3 breaches) will remain, and the degree of restoration of NESS may be less than that demonstrated by the D13R simulation.

Ecological Description

Vegetation

Historically, most lands within the study area were herbaceous wet prairies dominated by sawgrass. Other common native species found on these wet prairies include, but are not limited to arrowhead (*Sagittaria lancifolia*), spider lily (*Hymenocallis latifolia*), swamp lily (*Crinum*

Total Annual Discharge to Shark Slough

Northeast Shark Slough (NESS: L-30 to L-67) and Northwest Shark Slough (NWSS: L-67 to FMB) Components

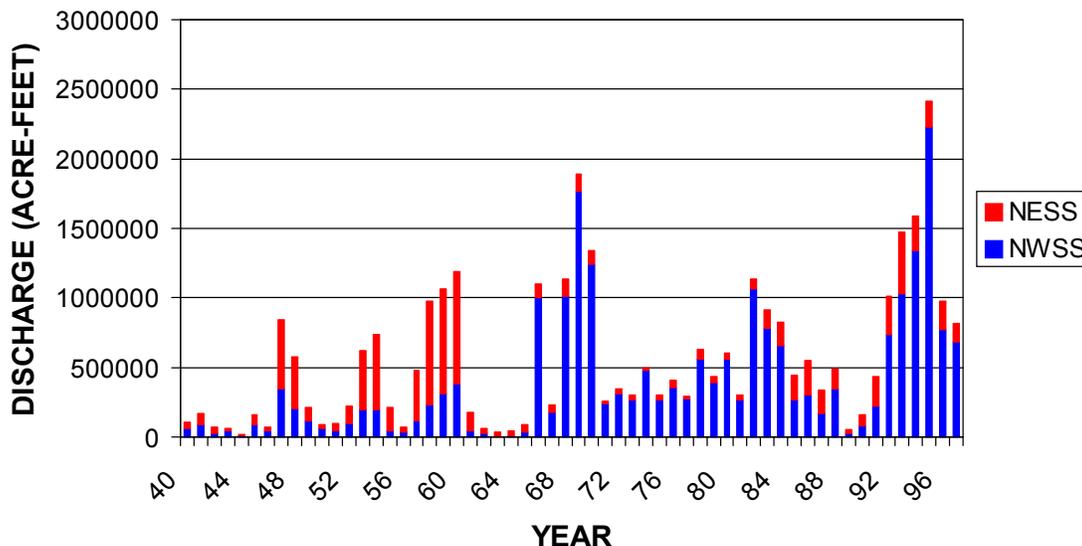


Figure 2.4. Total annual discharge to NESS and NWSS for the period of record, 1940-1997.

americanum), beakrush (*Rhynchospora* spp.), spikerush (*Eleocharis atropurpurea*), maidencane (*Panicum hemitomum*), Ludwigia (*Ludwigia repens*), primrose willow (*L. peruviana*). Information recorded from surveys conducted December 1999 identified sawgrass, arrowhead, beakrush (*R. tracyi*), spikerush, various bladderworts (*Utricularia* sp.), panic grass (*Panicum tenerium*), saltmarsh aster (*Aster tenuifolia*), bluestem (*Schizachrium* sp.), goldenrod (*Solidago* sp.), and pickerel weed (*Pontederia* sp.) in long hydroperiod graminoid wet prairies.

Forested wetlands consist of bayheads and willowheads. Species typical of bayheads in the study area include: red bay (*Persea palustris*), swamp bay (*Magnolia virginiana*), myrsine (*Myrsine guianensis*), wax myrtle (*Myrica cerifera*), dahoon holly (*Ilex cassine*), pond apple (*Annona glabra*), poisonwood (*Metopium toxiferum*), buttonbush (*Cephalanthus Occidentalis*), and willow (*Salix caroliniana*). Tropical hardwood species such as strangler fig (*Ficus aurea*), stopper (*Eugenia* sp.) and cocoplum (*Chrysobalanus icaca*) have established on the higher elevations with species indicative of bayheads and willowheads in the lower elevations and around the margins of the tree islands.

Along the edge of both the north and south sides of the Tamiami Trail corridor, invasive exotic species such as Brazilian pepper form a long, discontinuous and narrow (e.g. 20-foot wide) fringe.

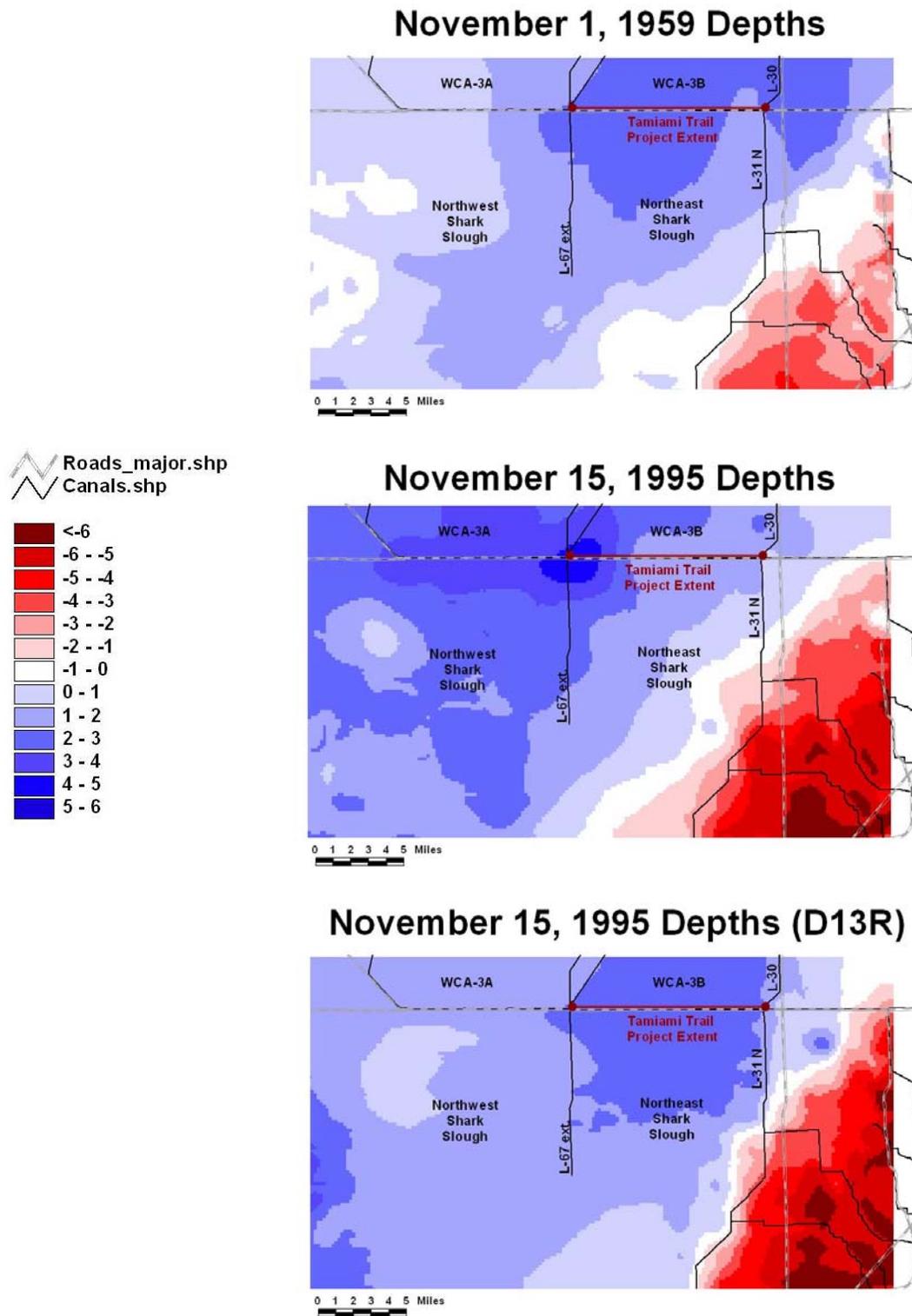


Figure 2.5. Water depth contour maps demonstrating changes in distribution of water releases across Tamiami Trail in 1959 and 1995, and under proposed restoration conditions.

Fish and Wildlife Resources

Avifauna

Avian diversity in this region of south Florida is high. Common aquatic species include double-crested cormorant (*Phalacrocorax auritus*), mottled duck (*Anas fulvigula*), anhinga (*Anhinga anhinga*), limpkin (*Aramus guarauna*), great blue heron (*Ardea herodias*), cattle egret (*Bubulcus ibis*), green heron (*Butorides striatus*), little blue heron (*Egretta caerulea*), black-crowned night heron (*Nycticorax nycticorax*), snowy egret (*E. thula*), great egret (*E. alba*), white ibis, (*Eudocimus albus*), and glossy ibis (*Plegadis falcinellus*). Common blackbirds found here include red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quiscalus quiscula*), boat-tailed grackle (*Q. major*), and brown-headed cowbird (*Molothrus ater*). Raptors found in the study area include the red-shouldered hawk (*buteo lineatus*), red-tailed hawk (*B. Jamaicensis*), marsh hawk (*Circus cyaneus*), black-shouldered kite (*Elanus caeruleus*), swallow-tailed kite (*Elanus forficatus*), turkey vulture (*Cathartes aura*), and black vulture (*Coragyps atratus*). Other common birds expected to be found along the Tamiami Trail corridor include northern cardinal (*Cardinalis cardinalis*), cedar waxwing (*Bombycilla cedrorum*), yellow-billed cuckoo (*Coccyzus americanus*), black-throated warbler (*Dendroica caerulescens*), yellow-rumped warbler (*D. Coronata*), prairie warbler (*D. Discolor*), palm warbler (*D. Pamarun*), mockingbird (*Mimus polyglottos*), house sparrow (*Passer domesticus*), rufous-sided towhee (*Pipilio erythrophthalmus*), American robin (*Turdus migratorius*), Carolina wren (*Thryothorus ludovicianus*), house wren (*Troglodytes aedon*), western kingbird (*Tyrannus verticalis*), white-eyed vireo (*Vireo griseus*), and the non-native european starling (*Sturnus vulgaris*).

Mammals

Aquatic mammals inhabiting the study area include the Everglades mink (*Mustela vison evergladensis*), river otter (*Lutra canadensis*), water rat (*Neofiber alleni*), marsh rabbit (*Sylvilagus palustris*). Terrestrial mammals include the bobcat (*Lynx rufus*), whitetail deer (*Odocoileus virginianus*), domestic dog (*Canis domesticus*), opossum (*Didelphis marsupialis*), striped skunk (*Mephitis mephitis*), house mouse (*Mus musculus*), cotton mouse (*Peromyscus gossypinus*), raccoon (*Procyon lotor*), black rat (*Rattus rattus*), hispid cotton rat (*Sigmodon hispidus*), eastern cottontail (*Sylvilagus floridanus*), and grey fox (*Urocyon cinereoargenteus*). Other mammals in the area include the nine-banded armadillo (*Dasybus novemcinctus*), eastern yellow bat (*Lasiurus intermedius*), evening bat (*Nycticeius humeralis*), rice rat (*Oryzomys palustris*), eastern mole (*Scalopus aquaticus*), spotted skunk (*Spilogale putorius*), and freetail bat (*Tadarida brasiliensis*).

Fish, amphibians, and other aquatic animals

During surveys conducted by the Wetland Rapid Assessment Procedure Team (WRAP), some small fish were recovered: least killifish (*Fundulus chrysotus*), sailfin molly (*Poecilia latipinna*), pygmy sunfish (*Elassoma evergladei*), and mosquito fish (*Gambusia* sp.). Only mosquito fish were found in abundance. One species of frog (*Hyla* spp.) was observed frequently throughout surveys within the wetlands, while leopard frogs (*Rana* spp.) were observed less frequently.

Aquatic invertebrates were abundant and representative of Everglades wetland complexes. Common invertebrates identified include: gyrenid water beetle (*Gyrinus* spp.), giant water bug (*Belostoma* sp.), mayfly (Order Ephemeroptera), water tiger (Order Coleoptera: *Dyticidae*), aquatic spiders (*Dolomedes* spp.), backswimmers (Order Hemiptera: *Corixidae*).

CHAPTER 3- NATURAL RESOURCE CONCERNS

Wetland Loss Concerns

The FWS and NPS are greatly concerned that the existing footprint of disturbance of the US 41/L-29 Canal and Levee would be widened with the implementation of those alternatives that encroach into ENP or WCA-3B. The US 41 highway/canal corridor has bisected the headwaters of Shark Slough, drastically altering hydrology and ecological connectivity. We estimate that this disturbance is approximately 400 ft wide and 11 miles long, encompassing an estimated 530 acres of historic Everglades. At the same time, this project is authorized as a restoration project, designed to restore the hydrology and ecology of ENP, and plans are underway to further restore US 41/L-29 Canal and Levee in the CERP Decompartmentalization Project currently in the planning stage. Therefore, any alternative that significantly *increases* wetland loss is viewed as contrary to both the authorized MWD restoration goals and the long-term CERP goals.

Fish and Wildlife Concerns

The four most important wildlife-related planning considerations for the Tamiami Trail Project are: 1) restoring fish and wildlife connectivity through the Tamiami Trail corridor between ENP and WCA-3B; 2) reducing wildlife highway-related mortality; 3) protecting nesting wading bird colonies, including State- and federally listed species; and 4) eliminating water quality degradation in the downstream receiving waters of ENP.

Regarding endangered wood storks, any alternative that would involve permanently moving this highway corridor into ENP would adversely affect the Tamiami West and East wood stork colonies. The Tamiami West colony is close to the highway, situated 300 feet south of the existing highway alignment in a pond apple forest. The Tamiami West Colony, in particular, is currently the largest wood stork colony in the southeast Everglades (over 1,300 wood storks, as well as other herons, egrets, and ibis nest at the colony site). Traffic noise, human disturbance, and potential mortality become factors affecting the long-term viability of these colonies. Therefore, permanent encroachment towards these colonies should be avoided.

Similarly, any alternative that permanently shifted the highway corridor to the north would result in encroachment towards endangered snail kite nesting sites. Based on recent nesting survey information, snail kite nesting is increasing in southeastern WCA-3B. This alternative would also eliminate snail kite foraging habitat. Site visits during the past three months by WRAP Team members conducting wetland functional assessments has documented snail kite foraging activity in the wetlands immediately north of the L-29 Levee. For example, on November 14, 2000, seven snail kites were observed foraging/perching within 500 feet of the L-29 Levee.

Restoring wildlife connectivity across the Tamiami Trail corridor between the ENP and the WCAs is also of major concern. The wildlife mortality survey described in this report attests to the need for protective barriers, wildlife underpasses, and land bridges over the L-29 canal to

provide connectivity for wildlife moving north and south through the study area. These wildlife features are recommended to be included as project features in the Federally Preferred Plan.

Integration with Other Modified Water Deliveries Components

As stated in the 1989 ENP Protection and Expansion Act, the primary purpose of the MWD Project is to restore, to construct modifications to the C&SF Project to improve water deliveries into ENP and shall, to the extent practicable, take steps to restore the natural hydrological conditions within the park. As stated earlier, the three components of the project are conveyance and seepage control, the 8.5 SMA, and Tamiami Trail. Since the attainment of the overall purpose of the project requires successful integration of the components, alternatives designed for Tamiami Trail must be compatible with the other two components. For this reason, the FWS and NPS evaluated the performance of each Tamiami Trail alternative for performance related to the compatibility with the other MWD project features (Other Project Objective #3, Performance Measure A). Of primary concern in the evaluation of this particular performance measure is whether the proposed alternatives are consistent with the NESS stage requirements used to identify the recommended plan for the 8.5 SMA as well as the flow requirements identified in the seepage control and conveyance hydrologic modeling.

Comprehensive Everglades Restoration Plan Compatibility

CERP is the most ambitious ecosystem-related project ever proposed. With a total cost of nearly \$8 billion, the Corps, in cooperation with the SFWMD, propose to restore the south Florida ecosystem, provide for the urban and agricultural water supply needs of the growing south Florida population, and maintain or enhance the levels of flood protection for local residents and businesses. The conceptual plan for the project that was submitted to Congress in July 1999 identified 68 individual projects that will take more than 30 years to build. These projects include: 15 above-ground reservoirs, 2 wastewater reuse plants, 330 aquifer storage and recovery wells, 3 sub-surface reservoirs, 19 stormwater treatment areas, the removal of 240 miles of existing canals and levees, and 6 pilot projects to test new engineering technologies.

The Water Resources Development Act of 2000 recently passed by Congress authorized the first series of projects to be implemented as components of the CERP. These projects are as follows:

1. Lake Okeechobee ASR – Pilot Project
2. L-31N Seepage Management – Pilot Project
3. Lake Belt In-Ground Reservoir – Pilot Project
4. Phase 1 - Everglades Agricultural Storage Reservoirs
5. Southern Golden Gate Estates Restoration Project
6. Wastewater Reuse Technology Pilot Project
7. C-111N Spreader Canal Project
8. WCA-3 Decompartmentalization Phase 1 Project
9. Water Preserve Areas Feasibility Study
10. Florida Bay Feasibility Study
11. Comprehensive Water Quality Strategy

12. Hillsboro Site I Impoundment and ASR – Pilot Project
13. Lake Okeechobee Watershed Projects
14. Caloosahatchee River Basin ASR
15. Part 1 C-43 Storage Reservoir Project

Included in Project 8, WCA-3 Decompartmentalization Phase 1 are modifications to existing structural features in WCA-3 that are also common to the MWD Project. These components are Tamiami Trail, L-67 A&C and the S-356 pump station. Decompartmentalization Phase 1 Project of CERP includes raising and bridging portions of Tamiami Trail below WCA-3B and filling portions of the Miami Canal within WCA- 3A to restore sheet flow and reduce unnatural discontinuities in the Everglades landscape. The purpose of the project is to reestablish the ecological and hydrological connection within WCA-3A and reconnect ENP with WCA-3B. Ultimately, the CERP authority will remove sheetflow obstructions through the back filling of the Miami Canal and southern 7.5 miles of the L-67A borrow canal, removal of the L-67A, L-67C, L-29, L-28, and L-28 tieback levees and borrow canals and also elevating of Tamiami Trail. By ensuring that the project features implemented in the MWD authority are consistent with the features contemplated to be implemented under the CERP authority, both the Corps and the SFWMD will maximize the use of the funds available through both project authorities. Therefore, it is prudent to develop a Federally Recommended Plan for the MWD Project that not only meets the requirements of the MWD Project but that can be readily adapted for meeting the requirements of CERP. For this reason, one of the primary objectives used in the evaluation of the Tamiami Trail alternatives was to maximize compatibility with future CERP actions (Objective 2, Performance Measures A-D).

CHAPTER 4 - PROJECT ALTERNATIVES

Alternative 1. Existing Alignment and Profile with Four New Bridges

This alternative would provide for the construction of four bridges and components of the existing Tamiami Trail to be reassembled as transitions to the new bridges (Figure 4.1). The existing section consists of two 12-ft-wide travel lanes, a 12-ft-wide shoulder on the north side, and an 8-ft-wide shoulder on the south side. With this alternative, the Tamiami Trail would have a grade transition from the nominal average 11-ft elevation to roughly 17 ft at the bridge deck. A large segment of the Tamiami Trail would remain intact.

New bridges will be built on the existing alignment, with traffic temporarily detoured to the south while bridge construction is in progress. Two of the bridges would be aligned with S-355A and S-355B, and the other two would be situated approximately midway between these structures and the east and west ends of the project, respectively. The two middle bridges would have a hydraulic width of 300 ft each, while the two outer bridges would have a hydraulic width of 425 ft each. The optimum span length for the superstructure system proposed for the permanent bridges would be around 30 ft. The substructure system for the bridges would embody 18-inch square piles. The proposed 43 ft, 1-in-wide bridge typical section for the four bridges within this alternative provides sufficient deck area for two 12-ft-wide travel lanes and 8-ft-wide shoulders on both sides of the travel lanes.

Because this alternative does not include reconstruction of the existing highway, no water quality treatment is proposed. However, Best Management Practices suitable for erosion and sedimentation controls will be provided during construction.

Existing utilities within the existing roadway corridor in the vicinity of the proposed bridges may be affected by the construction.

Staging areas for construction equipment and materials would be located near the eastern end of the corridor and at the locations of businesses along the highway. Staging and other functions would possibly require the utilization of sections of the existing shoulder for temporary periods.

Alternative 2A. Existing Roadway Alignment with Raised Profile and four New Bridges without Water Quality Treatment

Alternative 2 (Figure 4.2) would involve the modification of the existing Tamiami Trail alignment, profile, and typical section, throughout the length of the study segment and would include the construction of four new bridges to convey MWD Project flows from the L-29 borrow canal to ENP. The typical section consists of two 12-ft-wide travel lanes and 8-ft-wide shoulders on each side of the roadway. Five feet of this shoulder would be paved.

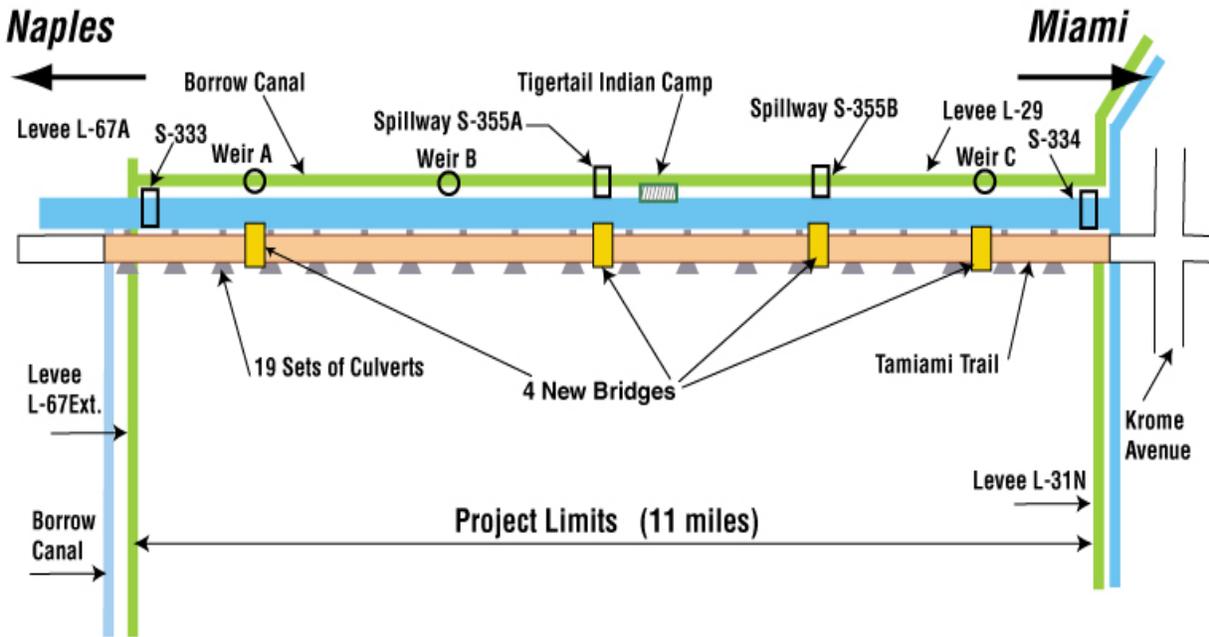


Figure 4.1. Alternative 1

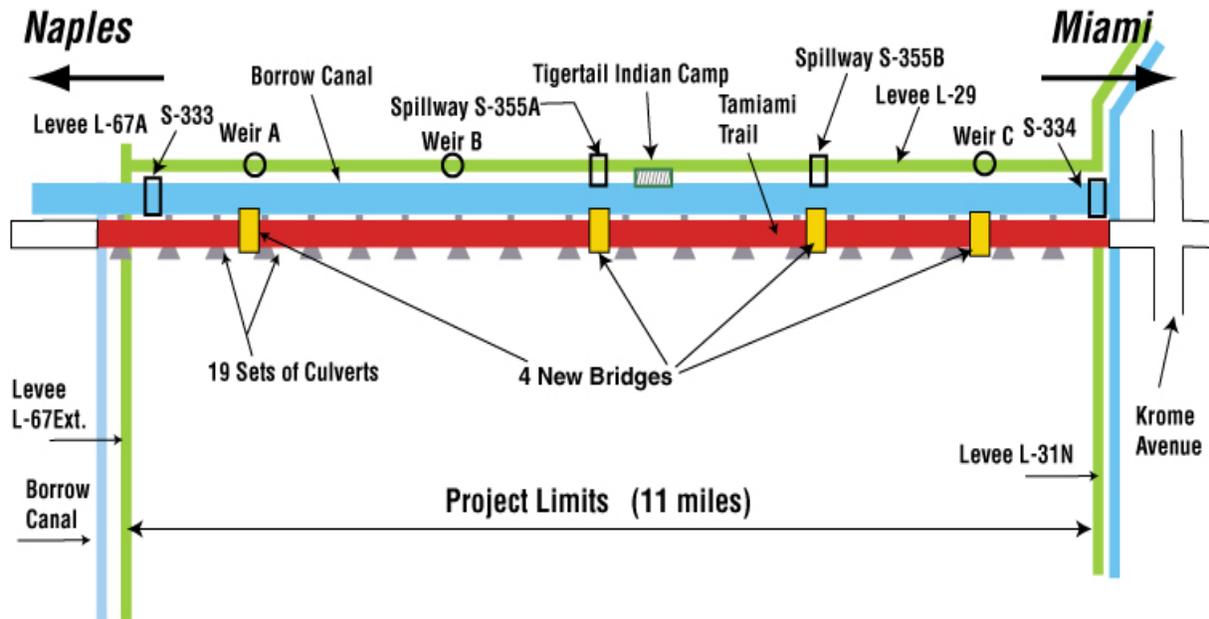


Figure 4.2. Alternative 2

The construction of the bridges would be accomplished as described for Alternative 1. Two of the bridges would be aligned with S-355A and B, and the other two would be located approximately midway between these structures and the east and west ends of the project, respectively. The two middle bridges would have a hydraulic width of 300 ft each, while the two outer bridges would have a hydraulic width of 425 ft each. The proposed 43 ft, 1-inch-wide bridge typical section for the four bridges within this alternative would provide sufficient deck area for two 12-ft-wide travel lanes, and 8-ft shoulders on both sides of the travel lanes.

Alternative 2 has been divided into two sub-alternatives (2A and 2B) to consider the treatment of highway runoff to improve water quality.

Alternative 2A would provide for the upgrading of the existing roadway to accommodate a design high water elevation of 9.3 ft and traffic for 50 years. With this approach, the existing asphalt pavement would be left intact so that it may act as a construction platform and serve as a black base. Low areas along the highway would be raised to a minimum elevation of 11.0 ft throughout the project. A 6-inch asphalt overlay would also be included. A 7-year resurfacing interval for this option would appear warranted.

Traffic flow would be maintained during construction as it exists today.

Alternative 2B. Existing Roadway Alignment with Raised Profile and four New Bridges with Water Quality Treatment

Alternative 2B would require widening the embankment footprint to provide water quality treatment facilities on each side of the roadway. With this option, the top of the pavement will be at an elevation of 14 ft, the bottom of the limerock base at an elevation of 12.75 ft, providing roughly 3.5 ft of clearance above the design high water elevation of 9.3 ft. As a precaution against capillary rise from the water table, a 4-inch granular drainage layer would be placed beneath the LBR 40 sub-base. A 12-year resurfacing interval would be recommended.

Water quality treatment would be achieved with dry linear retention facilities adjacent to the proposed roadway. The invert elevations would be set one ft above the new high control elevation of the L-29 Canal. Based on water quality treatment requirements established by Florida Department of Environmental Protection (DEP), the depth of the treatment area is estimated at 0.5 ft deep. All utilities within the proposed typical section would require relocation.

Under Alternative 2B, temporary barricades would be spaced every 50 ft at the north edge of the westbound travel lane line. In $\frac{1}{4}$ mile increments the existing guardrail would be removed and replaced with a temporary barrier wall. The existing shoulder would be removed and replaced with temporary pavement. Once completed for the entire project length, traffic would be shifted to the north, utilizing the new pavement. A 10-ft-wide strip of temporary pavement placed south of the existing centerline would allow the roadway to slope to the north at 2%. A temporary concrete barrier will be placed one ft north of the south edge of the temporary pavement. Staging areas for construction equipment and materials would possibly be located at the businesses along the corridor. Other staging areas may be necessary near the east end of the corridor.

Alternative 3A. New Roadway to the North with Eight New Bridges without Water Quality Treatment

Alternative 3 involves the construction of a new roadway with eight bridges immediately north of the L-29 levee on the north side of the Tamiami Trail (Figure 4.3). This alternative has been divided into two sub-alternatives (3A and 3B) to consider the treatment of highway runoff to improve water quality. This alternative would enable flows to be conveyed from WCA-3B across the L-29 levee to the L-29 Canal. The typical section consists of two 12-ft-wide travel lanes, and 8-ft-wide shoulders on each side of the roadway. Five feet of this shoulder would be paved. Alternative 3 will provide for a 15-ft-wide canal maintenance berm.

The eight bridges will be located:

- Over the L-29 Canal at the western end of the project.
- Over the L-29 Canal at the eastern end of the project.
- At the S-355A drainage structure.
- At the S-355B drainage structure.
- At the site of the Airboat Association of Florida.
- At the proposed Weir A location.
- At the proposed Weir B location.
- At the proposed Weir C location.

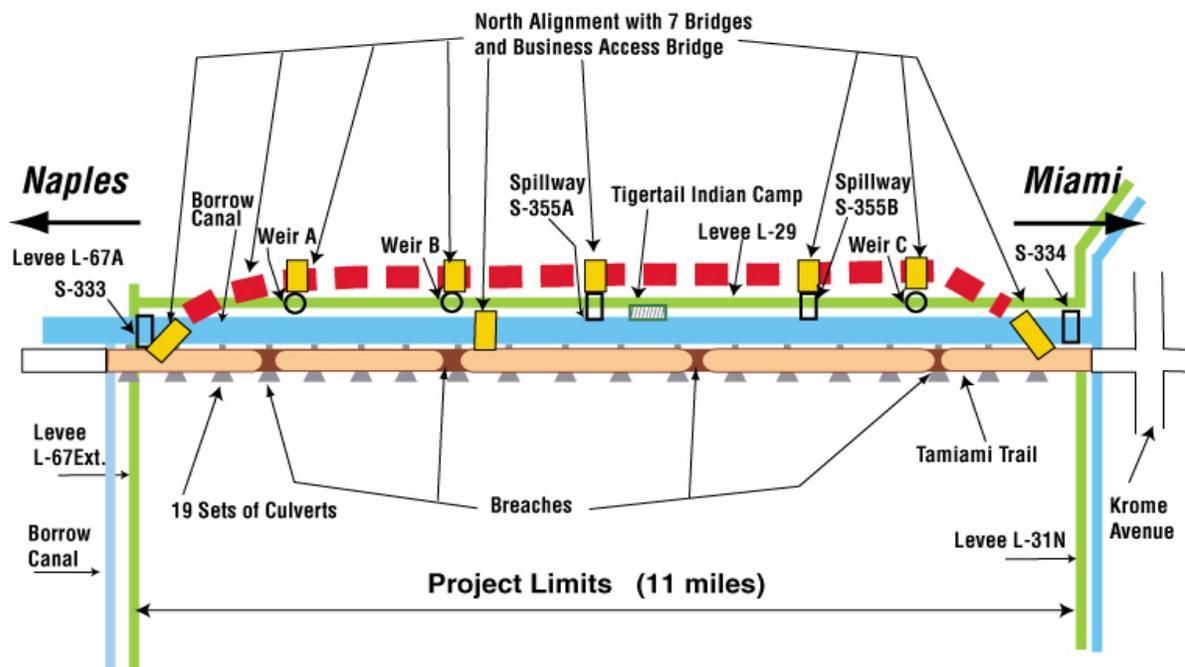


Figure 4.3. Alternative 3

The bridges would be aligned with existing S-355A and S-355B (each with flow channel bottom widths of 60 ft), and with proposed Weirs A, B, and C (200 ft, 150 ft, and 200 ft long, respectively). Bridges over the L-29 Canal near each end of the corridor would connect with the existing highway. A bridge over the canal would provide access to the site of the Airboat Association of Florida.

The proposed 43 ft, 1-inch-wide bridge typical section applies to all eight bridges to provide sufficient deck area for two 12-ft-wide travel lanes and 8 ft shoulders on both sides of the travel lanes. A proposed 35 ft, 1-in-wide bridge typical section would apply to the access bridge to the Airboat Association of Florida site and would provide sufficient deck area for two 12-ft-wide travel lanes, and 4 ft shoulders on both sides of the travel lanes.

The proposed roadway elevation would be 17.4 ft to conform to the elevation of the future Pump Station 356 tieback levee. A nominal 4-ft pavement envelope would be required, which is ample clearance above the 9.3 ft design high water elevation. A periodic resurfacing interval of 12 years would be recommended. Utility relocations would be a necessity.

Because this alternative does not retain the centerline of the existing facility, alignment transitions would be required at either end of the project limits. Traffic would be maintained as it currently exists; once a temporary transition roadway is completed, traffic would then be shifted while permanent transitions to the new roadway are constructed. Following construction of the new roadway, traffic would be shifted to the new alignment, and the existing roadway would be removed. Staging areas for construction equipment and materials would be located on the sites of the businesses along the corridor. Staging and other functions may require utilizing sections of the existing shoulder for temporary periods.

Access to the Flight 592 Memorial and the S-333 structure will be retained. The alignment would be shifted to the north to minimize impacts to the Tiger Tail Camp, S-355A, and S-355B. A portion of the existing roadway would be retained at the western end of the project area to provide access to the Osceola Camp.

The existing Tamiami Trail embankment would be breached at locations near those of the bridge locations for Alternatives 1 and 2.

Alternative 3B. New Roadway to the North with Eight New Bridges with Water Quality Treatment

Alternative 3B would have a slightly wider footprint than Alternative 3A because of the incorporation of water quality treatment, which would be achieved with dry linear retention facilities adjacent to the proposed roadway. The treatment facilities would have a control elevation of 11.5 ft and an overall depth of 1 ft. The invert elevation for the south treatment area is set 1 ft above the 8.5 ft control elevation of Canal L-29. Based on water quality requirements established by DEP, the depth of the treatment area would be estimated at 0.5-ft deep.

Alternative 4A. New Roadway to the South with Four New Bridges without Water Quality Treatment

Alternative 4 (Figure 4.4) consists of a new road constructed immediately to the south of the Tamiami Trail within the edge of the ENP. This alternative has been divided into two sub-alternatives (4A and 4B) enabling consideration of incorporating treatment of highway runoff to improve water quality.

Two bridges of Alternative 4A would be aligned with S-355A and S-355B (each with flow-channel bottom widths of 60 ft), and the other would be located approximately midway between these structures and the eastern and western ends of the project, respectively. The two middle bridges would have a hydraulic width of 300 ft each, while the two outer bridges would have a hydraulic width of 425 ft each. The existing roadway embankment would be breached at locations approximating the bridge locations for Alternatives 1 and 2. The proposed 43 ft, 1-inch-wide bridge typical section for the four bridges within this alternative provides sufficient deck area for two 12-ft-wide travel lanes and 8-ft-shoulders on both sides of the travel lanes.

The existing system of culverts would not be replaced; the culverts would be plugged with flowable fill.

Because Alignment 4A does not retain the centerline of the existing facility, alignment transitions would be required at either end of the segment. At the eastern end of the corridor, the proposed S-356 pump station, the S-334 spillway replacement and adjustments to levees and the

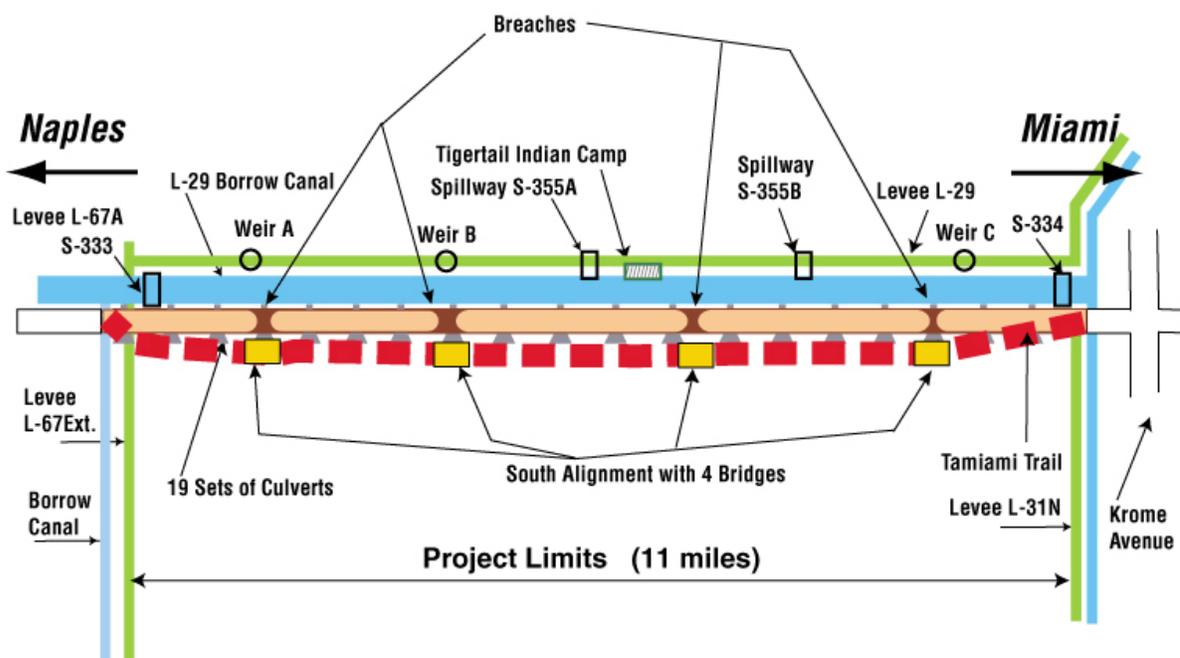


Figure 4.4. Alternative 4.

Tamiami Trail would be additional factors affecting the transition. The typical section consists of two 12-ft-wide travel lanes, and 8-ft-wide shoulders on each side of the roadway. Five feet of this shoulder would be paved.

Temporary barricades would be placed every 50 ft at the southern edge of the westbound travel lane line. In $\frac{1}{4}$ mile increments the existing guardrail would be removed and replaced with temporary barrier walls. The existing shoulder would be removed and replaced with temporary pavement. Once completed for the entire project length, traffic would be shifted to the north, utilizing the new pavement. A 10-ft wide strip of temporary pavement would be placed south of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier would be placed one ft north of the south edge of the temporary pavement.

Staging areas for construction equipment and materials may be located at the business sites along the corridor. Staging and other functions may also possibly require utilizing sections of the existing shoulder for temporary periods, as well as locations near the eastern end of the corridor.

It would be necessary to obtain rights-of-way from the Airboat Association of Florida to construct the roadway under this alignment.

Existing utilities within the corridor would be affected by the new construction.

Alternative 4B. Build New Roadway to the South with Four New Bridges with Water Quality Treatment

Alternative 4B would have a wider footprint than Alternative 4A because of the incorporation of water quality treatment, which would incorporate dry linear retention facilities adjacent to the proposed roadway. The invert elevations would be set 1 ft above the new high control elevation of Canal L-29, which is 8.5 ft. The treatment facilities would have a control elevation of 9.5 ft, and overall depth of 1 ft. Due to the proximity of the new alignment to the existing roadway, the proposed treatment facilities on the north side of the new alignment would have to be constructed in the existing embankment.

Alternative 5A. Elevated Roadway within Existing Right-of-Way without Water Quality Treatment

Alternative 5 (Figure 4.5) involves the construction of an elevated roadway generally within the right-of-way of the road. Alternative 5 has been divided into four sub-alternatives. 5A and 5B for evaluation of water quality measures and each with “Partial” and “Full” removal of the existing road.

Alternative 5A consists of a bridge that covers the entire 11-mile length of the MWD Project. At each end, there would be short reconstruction segments of the roadway to transition to the new

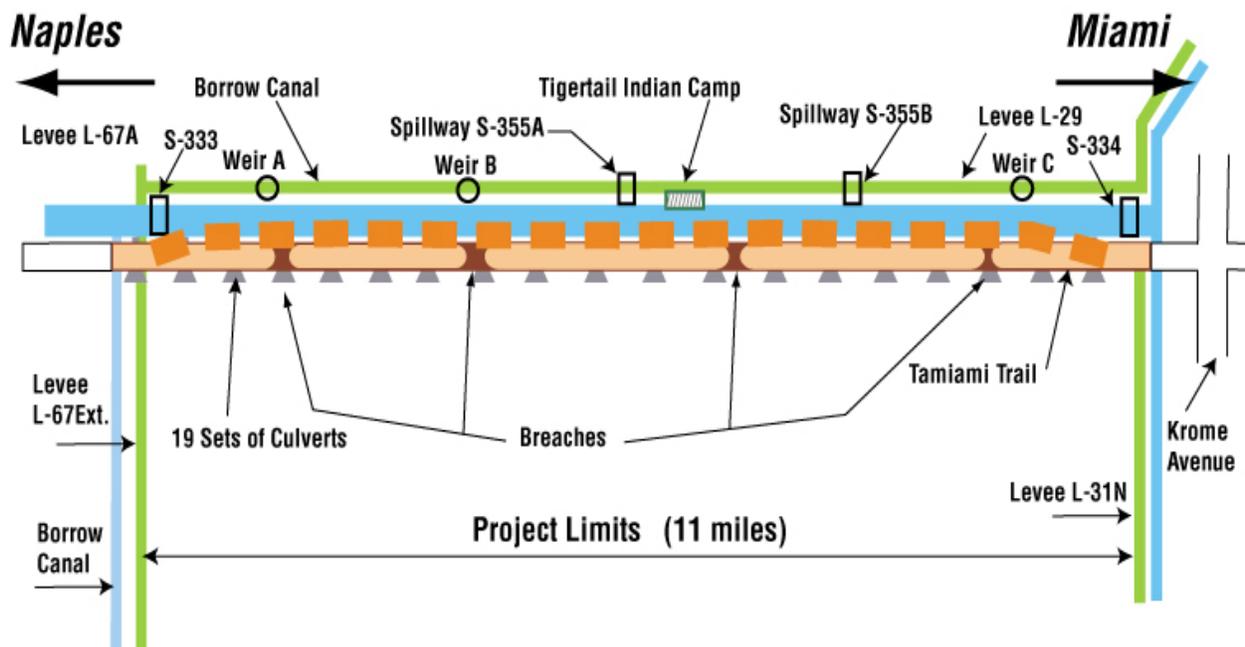


Figure 4.5. Alternative 5

bridges. The pavement would have a grade transition from the nominal average of an 11-ft elevation to about an elevation of 17 ft at the bridge deck.

The proposed 43 ft, 1-inch-wide bridge typical section would provide sufficient deck area for two 12-ft wide travel lanes and 8-ft shoulders on both sides of the travel lanes. Exceptions would occur where a surface connection for access or other reasons might be required. A 35 ft, 1-inch-wide bridge typical section would provide access to the Airboat Association of Florida and include sufficient deck area for two 12-ft-wide travel lanes, and 4-ft-wide shoulders on each side of the travel lanes. The new bridge deck would be equipped with drain scuppers that discharge directly to the area below.

For the two “Partial” sub-alternatives, the existing Tamiami Trail embankment would be breached at locations similar to the bridge locations for Alternatives 1 and 2. For the two “Full” sub-alternatives, the full 10.7 miles of the existing road would be removed to allow unrestricted flow beneath the new elevated highway.

This alignment would be positioned to minimize impact and construction cost and to facilitate maintenance of traffic during construction. The alternative would require only a modest alignment transition at either end of the segment.

Temporary barricades would be placed every 50 ft at the southern edge of the westbound travel lane line. In ¼-mile increments the existing guardrail would be removed and replaced with temporary barrier wall. The existing shoulder would be removed and replaced with temporary pavement. Once completed for the entire project length, traffic would be shifted to the south, utilizing the new pavement. A 10-ft-wide strip of temporary pavement would be placed north of the

existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier would be placed 1 ft north of the southern edge of the temporary pavement. The bridge would then be constructed. Staging areas for construction equipment and materials may be located at the sites of the businesses along the corridor. Staging and other functions would also possibly require utilizing sections of the existing shoulder for temporary periods. Staging areas may be necessary near the eastern end of the corridor.

Connecting roads would provide temporary access to the Airboat Association. Temporary access to the Osceola Camp would be accomplished via a connecting road from the west. Turning lanes may be needed at these locations.

Existing utilities would be affected by the new construction.

Alternative 5B. Elevated Roadway within Existing Right-of-Way with Water Quality Treatment

Alternative 5B includes the same alignment as described in Alternative 5A, but also incorporates water quality treatment. Piping would convey highway runoff to dry retention swales constructed on adjacent segments of the abandoned roadway embankment. Swales would be approximately 600 ft long and spaced at ½ mile intervals; there would be approximately 22 within the corridor. Maintenance of swales would be provided by workers using lightweight equipment transported by boat. Under the “Partial” sub-alternative, culverts under the existing roadway embankment would be unaffected by new construction except for breaches for water flow and would be left in place. Under the “Full” sub-alternative, the old road would be removed except for “islands” which would remain to serve as dry retention areas for water quality treatment.

Alternative 6A. Existing Alignment Raised Profile with 4-Mile Structure without Water Quality treatment

Alternative 6 (Figure 4.6) is a hybrid between Alternative 5: New Alignment on Structure for the entire 11-mile project limits and Alternative 2: Existing Alignment with Raised Profile and Four New Bridges. It is defined as modifying the existing Tamiami Trail embankment with a modified profile and typical section and the construction of a bridge similar to that for Alternative 5 with a length of approximately 4 miles to convey MWD Project flows from the L-29 Borrow Canal to ENP. The bridge would begin at the Blue Shanty Canal about 3 miles from the west end of the corridor, and would extend just to the east of the Coopertown Canal.

Consideration may be given to including various wildlife features as part of this alternative. Were they to be included, the wildlife underpasses and land bridges over the L-29 Canal could be constructed in the embankment to the east and west ends of the four-mile bridge. The underpasses consist of an approximately 50-ft-long concrete slab bridge placed in the highway alignment. The land bridges consist of a 24-ft-wide concrete bridge with 2 ft of soil spread on its surface for vegetation to grow. Fencing would be needed on each side of the 2 underpasses to funnel wildlife to the underpasses.

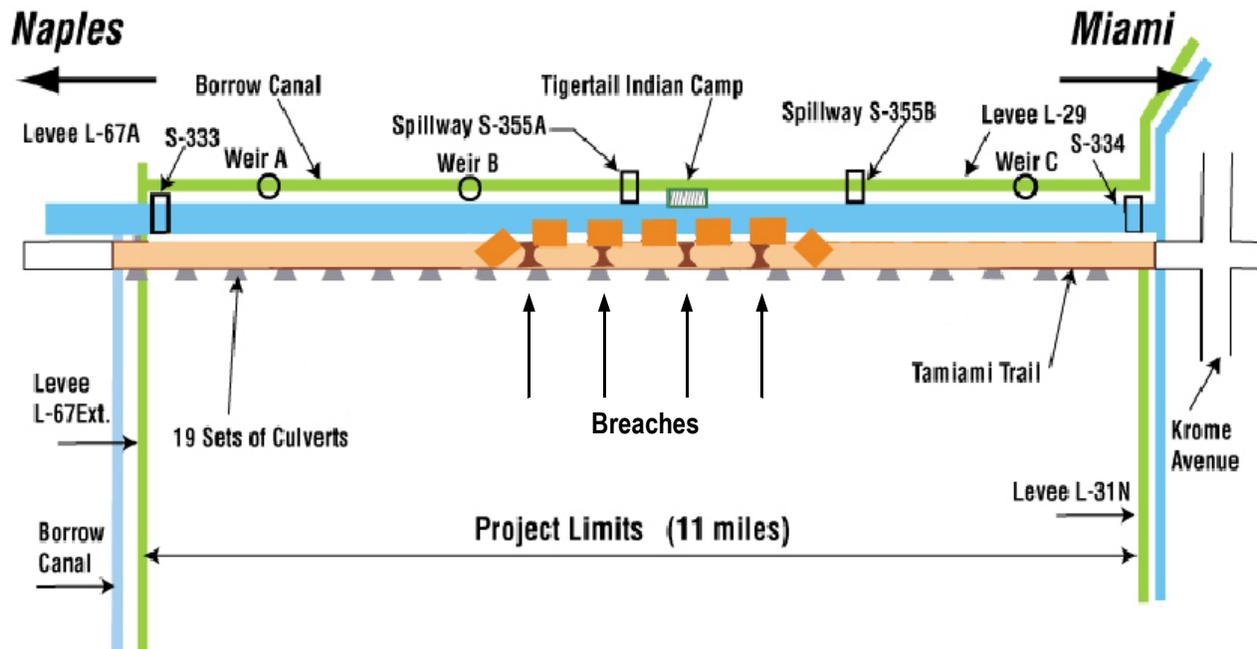


Figure 4.6. Alternative 6

The existing Tamiami Trail embankment profile and typical section would be modified for approximately 3 miles at the western end of the project and approximately 4 miles at the eastern end of the project. The centerline of the roadway may be adjusted southward to avoid encroachment into the L-29 Borrow Canal. Eight box culverts would be strategically placed in areas where the natural slough crosses Tamiami Trail to enhance the natural, historic sheet flow.

For Alternative 6A, where there is no water quality treatment, the centerline of this alignment would fall very close to the centerline of the existing facility. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor. As part of this option, the existing drainage culverts would be retained and extended 55 ft to connect through the widened typical section.

The bridge portion of this alternative is defined as reconstruction of approximately 4 miles of the Tamiami Trail alignment as an elevated structure. The alignment would be positioned to minimize impact and construction cost, and to facilitate maintenance of traffic during construction. The profile would be established per the applicable drift, maintenance and navigation bridge clearance. This alternative requires only a modest alignment transition at either end of the bridge.

The existing Tamiami Trail embankment would need to be breached at four evenly spaced locations along the four-mile bridge totaling about 1,500 ft in length. The bridge typical section would be standard the entire length, with two travel lanes of 12 ft, two shoulders of 8 ft, and out-

side barrier shapes. Exceptions would occur where a surface connection for access or other reasons might be required; at these locations turning lanes might be needed.

For Alternative 6A, the new bridge deck would be equipped with drain scuppers that would discharge directly to the area below

Alternative 6B. Existing Alignment Raised Profile with 4-Mile Structure with Water Quality treatment

Alternative 6B requires widening the embankment footprint to provide water quality treatment facilities on each side of the roadway. The centerline of the alignment would fall approximately 27 ft to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road.

Piping would convey runoff to dry retention facilities constructed on adjacent segments of the abandoned existing roadway embankment. These swales would be approximately 600 ft long and spaced at ½ mile intervals, such that there would be approximately seven of them adjacent to the bridge. These would require maintenance to be provided by workers using lightweight equipment transported by boat.

Alternative 7A. Raised Profile with 3000-ft Structure without Water Quality Treatment

Alternative 7 (Figure 4.7) is a hybrid between the New Alignment on Structure for the entire 11-mile project limits (Alternative 5) and the existing alignment with Raised Profile (Alternative 2). It is defined as modifying the existing Tamiami Trail profile and typical section at the beginning and end of the study segment, and the construction of a bridge with a span of approximately 3,000 ft to convey MWD Project flows from the L-29 Borrow Canal to ENP. The bridge would begin approximately 1 mile from the west end of the corridor.

Consideration may be given to including various wildlife features as part of this alternative. Were they to be included, the wildlife underpasses and land bridges over the L-29 Canal could be constructed in the embankment to the east and west ends of the 4-mile bridge. The underpasses consist of an approximately 50-ft-long concrete slab bridge placed in the highway alignment. The land bridges consist of a 24-ft-wide concrete bridge with 2 ft of soil spread on its surface for vegetation to grow. Fencing would be needed on each side of the 2 underpasses to funnel wildlife to the underpasses.

The existing Tamiami Trail profile and typical section would be modified for approximately 1 mile at the western end of the project and approximately 9.4 miles to the east of the bridge. The centerline of the roadway may be adjusted southward to avoid encroachment into the L-29 Borrow Canal. Existing box culverts will be retained for the Without Water Quality Treatment option, and would be plugged or removed in the With Water Quality Treatment option.

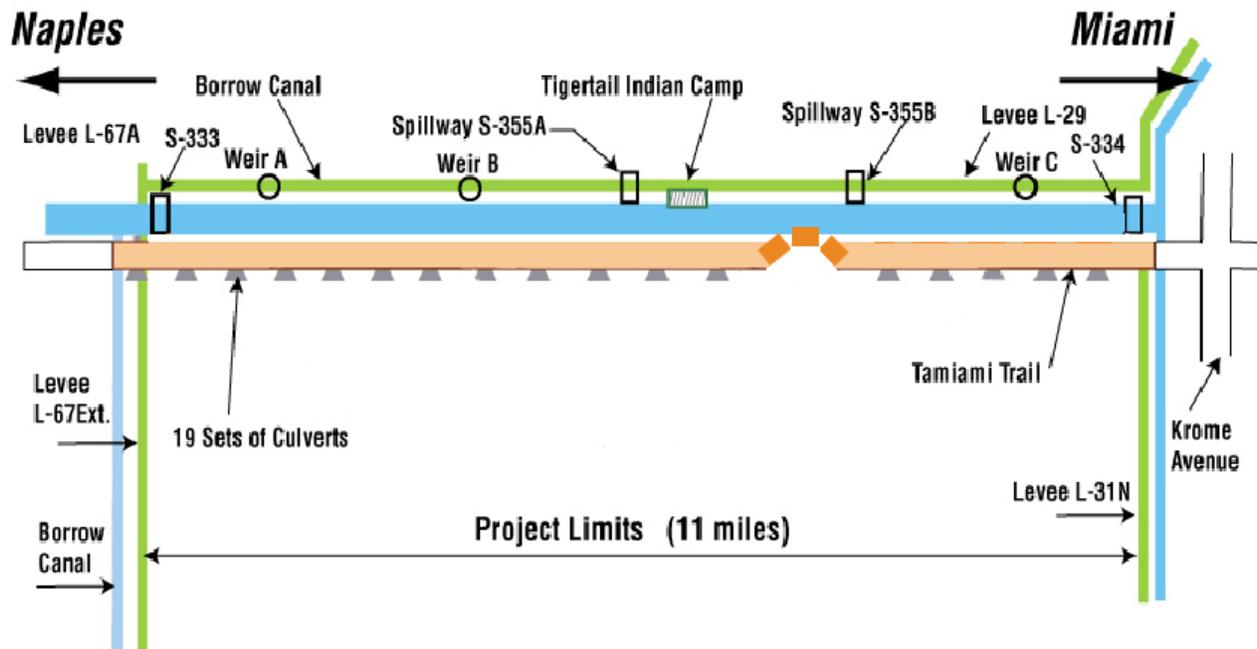


Figure 4.7. Alternative 7

For Alternative 7A where there would be no water quality treatment, the centerline of this alignment would fall very close to the centerline of the existing facility. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

The bridge portion of this alternative is defined as reconstruction of approximately 3,000 ft of the Tamiami Trail alignment as an elevated structure. The alignment would be positioned to minimize impact and construction cost, and to facilitate maintenance of traffic during construction. The profile would be established per the applicable drift, maintenance and navigation bridge clearance. This alternative requires only a modest alignment transition at either end of the bridge.

The existing Tamiami Trail embankment would be removed adjacent to the 3,000-ft-long bridge. The bridge typical section would be standard the entire length, with two travel lanes of 12 ft, two shoulders of 8 ft, and outside barrier shapes. Exceptions would occur where a surface connection for access or other reasons might be required; at these locations turning lanes might be needed.

For Alternative 7A, the new bridge deck would be equipped with drain scuppers that would discharge directly to the area below.

Alternative 7B. Raised Profile with 3000-ft Structure with Water Quality Treatment

This alternative requires widening the embankment footprint to provide water quality treatment facilities on each side of the roadway. For Alternative 7B, the centerline of the alignment would fall approximately 27 ft to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

Piping would convey runoff to dry retention facilities at either end of the bridge. These facilities would be approximately 600 ft long and spaced at ½-mile intervals, such that there would be approximately two of them adjacent to the bridge. These would require maintenance to be provided by workers using lightweight equipment transported by boat. By definition for this alternative, 3,000 ft of existing roadway embankment adjacent to the bridge would be breached and removed for hydraulic flow.

Alternative 8A. Existing Alignment with Raised Profile and Box Culverts without Water Quality Treatment

Alternative 8 (Figure 4.8) is defined as modifying the existing Tamiami Trail profile and typical section throughout the length of the study segment, and the construction of new box culverts to convey MWD Project flows from the L-29 Borrow Canal to ENP. The box culverts will be 5-ft-high by 10-ft-wide (inside dimensions) with an invert elevation of 3.0 ft. They would be installed throughout the roadway alignment and would extend through the embankment to ensure that flow is not impeded. For Alternative 8a the existing culverts are left in place and 24 new box culverts would be constructed .

Consideration may be given to including various wildlife features as part of this alternative. Were they to be included, the wildlife underpasses and land bridges over the L-29 Canal could be constructed in the embankment to the east and west ends of the 4-mile bridge. The underpasses consist of an approximately 50-ft-long concrete slab bridge placed in the highway alignment. The land bridges consist of a 24-ft-wide concrete bridge with 2 ft of soil spread on its surface for vegetation to grow. Fencing would be needed on each side of the 2 underpasses to funnel wildlife to the underpasses.

For Alternative 8A the centerline of this alignment would fall very close to the centerline of the existing facility. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

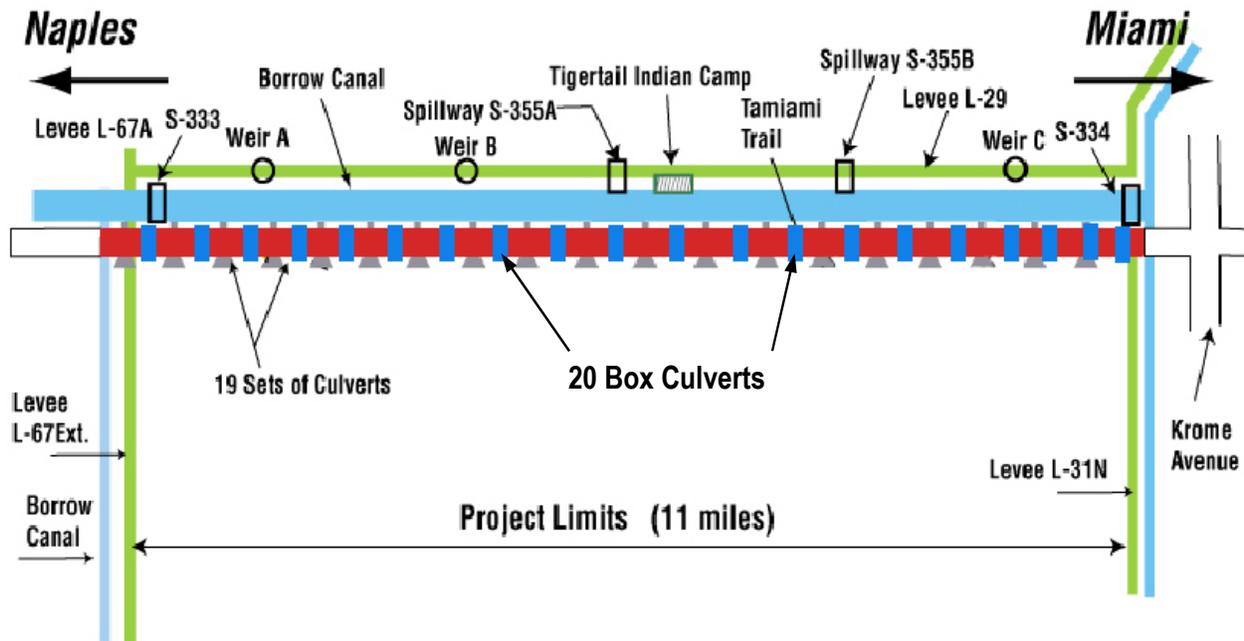


Figure 4.8. Alternative 8

Alternative 8B. Existing Alignment with Raised Profile and Box Culverts with Water Quality Treatment

For Alternative 8B, 40 box culverts are required and the existing culverts would be removed from the embankment. The centerline of the alignment would fall approximately 27 ft to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

Alternative 9A. Raised Profile with 2.7-mile Structure without Water Quality Treatment

Alternative 9 (Figure 4.9) is a hybrid between the New Alignment on Structure for the entire 11-mile project limits (Alternative 5) and the Existing Alignment with Raised Profile (Alternative 2). It is defined as modifying the existing Tamiami Trail profile and typical section at the beginning and end of the study segment, and the construction of a bridge with a span of approximately 2.7 miles to convey MWD Project flows from the L-29 Borrow Canal to ENP. The bridge would begin at the Blue Shanty Canal about 4.3 miles from the west end of the corridor, and would extend just to the east of the Coopertown Canal.

Consideration may be given to including various wildlife features as part of this alternative. Were they to be included, the wildlife underpasses and land bridges over the L-29 Canal could be constructed in the embankment to the east and west ends of the four-mile bridge. The underpasses consist of an approximately 50-ft-long concrete slab bridge placed in the highway align-

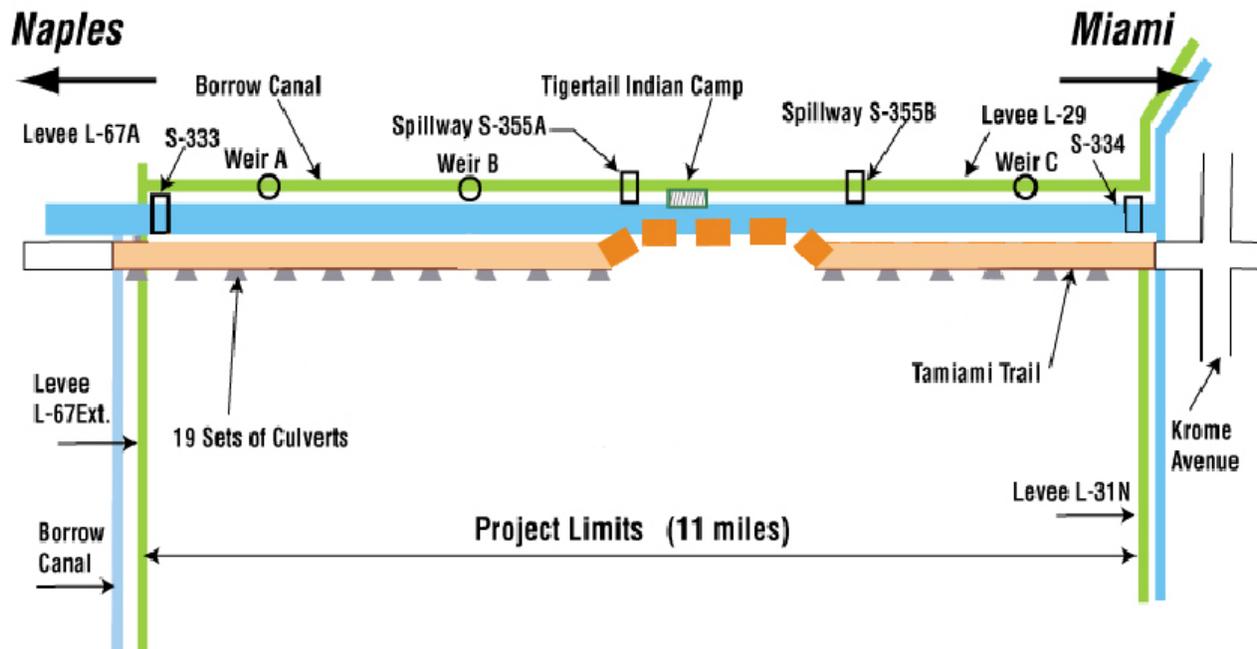


Figure 4.9. Alternative 9

ment. The land bridges consist of a 24-ft-wide concrete bridge with 2 ft of soil spread on its surface for vegetation to grow. Fencing would be needed on each side of the 2 underpasses to funnel wildlife to the underpasses.

The existing Tamiami Trail embankment profile and typical section would be modified for approximately 4.3 miles at the western end of the project and approximately 4 miles at the eastern end of the project. The centerline of the roadway may be adjusted southward to avoid encroachment into the L-29 Borrow Canal. Eight box culverts would be strategically placed in areas where the natural slough crosses Tamiami Trail to enhance the natural, historic sheet flow.

For Alternative 9A where there would be no water quality treatment, the centerline of this alignment will fall very close to the centerline of the existing facility. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

The bridge portion of this alternative is defined as reconstruction of approximately 2.7 miles of the Tamiami Trail alignment as an elevated structure. The alignment would be positioned to minimize impact and construction cost, and to facilitate maintenance of traffic during construction. The profile would be established per the applicable drift, maintenance and navigation bridge clearance. This alternative requires only a modest alignment transition at either end of the bridge.

The existing Tamiami Trail embankment would be removed adjacent to the 2.7-mile-long bridge. The bridge typical section would be standard the entire length, with two travel lanes of

12 ft, two shoulders of 8 ft, and outside barrier shapes. Exceptions would occur where a surface connection for access or other reasons might be required; at these locations turning lanes might be needed.

For Alternative 9A, the new bridge deck would be equipped with drain scuppers that would discharge directly to the area below.

Alternative 9B. Raised Profile with 2.7-mile Structure with Water Quality Treatment

This alternative requires widening the embankment footprint to provide water quality treatment facilities on each side of the roadway. For Alternative 9B, the centerline of the alignment would fall approximately 27 ft to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

Piping would convey runoff to dry retention facilities at either end of the bridge. These facilities would be approximately 600 ft long and spaced at ½-mile intervals, such that there would be approximately 7 of them adjacent to the bridge. These would require maintenance to be provided by workers using lightweight equipment transported by boat. By definition for this alternative, 2.7 miles of existing roadway embankment adjacent to the bridge would be removed for hydraulic flow.

Bridge Alignment Alternatives

The construction of the proposed bridges as described in the proposed alternatives would be performed in one of three ways.

Bridge Option 1

Under Bridge Option 1, new bridges would be built to the south of the existing road. Analysis showed this option be the most cost-effective. Two reverse curves in the alignment at every bridge would be introduced.

Bridge Option 2

Under Bridge Option 2, new bridges would be built on the existing alignment with a temporary detour to the south. This option is less cost-effective than the previous option. Alignment curvatures and permanent wetland disruption would be avoided.

Bridge Option 3

Under Bridge Option 3, new bridges would be built on the existing alignment with temporary detour to the north (in the L-29 Canal). This option would avoid temporary impact to wetlands south of the road but requires a costly detour on structural elements located north of the existing road. This option would constitute over \$52 million of the total project cost.

Water Quality Treatment Alternatives

Alternatives 2B, 3B, 4B, and 5B incorporate dry retention systems on both sides of the roadway for the treatment of highway runoff. This type of system is relatively simple to build and maintain. However, in consideration of the wide footprint required for dry retention and the impacts to ENP wetlands, additional water quality treatment options were identified and evaluated.

Option 1: Shifting and/or Compressing the Roadway Section.

This option entails shifting the typical section of Alternative 2B to the north. In conjunction with this modification, the resulting encroachment into the L-29 Canal would be accommodated by widening the canal to the north, or by using vertical wall sections in two different configurations to reduce the width of the typical section in the area of the dry retention swales. Sub-alternatives for this option are described in detail in sections 5.10.2 - 5.10.4.

Option 1-A: Shift Alignment and Compress Swale With Wall Elements/South Side

In this option, the typical section would be compressed by installing a wall system on the southern side of the roadway that would reduce encroachment into ENP wetlands without any encroachment into the L-29 Canal. The construction of a reinforced wall along the south side of the existing roadway would minimize the extent of this encroachment, and the dry retention area is compressed between the reinforced wall and a short gravity wall.

The existing pavement, sub-grade, fill, and muck would be removed totally and back-filled with appropriate fill to the bottom of the sub-grade. A double wall section on the south side would provide a 5-ft-wide dry retention area. The placement of this walled section on the south side provides adequate space on the north side for a 5-ft-wide dry retention area with standard reinforced side slopes. Runoff from the south side of roadway would enter the south side swale through barrier wall inlets, whereas runoff from the north side would sheet flow into the north side retention area. The bottom elevation of the swales would be 9.5 ft, one ft above the high water level control elevation.

Construction of this alternative would require that traffic lanes be shifted to the north and a temporary wall system be installed adjacent to the roadway on the south side. The remaining existing embankment on the south side would then be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of the new roadway. Traffic would be shifted to the new roadway,

and the northern portion of the roadway would be excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration.

The additional profile elevation affects the section width, which would be 29 ft less than Alternative 2B. This option does not encroach into the hydraulic capacity of the L-29 Canal.

Option 1-B: Shift Alignment and Compress Swale with Wall Elements/North Side (Alt. 2D)

In this option, the typical section would be compressed by installing a wall system that would encroach into the L-29 Canal sufficiently so that there would be no encroachment into the wetlands of ENP on the south side of the roadway. The construction of a reinforced wall along the north side of the existing roadway entails the placement of piles and concrete panels in the L-29 Canal at an elevation near the bottom of the canal.

The existing pavement, sub-grade, fill, and muck would be removed totally and back-filled with appropriate fill to the bottom of the sub-grade. A double wall section is proposed on the north side providing a 5-ft-wide dry retention area. The placement of this walled section on the north side provides adequate space on the south side to provide again a 5-ft-wide dry retention area with standard reinforced side slopes. Runoff from the north side of the roadway would enter the north side swale through barrier wall inlets, whereas runoff from the south side would sheet flow into the south side retention area. The bottom of the swales would be the same as for Alternative 2B - With Water Quality Treatment (Dry Retention Swales), which is an elevation of 9.5 ft, one ft above the high water level control elevation of 8.5 ft.

Construction for this alternative would require that the traffic lanes are shifted to the north and a temporary wall system is installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

This option does encroach into the L-29 Canal, removing about 200 square ft of flow area. This loss can be compensated for by removal of a like area along the northern bank of the canal or by deepening the canal.

Option 1-C: Shift Typical Section North into L-29 Canal (Alt. 2E)

In this option, the typical section would be shifted northward, encroaching approximately 50 ft into the L-29 Canal. The southern bank of the canal would be filled in, and the northern bank of the canal would require excavation.

While this is conceptually feasible, there are several issues associated with it. First, because the canal is approximately 100-ft-wide, the 50 ft of encroachment and resulting excavation would consume most of the maintenance road to the north of the canal. It may be possible to excavate the lower portion of this replacement widening at a steeper slope to replace the lost hydraulic capacity. This would allow for a relocated canal maintenance road and would permit the telephone and fiber optic utilities to remain in place.

Another issue is the method for filling in the canal so that sufficient load capacity is achieved and that the fill is stable. It may be necessary to use the construction method noted for Option 1-B wherein a concrete panel wall is constructed to contain the fill material. This approach would also reduce the lost cross-sectional area in the canal and require less excavation to the north. However, this wall system would significantly increase the cost of the solution.

Other issues associated with this concept are preserving the required canal section in the vicinity of the Tiger Tail Camp, at the recreational area at structures S-355A and S-355B, and at the site of the four proposed weir structures. In these areas, several solutions could be considered. The roadway section could be shifted to the south to avoid impacts, but shifting to the south would encroach into ENP. Also, such offsets could result in an unacceptably “wavy” alignment with safety implications. It appears that if the extent of canal excavation is reduced from 50 ft to 25-30 ft, then the existing and future water control structures would not be affected.

Another solution would be to place the roadway on structure in these areas over the canal. However, considering the lengths involved, this would add considerable costs.

If impacts to water control structures are avoidable, then a compromise would be to shift the alignment at the Tiger Tail Camp and the eastern recreational area and incur some wetlands impact. A total distance of about 3,500 ft of the roadway would encroach into the wetlands in each of these areas, with the extent of the encroachment ranging up to 59 for Alternative 2B. This would yield a wetland impact of 2.7 acres per location or a total of 5.4 acres.

Construction of this alternative would require that the traffic lanes are shifted to the south within the existing roadway and a temporary wall system installed adjacent to this roadway on the north side. The remaining existing embankment on the north side would then be removed and the new embankment installed in this area and in the canal up to the elevation of the existing road. The existing pavement, sub-grade, fill, and muck would be removed and backfilled with appropriate fill to the bottom of the sub-grade.

This step would be preceded by the placement of the wall system in the canal, if that were determined to be necessary. The temporary wall system would be extended upward to allow the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the south portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. There is a cost premium associated with this phasing scheme because of the roadway elevation differentials and the need for the temporary wall.

This option encroaches into the hydraulic capacity of the L-29 Canal, removing about 900 square ft of flow area.

For the configuration where the canal fill is not contained by a wall, and a like area is excavated from the north bank, the estimated cost for this alternative is \$73,917,450 for the length of the corridor. This would be a \$15,366,800 addition to the cost of Alternative 2B. It is also assumed that the water control structures would not be affected and that the alignment would be shifted at the other two locations. These cost estimates do not include relocation of utilities on the levee or a wall system for retaining fill on the south bank of the canal.

Option 2: Exfiltration Trenches With Curb and Gutter

The second option is to use an exfiltration trench below the roadway, with roadway runoff routed from a curb and gutter section with inlets spaced every 200 ft. The exfiltration trench would be comprised of an 18-inch perforated pipe surrounded by coarse aggregate and extending for the length of the corridor, less the bridge sections, on both sides of the roadway.

The concept would allow the collected runoff in the pipe to infiltrate into the surrounding aggregate and dissipate into the adjacent fill material. The trench will have an envelope of filter fabric to prevent the introduction of sand into the rock trench. This option does require the invert of the exfiltration trench pipe to be above the design high water elevation of the L-29 Canal, which is elevation 9.3 ft. As such, the profile of the roadway would need to be approximately two ft higher than that of Alternative 2B, or a centerline elevation of 16.0 ft.

The additional profile elevation affects the section width, but requires 17 to 27 ft less width (without and with stabilized side slopes respectively) than Alternative 2B, for a net impact of 23 to 33 ft of wetland impact. This is in comparison to 50 ft of impact for the original Alternative 2B with dry retention.

Construction of this alternative would require traffic lanes to be shifted to the north and a temporary wall system installed adjacent to the southern side of the roadway. The remaining embankment on the south side would then be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the northern portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for a temporary wall.

The estimated cost for this alternative is \$76,116,250 for the length of the corridor. This is a \$17,565,600 additive to the cost of Alternative 2b.

Option 3: Exfiltration Trenches With Shoulder Gutter

A third option is to use an exfiltration trench below the roadway, with roadway runoff routed from a shoulder gutter section with inlets spaced every 200 ft. As for Option 2, the exfiltration trench would be comprised of an 18 inch perforated pipe surrounded by coarse aggregate and extending for the length of the corridor, less the bridge sections, on both sides of the roadway. The collected runoff would infiltrate from the pipe into the surrounding aggregate and dissipate into the adjacent fill material. The trench would have an envelope of filter fabric to prevent the introduction of sand into the rock trench. This option requires the invert of the exfiltration trench pipe to be above the design high water elevation of the L-29 Canal, which is elevation 9.3 ft. The profile of the roadway would be at a centerline elevation of 16.0 ft, approximately two ft higher than for Alternative 2B.

The additional profile elevation affects the section width, but requires 17 to 27 ft less width (without and with stabilized side slopes respectively) than Alternative 2B, for a net impact of 23 to 33 ft of wetland impact. This is in comparison to 50 ft of impact for the original Alternative 2B.

Construction of this alternative would require the traffic lanes to be shifted to the north and a temporary wall system installed adjacent to the southern side of the roadway. The remaining existing embankment on the south side would then be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the northern portion of the roadway excavated and reconstructed to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

The estimated cost for this alternative is \$76,394,750 for the length of the corridor. This is a \$17,844,100 additive to the cost of Alternative 2B.

Option 4: Wet Detention System

Utilizing a wet detention system requires the treatment of one inch of runoff from the contributing area in contrast to a dry retention system, where the treatment volume is equal to 1/2 inch of runoff. It also requires a wider footprint than the dry retention design, because the control elevation would be at the control elevation of the L-29 Canal rather than one ft above the control elevation. A minimum depth of 2 ft is proposed below the control elevation for deposition of sediments. Wet detention systems typically require a minimum width of 100 ft at the control elevation and an average depth between 6 and 8 ft, which would require a wider footprint. Incorporating a wet detention system would require a variance from the standard typically required for this type of treatment.

As depicted in the schematic in a narrow footprint, this option would require a distance of 55 ft beyond the edge of the shoulder. The dry retention system as originally proposed requires 35 ft.

Even if stabilized slopes were employed, the wet retention option would have slightly more impact as the dry retention technique. Alternative 2B has a 50-ft wetland impact with natural slope grading; the wet detention technique with similar slope treatment would add 40 ft of impact, for a total impact of 90 ft.

The estimated cost for this alternative is essentially unchanged from the cost of Alternative 2B, \$58,550,650. The fill areas associated with each are nearly the same.

Option 5: Single Dry Retention Area System

In this option, there would be a dry retention area on only one side of the roadway. This single area would retain the standard 5-ft width. Drainage from the side of the roadway without treatment would be channeled via a shoulder gutter and gutter inlets and piped under the roadway to the dry retention area.

The roadway would require raising approximately 2.5 ft to accommodate an inlet and a connecting pipe. While this eliminates a retention area on the north side of the roadway, the retention area on the south side of the road is approximately 0.5 ft deeper and the side slopes of the roadway are wider due to the additional 2.5 ft of elevation. The net effect is that this footprint is 122-ft-wide, while that for Alternative 2B is 112-ft-wide, for an increased width of 10 ft.

If the dry retention area were constructed on the northern side of the road, the result would be similar. The new alignment must be offset from the canal by a minimum amount to accommodate maintenance of traffic requirements, and if the typical section is compressed sufficiently, then this maintenance of traffic criterion governs.

The construction cost for this option would be slightly greater than Alternative 2B because of the stormwater piping and gutter system. The estimated cost for this alternative is \$67,015,550 for the length of the corridor. This is an \$8,464,900 additive to the cost of Alternative 2B.

CHAPTER 5 - HYDROLOGIC IMPACT EVALUATION

Introduction

The Tamiami Trail component of the MWD Project is necessary to provide a more natural distribution of flow in Shark Slough. When ENP was created in 1947, a significant portion of the NESS, was not included in the authorization. The water supply for the ENP was thus constrained to the western portion of NESS. Since the 1960's, protection of the developed areas to the east has intensified the effort to confine flows to the west by releasing water to ENP through the S-12 structures west of the L-67 levees. As a result of this management strategy, NESS has experienced unnaturally low water levels and short hydroperiods while NWSS has been unnaturally wet. This condition has adversely affected the vegetative and wildlife communities in both areas.

The ENP Protection and Expansion Act of 1989 was a result of the realization that rehydration of NESS is critical to the viability of the ecosystem as a whole. Congress authorized the DOI to acquire these lands and directed the Corps in consultation with the Secretary of the Interior to "improve delivery of water into Everglades National Park and, to the extent practicable, restore the natural hydrologic conditions within Everglades National Park." (1989 ENP Protection and Expansion Act – Section 410r-8a (1)). The MWD Project was proposed to provide the necessary changes in the conveyance systems to accomplish the restoration directive.

The restoration effort associated with the MWD Project will provide a more natural spatial and temporal distribution of stages and flows in Shark Slough. Modifications to the 10.7-mile section of Tamiami Trail between S-333 and S-334 are a critical element of this project. These modifications are necessary because the existing road bed would be degraded to the point of failure by the higher water levels proposed, and because the road obstructs the proposed increases in flow to NESS. The sole objective of this component is to identify a road design that is compatible with the restoration goals of the MWD Project. The operations required to achieve these goals will be provided by the Combined Structural and Operation Plan, for the MWD and C-111 projects. However, the structural features of the selected Tamiami Trail alternative will impose an upper limit on the operational stages in L-29.

This section will present the hydrologic analysis of the proposed alternatives for Tamiami Trail. Ecosystem restoration in general, and specific design considerations are discussed. Historical analyses of stage and discharge are provided and compared to model results. Finally, each of the hydrologic performance measures are described and applied to the proposed alternatives.

Ecosystem Restoration

Vegetation

The Tamiami Trail has affected a number of changes in vegetation along its length. Pond apple forests have developed at the outlets of the culverts due either to generally wetter conditions or to concentrated flow at those points. The damage to the vegetative community in the area, and the benefits expected by the proposed alternatives are discussed in depth in Chapter 6.

Wildlife

The Tamiami Trail has presented a significant barrier to terrestrial and aquatic species. The effect of the road on wildlife in the area, including wildlife mortality, is presented in depth in Chapters 7 and 8.

Ridge and Slough Landscape

The Tamiami Trail crosses Shark Slough in a landscape called “Ridge and Slough.” Sawgrass ridges were elongated areas, with peat elevations approximately 1½ feet above the surrounding slough bottom elevations. Sloughs in turn were deeper water areas of open water or water lilies. Tree Islands formed the third main element, slightly elevated above the sawgrass ridge ground surface. The ecologic significance of the topographic variation within the ridge and slough landscape is that the sloughs provide year-round inundation adjacent to the shorter hydroperiod ridge habitat. When viewed from the air, the ridges, sloughs, and tree islands all formed an elongated, highly directional pattern. Obstruction of flow and lowered stages may have had the combined effect of masking these landscape features by causing an imbalance in either the decomposition and accretion rates or in the sediment transport rate or both. While these mechanisms have not been quantitatively studied in this ecosystem, it is the overwhelming scientific opinion that full ecological restoration will not occur without reestablishing historical stages and unrestricted flows (Science Coordination Team 2003).

Roadbed Constraints

The subgrade of the existing road is composed of peat and uncontrolled fill which have not settled uniformly. The road base (above the subgrade) is crushed limestone. The subgrade and base are frequently saturated under current conditions, but the raising of water levels is expected to weaken the lower portions of the limestone base and result in additional cracking of the surface. (Engineering Appendix for the Tamiami Trail Modifications General Reevaluation Report/Supplemental Environmental Impact Statement, December 22, 2000, p. 27. Hereafter referred to as GRR/SEIS.)

In general, roadbeds consist of a friction course, over a structural course of asphalt, over a 10-inch crushed limestone or asphalt base course. Ideally, this pavement structure is constructed on top of a crushed limestone embankment that rests on the bedrock surface so that the problems

associated with settling are minimized. The structural integrity of the road is protected when the water level remains one ft below an asphalt base course and two ft below a limestone base course. This guideline has direct implications for all of the alternatives except the elevated causeway (Alternative 5). The relative abilities of the alternatives to withstand high water levels are assessed under the “Justification and Evaluation of Hydrologic Performance Measures” heading at the end of this section.

The Florida Department of Transportation (FDOT) drainage manual (2000) recommends a minimum design frequency of 50 years for bridges on “Essential” roads (those required for emergency access or evacuation). Tamiami Trail is an official hurricane evacuation route and should therefore be designed to satisfy the minimum 50-year return frequency for stage and discharge. (Florida Department of Community Affairs, pers. comm.). Analyses to determine stage and flow frequencies are outlined in the following sections.

Stage- Historical and Projected

The construction of the Miami, North New River, and Hillsboro canals between 1906 and 1915 probably lowered water levels in Shark Slough, although a lack of stage records from this time period precludes a quantitative analysis. In 1928, the completion of the Tamiami Trail created a significant obstacle to flow, but it was not until 1953 when the L-31N canal was constructed, and 1963 when the L-67 and L-29 levees impounded WCA-3B, that lowered water levels in the vicinity were documented.

The earliest available stage data is from 1940 at bridge 45 of the Tamiami Trail, where stage was recorded until 1967. Stage records represent daily staff gage observations before 1950 when a graphic stage recorder was installed. Before impoundment in 1963, average wet season stages (June 1 – October 31) were 7.1 ft and average dry season stages (November 1 – May 31) were 6.7 ft. Since 1963, these stages have been lowered to 6.9 ft and 6.6 ft, respectively. According to the D13R simulation of the SFWMM, (cell C22R22), wet and dry season stages can be expected to increase to average seasonal levels of 7.7 ft and 7.2 ft, respectively, under estimated restoration conditions.

Stages that result in sustained inundation of the sub-base of the road can cause severe structural damage. Figure 5.1 shows the frequency analysis of maximum annual stages. Before 1963, peak stages of at least 7.8 ft could be expected in a typical year. Peak stages above 9.0 ft were recorded in 4 out of the 25 years, corresponding to a 6-year return frequency. Since 1963, peak stages have declined in all but the driest years and “1-in-20” year wet stages have fallen by about 1.5 ft. The D13R simulation predicts slightly lower than pre-1963 peak stages in wet years with greater than a 3-year return frequency, but higher than historical stages in drier years. Peak stages of 8.2 ft might be expected in a typical year.

Additional modeling has been performed for other components of the MWD Project. The MOD-BRANCH D13R simulation was performed by the Corps for the 8.5 SMA component of the MWD Project. It predicted average stages along the road (cells 18815 to 18859) of greater than 9.5 ft for three consecutive weeks in late October of 1995. (The simulation included an additional “1-in-10” year event in May which had the effect of raising stages at the road by 0.05 ft in

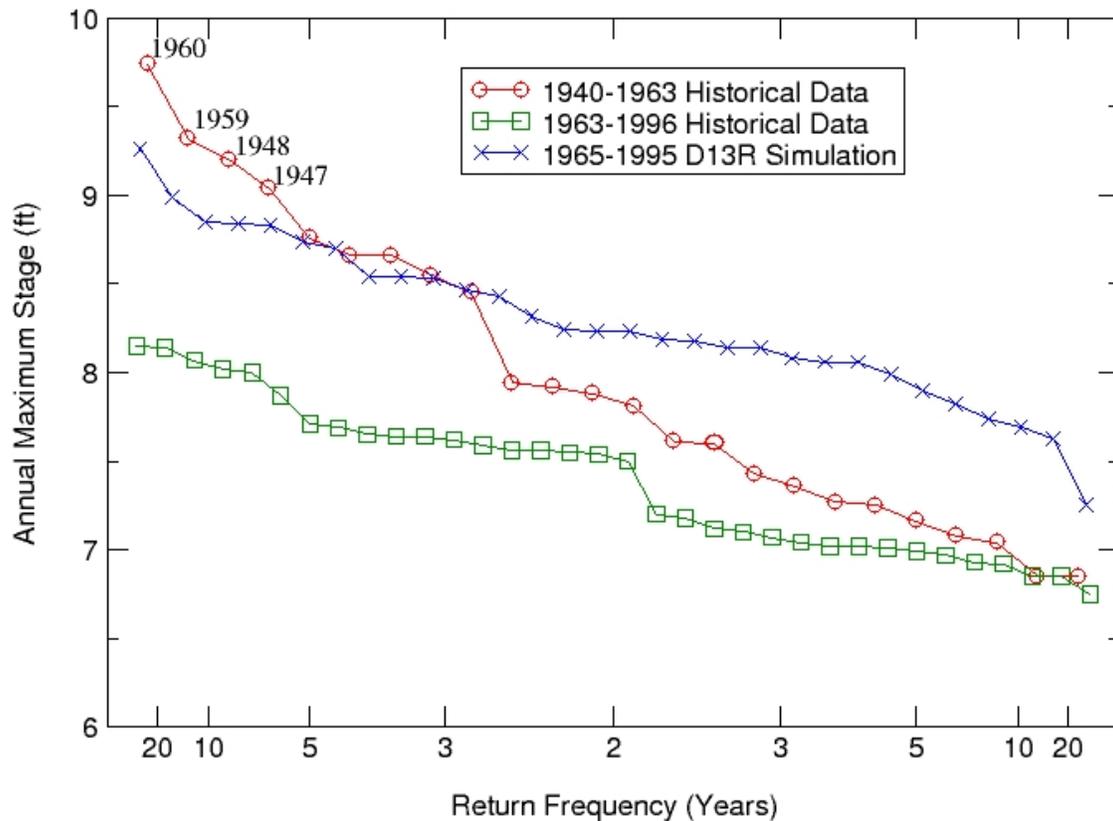


Figure 5.1. Frequency analysis of peak annual stage, L-67 ext. to L-30 section of L-29.

late October over the stage that would have been predicted under the actual rainfall conditions. When the predicted high stage of 9.6 is corrected by this factor, the predicted high stage for the roughly “1-in-10” year event is 9.55 ft.) The Corps used the RMA-2 model, developed by Resource Management Associates of California, for the Tamiami Trail Component. The RMA-2 model predicted stages of 8.7 ft south of the road coincident with flows of 2700 cfs across the road which were considered to represent a 10-year return frequency. However, if historical “1-in-10” year flows are modeled (4,444 cfs), the resulting stage is between 9.2 and 9.3 ft on the south side of the road. Modeling of an extreme event with a flow rate of 5,550 cfs, demonstrated a backwater effect with 9.43-ft stages south of the road but 9.58 ft north of the road (GRR/SEIS Appendix B, p. 7).

The design high water level used in the GRR/SEIS is 9.3 ft (p. i). In order to ensure the design of a durable road, the mean peak stage along the road predicted by the MODBRANCH simulation (9.55 ft) was adopted by DOI as the minimum acceptable design stage. While this model exhibits the highest predicted stage of the three models examined, it represents only a “1-in-10” year event. More severe, but less frequent, events will result in higher stages. Additionally, this stage is an average across the 11-mile section of the road encompassed by this project; locations to the west may experience higher stages than those influenced by the drainage of the L-30 and

L-31N canals to the east. Further, frequency analysis of historical stage data shows that the 1960 peak stage of 9.74 might occur with roughly a “1-in-20” year return frequency (Figure 5.1).

Discharge - Historical and Projected

Rating curves, developed by U.S. Geological Survey, were used to translate stage data prior to 1963 into discharge. A frequency analysis of the annual peak flow data was performed in accordance with Bulletin 17B (Appendix A). Bulletin 17B was developed by the U.S. Water Resources Council to provide Federal agencies with a standard method for calculating flood frequencies. Using this method, the flow distribution based on historic data is significantly higher than that predicted by the D13R simulation of the SFWMM (Figure 5.2, Table 5.1). It should be noted that the D13R simulation also predicted lower flows than the Natural System Model (NSM) simulation by about 25 percent.

One explanation for this difference is that the daily stages and flows in the historical record might have been maximums for each day, while the D13R model output consists of daily averages. However, frequency analysis of peak two-day averages of the historic record resulted in very little change in the flow frequency compared to the daily peak data, indicating that the historical data is representative of sustained (at least 24-hour) flows (Table 5.1). In addition, while the model results are appropriate for prediction of total flows, 24-hour peak flows may not be accurately predicted.

The RMA-2 modeling performed by the Corps for this project analyzed the ability of the road to convey the flow rates predicted by the D13R simulation. Thus, the successful conveyance of 4,270 cfs by the alternatives satisfies the hydrologic requirements of a “1-in-100” year event according to D13R but only a “1-in-10” year event according to historical data. FDOT guidelines recommend a design frequency of “1-in-50” years for evacuation routes such as this one. If the historical analysis was accepted and the FDOT guidelines were followed, the design discharge for this project would be 8,973 cfs.

Because historic flows are not expected under either the MWD Project or the CERP, the satisfactory design flow is probably somewhere between 4,270 and 8,973 cfs.

L-29 Borrow Canal Capacity

Raising the crown elevation of the road necessitates broadening the road bed so as not to exceed standards for embankment slopes. If the current alignment (Alt. 2) is chosen over the northern (Alt. 3) or southern (Alt. 4) alignments, accommodation of water quality treatment would require the road to expand north into the L-29 borrow canal or south into the undisturbed wetlands of ENP. One of the major considerations in determining the preferred alternative is the acreage of wetlands lost (Objective 8, evaluated in Chapter 6). In an effort to minimize wetland loss, the current and future conveyance needs of the canal were assessed to determine the feasibility of expanding the road bed north into the canal.

The L-29 borrow canal is a component of the South Dade Conveyance System (SDCS). The primary purpose of the SDCS is to provide water supply to Miami-Dade County and ENP from

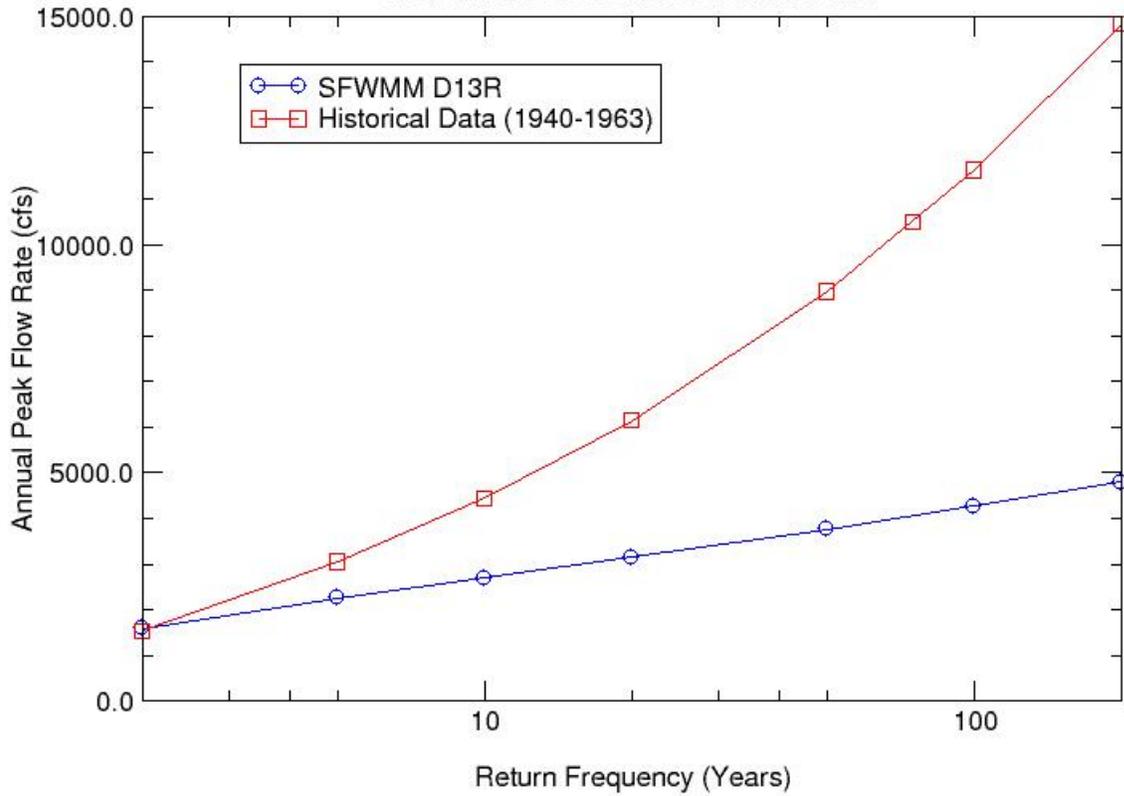


Figure 5.2. Frequency analysis of peak annual flow rates, L-67 ext. to L-30 section of Tamiami Trail

Table 5.1. Return frequencies for discharge across the L-67 ext to L-30 section of Tamiami trail as predicted by the SFWMM D13R simulation and historical data from bridge 45

Return Frequency (wet)	D13R Peak Annual Daily Flow (cfs)	Historical Peak Annual Daily Flow (cfs)	Historical Peak Annual 2-day Averaged Daily Flow (cfs)
2-year	1,600	1,535	1,499
5-year	2,250	3,051	2,990
10-year	2,700	4,444	4,361
20-year	3,150	6,148	6,042
50-year	3,770	8,973	8,831
100-year	4,270	11,632	11,461
200-year	4,800	14,830	14,628

the C&SF Project. The system was completed around 1979 through an increase in the conveyance capacities of L-29, L-31N, and the C-111 canals. However, the South Dade Conveyance System (SDCS) has functioned as much as a flood control project as a water supply project since its completion in 1983.

The section of the L-29 canal under consideration is bounded by S-333 on the west and S-334 on the east. Both S-333 and S-334 are single-bay gated spillways that release water eastward to control water levels in the L-29 and L-31N canals. By design, they convey water from WCA-3A to Taylor Slough and south Miami-Dade County to supply municipal, industrial, and agricultural water users. S-333 has a design discharge capacity of 1,350 cfs; S-334 has a design discharge capacity of 1,230 cfs. Use of the structures is constrained by water levels in the developed areas just east of NESS. Specifically, S-333 is closed when water levels at G-3273 exceed 6.8 ft and when S-176 headwater stage exceeds 5.0 ft or S-331 headwater exceeds its target stage.

S-333 and S-334 have generally not been used for dry season water supply, the bulk of which is typically delivered through S-335 (Figure 5.3). Recent discharges through S-334 have been wet-season discharges related to the Interim Structural Operations Plan, which sought to avoid excessive discharges to NWSS when WCA-3A regulatory releases were made. S-334 discharge (and therefore L-29 conveyance) exceeded 1000 cfs only once (January-June 1985) since the SDCS has been operational. This conveyance satisfied water supply needs of South Dade, as did an event in May 1984 (500 cfs). Only two other events required significant L-29 conveyance (January-March 1987 at ~700 cfs and April 1988 at ~400 cfs).

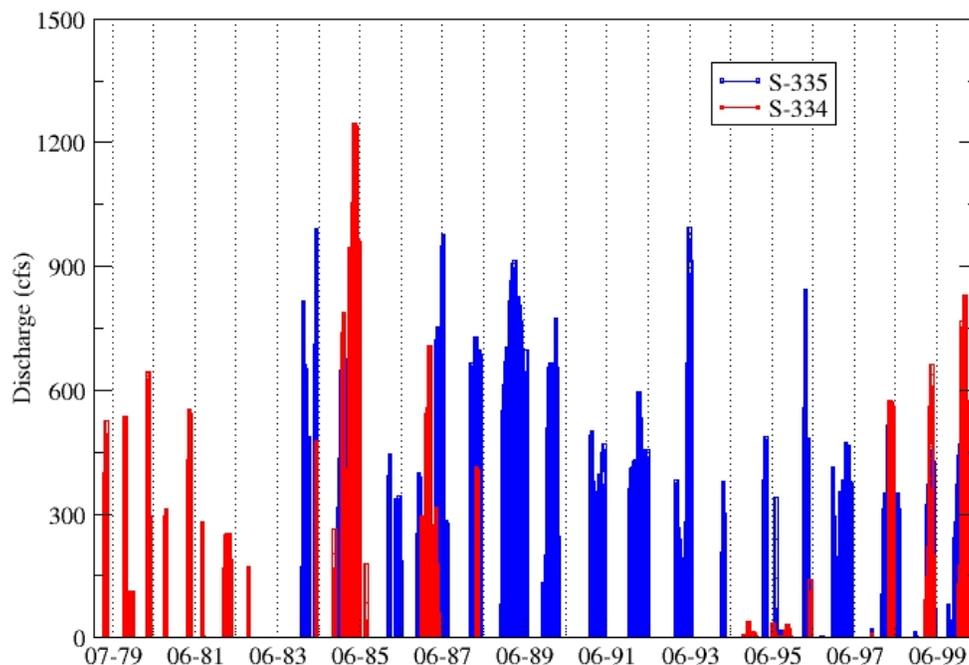


Figure 5.3. Discharge at S-334 and S-335

Once the Tamiami Trail is reconstructed to discharge water to NESS through bridges and culverts, regulatory releases from WCA-3A will be accomplished by releases to NESS through the road and will not require conveyance from S-333 through S-334 and down L-31N. At that time the L-29 borrow canal will serve as a spreader canal to equalize heads across the northern boundary of the ENP, and will serve to distribute inflows from S-333, S-355A, S-355B, and S-356, except for infrequent water supply releases.

The canal dimensions between S-333 and S-334 vary in width and depth with cross-sectional areas ranging from 1073.5 ft² (adjacent to S-334) to 1509.4 ft² (near the middle of the section.) (*Final Environmental Impact Statement South Dade Conveyance Canals and East Coast Back-pumping*, (Corps, June 1975), Table 5, p. 24, hereafter referred to as FEIS). (Relevant data summarized in Appendix B.)

The conveyance of this canal is limited by the head gradient along the length of the section. Manning's Equation was used to estimate the gradient required by the maximum flow at S-333 and S-334 for different cross-sectional areas. This calculated gradient was then compared to the design gradients reported in the FEIS (Appendix B).

Just downstream of S-333, at the maximum design discharge of 1,350 cfs, the head loss was 0.2 ft along a 14,350 ft-section. This section has a design head loss of 0.6 ft (FEIS). If the width of the base of the canal in this section were reduced from 35 ft to 15 ft, the gradient required to convey 1,350 cfs would go up to 3.264×10^{-5} – a 0.5-ft drop along the section, still less than the design gradient.

In the section just upstream of S-334, at the maximum design discharge of 1,230 cfs, the head loss was 0.5 ft across the 29,200 ft section. The design head loss for this section is 1.2 ft (FEIS). If the width of the canal at this point were also reduced by 25 ft (from 60 ft to 35 ft), the gradient required to convey 1,230 cfs would go up to 3.189×10^{-5} – a 0.9-ft drop along the section, 0.3 ft less than the design gradient.

According to this preliminary analysis, 25 ft of the canal base could be filled by the design of the new road while maintaining the maximum conveyance capacity of the bounding structures without an unreasonable increase in gradient. Since the SDCS was completed in 1983, S-334 has passed more than 1000 cfs during only one event (4/29/1985 – 5/9/1985). Future conveyance requirements are expected to be lower under the MWD Project because of the increased discharge capacity from the canal into NESS. CERP, as currently modeled, eliminates the canal altogether.

It is our opinion, for all of these reasons, that the cross-sectional area of flow in the canal could be significantly reduced without impairing the operation of the system in the near future. Although this option has not been explored in the proposed alternatives, it should be considered if an alternative with substantial wetland loss is selected.

Discharge Requirements of the 1999 FWS Biological Opinion

Discharge to ENP across the northern boundary has been guided by “The Rainfall Formula” since 1985. The total water delivery to ENP is the sum of rainfall and regulatory components distributed between NESS (55 percent) and NWSS (45 percent). This formula is described in detail in SFWMD Technical Publication 89-3 (TP 89-3); A Two-year Field Test of the Rainfall Plan: A Management Plan for Water Deliveries to Everglades National Park.

The volume of the rainfall component is calculated weekly and is dependent in part on the antecedent rainfall and evaporation, the previous week’s discharge, and historic means of flow, rain, and evapotranspiration. According to TP 89-3, 45 percent of calculated rainfall discharges go through the S-12 structures to NWSS, and 55 percent go through S-333 to be released to NESS through the culverts under the Tamiami Trail. The distribution of this component remains unchanged under the Reasonable and Prudent Alternative (RPA). The maximum total calculated rainfall release since 1993 was 2863 cfs in late October of 1995. Under the distribution guidelines, NESS would have received 55 percent of this amount, or 1575 cfs.

The regulatory component is calculated by multiplying the difference between the three-gage average stage (Corps’ gages 3A-3, 3A-4, and 3A-28) for WCA-3A and the Zone E regulation stage by 2500 cfs/ft to calculate the regulatory discharge in cfs. Under normal conditions, the current WCA-3A schedule calls for 45 percent of the discharge to be released through the S-12 structures to NWSS with the remaining 55 percent discharged through S-333 to NESS. However, when water levels to the east (as measured at G-3273) are higher than 6.8 ft, discharges through S-333 are not permitted and more water, up to 100 percent of the regulatory and rainfall components (at NPS discretion) is released to NWSS, none to NESS. It is this distribution under typical wet season stage conditions which jeopardizes populations of CSSSs found on the northwest and east edges of Shark Slough and leaves NESS without significant inflows during large portions of the wet season. The RPA requires scheduled increases in water releases to NESS over a period of three years by allowing flows through S-333 even during wet periods. Specifically, between March 1, 2000, and March 1, 2001, 30 percent of the regulatory releases were to be released to NESS. (In 2000, structural capacity was never the limiting factor in meeting RPA flows (Figure 5.4). Stages above 6.8 ft at G-3273 apparently limited discharges from S-333 and therefore releases to NESS.) Beginning in March of 2001, 45 percent must be released to NESS, and after March 2002, 60 percent must be released to NESS. The three-gage average stage (corresponding to the late October 1995 rainfall formula peak) was 12.56 ft. Had the final form of the RPA been in effect during this event, the 12.56 ft stage would have translated into a regulatory discharge of 5400 cfs, of which 60 percent (3240 cfs) would be delivered to NESS.

The sum of the rainfall (1575 cfs) and the regulatory (3240 cfs) components of discharge to NESS is 4815 cfs. However, the RPA permits an exception when C&SF Project features are incapable of delivering the required discharge to NESS, effectively limiting maximum discharges to NESS to the maximum combined capacity of the structures delivering water to the L-29 canal section between L-67 ext. and L-30. Therefore, the alternatives are considered to satisfy the RPA if they permit a discharge equal to the sum of the conveyances to L-29 canal.

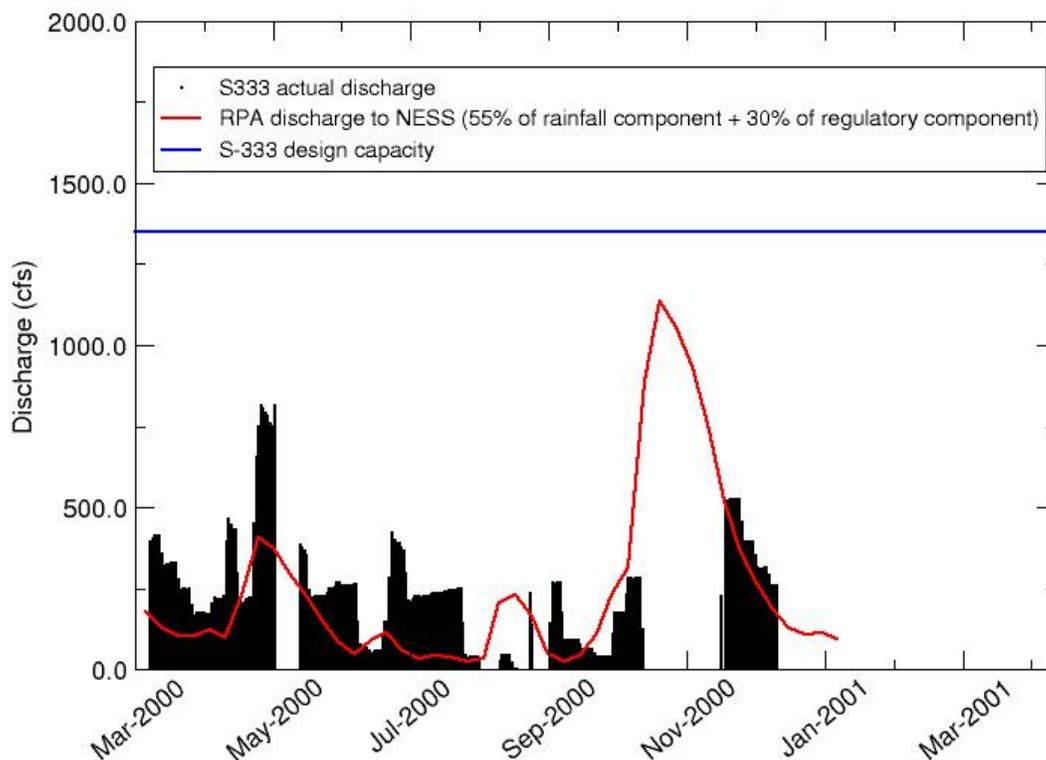


Figure 5.4. RPA Calculated and Actual Discharge, March 2000 to December 2000

Evaluation of Flow Distribution

It is widely believed that the magnitude and direction of flow through the Everglades landscape are critical factors in the development and maintenance of the Ridge and Slough microtopography. Faster velocities can be erosive and can carry heavy sediment loads. It is also understood that fish and aquatic invertebrates are effected by flow rates. While the function of these mechanisms in this landscape require further study, it is reasonable to assume that the closest approximation of marsh conditions at the road would be the preferred result of this project. In this section, attempts have been made to quantify the severity of the effect on flow velocities at the road and the area downstream required to slow the water down in the marsh.

The flow distributions for each of the Alternatives were simulated using RMA-2. (Alternative 8, with box culverts, was not simulated. A configuration with ten 100-ft bridges was simulated, and has been used in this analysis to approximate the effects of Alternative 8.). Contour maps of velocity magnitude in the first 2 miles downstream of the road are presented in Figures 5.5 a-g. These images clearly show the distribution of flow through culverts (a), short bridges (b, c), and long bridges (d, e, f, g). The shorter flow openings (culverts/short bridges) force higher velocities in the structures and immediately downstream while the longer flow openings have spatially far-reaching, though less severe, effects.

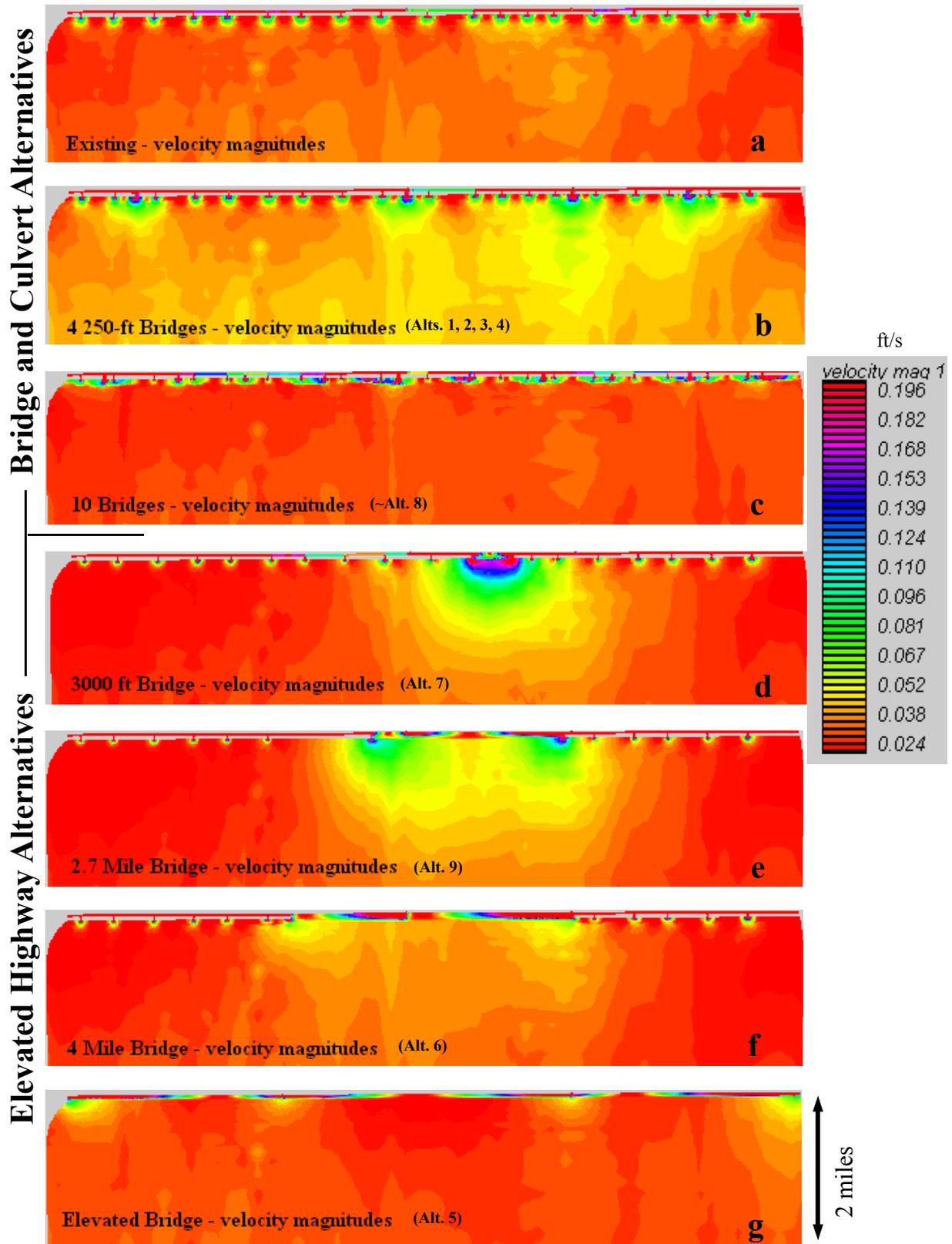


Figure 5.5 a-g. Contour maps of velocity. (Spatial extent is L-67 ext to L-31 N, Tamiami Trail to 2 miles south.)

To assess the effects of the alternatives on velocities at the road and in the marsh, transects (1/4 mile thick) were selected at distances from the road of 1/4, 1/2, 1, 2, and 5 miles. One additional transect (1/8 mile thick) was selected at the road. The mean velocity (speed) was calculated for each of these transects at the highest flow rate (5548 cfs). (Because of the irregular distribution of elements in the mesh, this mean is biased toward the faster velocities at the culvert and bridge outfalls in the 1/8-mile transect just south of the road. We intend to refine this analysis in the future). The mean velocity graph, Figure 5.6, shows generally higher velocities near the road in alternatives that confine flow to culverts or narrow bridges. Most of the alternatives reach a steady marsh velocity of 0.029 ft/s within 2 miles of the road. Alternative 5, the causeway, shows a mean velocity at the road (0.03 ft/s) which is consistent with downstream velocities. Alternative 8 achieves a lower marsh velocity within the first 1/4 mile, although at the road the mean velocity is much higher (0.052 ft/s.) Alternative 6, the 4-mile bridge, has a slightly higher mean velocity at the road (0.0375 ft/s) than downstream, and the velocity drops to a more natural velocity within the first 1/4 mile. The existing condition, also achieves a more natural velocity within the first 1/4 mile, although at the road it has a much higher velocity (0.052 ft/s). Alternative 9, the 2.7 mile bridge, has higher velocity at the road (0.043 ft/s) than Alternative 6, and does not fall to natural marsh velocity until 2 miles away from the road. Alternative 7 has roughly the same effect on marsh velocities, but has higher velocities at the road (0.057 ft/s) due to its shorter opening. Both Alternative 1 (existing condition) and Alternatives 2, 3 and 4, (four bridges) have higher velocities in the marsh more than 2 miles away from the road than any of the other alternatives (0.033 and 0.043 ft/s.) At this time, the explanation for this is unknown, and model error is suspected.

Standard deviation in the mean was also calculated for each transect. In the marsh, 5 miles from the road, the standard deviation for the simulations ranged from 0.003 to 0.005. To estimate the

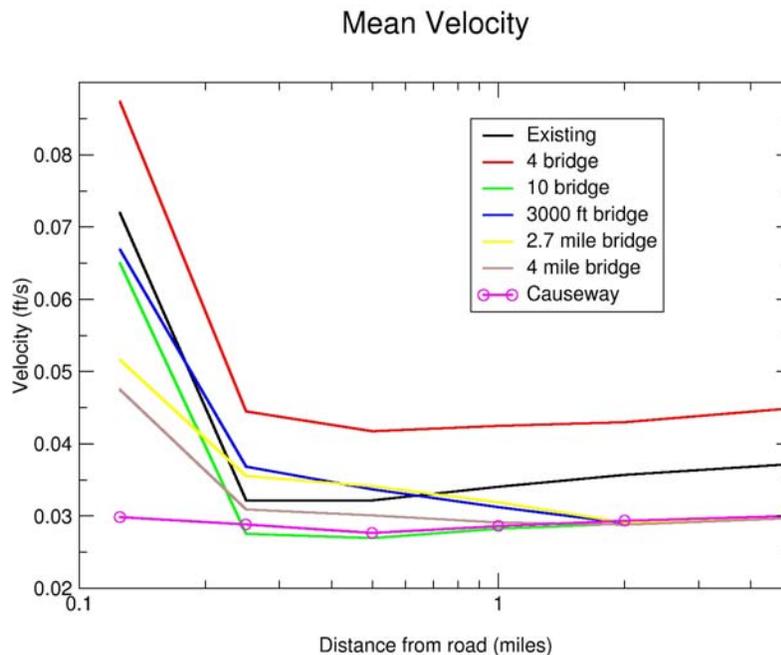


Figure 5.6. Mean Velocity as a function of distance from Tamiami Trail for each of the alternatives.

spatial extent of the higher velocities, the area inside the 0.045 ft/s contour (outside 3 standard deviations of the mean) was estimated for all of the alternatives. Because of the higher overall velocities in the four-bridge alternative, the analysis was performed using the mean marsh velocity of 0.043 ft/s (threshold of 0.58 ft/s) particular to this simulation. In general, the longer bridges required larger areas to slow water to marsh velocity with the 2.7-mile bridge affecting the largest area, 2567.7 acres. Culvert and short bridge options did better, requiring only 437.5-623.4 acres. The full elevated highway, with completely unobstructed flow required only 165.7 acres to reach normal velocity. (This acreage is located in the downstream direction of the four structures contributing water to the L-29 canal which is effectively a spreader canal in this alternative.)

Figure 5.7 compares the performance of the alternatives with respect to flow distribution. The difference between mean velocities at the road and in the marsh is used as an indication of the severity of the effect on flow magnitudes. Acreage required to slow the water down to within 3 standard deviations of marsh velocity is also shown. Clearly, the full elevated highway reduces both the severity of the effect of the road and the total area effected by not forcing flow through constricting openings. The 2.7-mile bridge is interesting because it produces a much slower velocity at the road than the 3000-ft bridge but a larger area of impact. This is because the velocities are fast enough and distributed across a wide enough distance to require a large area to slow down. The four-mile bridge spreads flow over a long distance, and therefore could have a large area of impact, but the velocities are slow enough coming through the road to reach comparable marsh velocities over a very short distance.

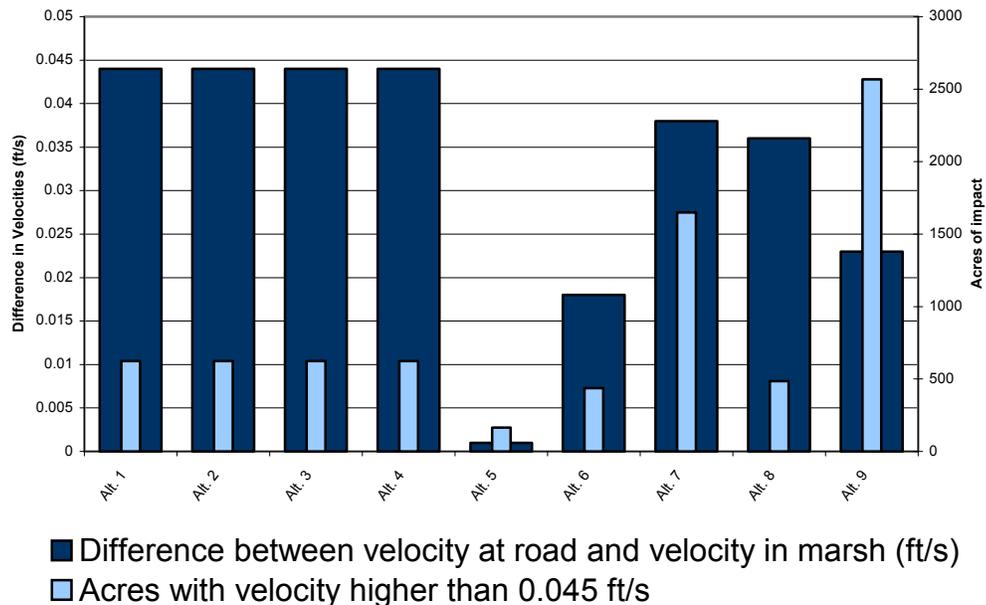


Figure 5.7. Comparison of Alternatives with respect to flow distribution.

Justification and Evaluation of Hydrologic Performance Measures

A number of Performance Requirements require hydrologic information in the associated performance measure. Their justifications and applications are discussed below.

Satisfaction of the Reasonable and Prudent Alternative (RPA) (Environmental Objective 2)

If the RPA had been in place on October 20, 1995, the total discharge to NESS would have been calculated as 4815 cfs. The RPA requires 60 percent of regulatory discharges to be released to NESS, with three exceptions including instances when “failure to meet the requirement is due entirely to limited structural capacity of the C&SF Project works” (1999 FWS Biological Opinion). By the time the Tamiami Trail Modifications are made, conveyance into the L-29 canal will be at least 4300 cfs (the sum of the design capacities of S-333 [1350 cfs], S-355A and S-355B [each 1000 cfs], and S-356 [950 cfs]). All of the alternatives are designed to convey peak flows of 5550 cfs to NESS, and therefore should meet RPA requirements as conveyance to L-29 permits.

Consistency with the 1989 ENP Protection and Expansion Act (Environmental Objective 4)

Section 410r-8a(1) states that the Secretaries of the Army in consultation with the Secretary of the Interior are “...authorized and directed to construct modifications to the Central and Southern Florida Project to improve water deliveries into the park and shall, to the extent practicable, take steps to restore the natural hydrological conditions within the park.” While the Tamiami Trail component of the MWD Project does not determine water levels, the preferred alternative must be compatible with the higher water levels and flows that are the goal of the project. There is no specific stage or flow defined as a project goal in any of the legislation associated with the MWD Project. However, it would be sensible to design the new road to accommodate CERP stages and flows to prevent the necessity of costly retrofitting.

In the Engineering Appendix of the Final Design (100 percent) Submittal, (page 32), the design high water elevation is given as 9.3 ft. This stage does not satisfy the DOI minimum design stage of 9.55 ft, which is based on both historical observed and modeled CERP condition data.

The acceptability of each of the alternatives is summarized in Table 5.2 and demonstrated in Figure 5.8. Alternative 1 does not meet the performance criteria because degradation of the road surface would accelerate with the design high water elevation at the bottom of the asphalt base. (This alternative involves leveling the road to the average crown elevation of 11.0 ft.) Similarly, Alternatives 2A, 6A, 7A, 8A, and 9A (without water quality treatment) do not meet the performance criteria because the bottom of the asphalt base is within 1 ft of the DOI design high water elevation. We have recommended (in Chapter 10) that these alternatives be raised by 0.25 ft to satisfy the DOI high water elevation of 9.55 ft. Alternatives 2B (with water quality),

Table 5.2. Evaluation of each Alternative with respect to the DOI design high water level (9.55 ft) to determine satisfaction of Environmental Objective 4.

Alternative Description	Base Type	Clearance required	Base Bottom Elevation / Clearance Provided	Compatible with 9.55 ft design high water elevation
Alternative 1 Without Water Quality	Asphalt	1 ft	9.3 ft / -0.25 ft	NO
Alternative 2A Without Water Quality	Asphalt	1 ft	10.3 ft / 0.75 ft	NO
Alternative 2B With Water Quality	Crushed Limestone	2 ft	12.9 ft / 3.35 ft	YES
Alternative 3A Without Water Quality	Crushed Limestone	2 ft	16.1 ft / 6.55 ft	YES
Alternative 3B With Water Quality	Crushed Limestone	2 ft	16.1 ft / 6.55 ft	YES
Alternative 4A Without Water Quality	Crushed Limestone	2 ft	12.9 ft / 3.35 ft	YES
Alternative 4B With Water Quality	Crushed Limestone	2 ft	12.9 ft / 3.35 ft	YES
Alternative 5	NA	NA	13.5 ft / 3.95 ft	YES
Alternative 6A Without Water Quality	Asphalt	1 ft	10.3 ft / 0.75 ft	NO
Alternative 6B With Water Quality	Crushed Limestone	2 ft	12.9 ft / 3.35 ft	YES
Alternative 7A Without Water Quality	Asphalt	1 ft	10.3 ft / 0.75 ft	NO
Alternative 7B With Water Quality	Crushed Limestone	2 ft	12.9 ft / 3.35 ft	YES
Alternative 8A Without Water Quality	Asphalt	1 ft	10.3 ft / 0.75 ft	NO
Alternative 8B With Water Quality	Crushed Limestone	2 ft	12.9 ft / 3.35 ft	YES
Alternative 9A Without Water Quality	Asphalt	1 ft	10.3 ft / 0.75 ft	NO
Alternative 9B With Water Quality	Crushed Limestone	2 ft	12.9 ft / 3.35 ft	YES

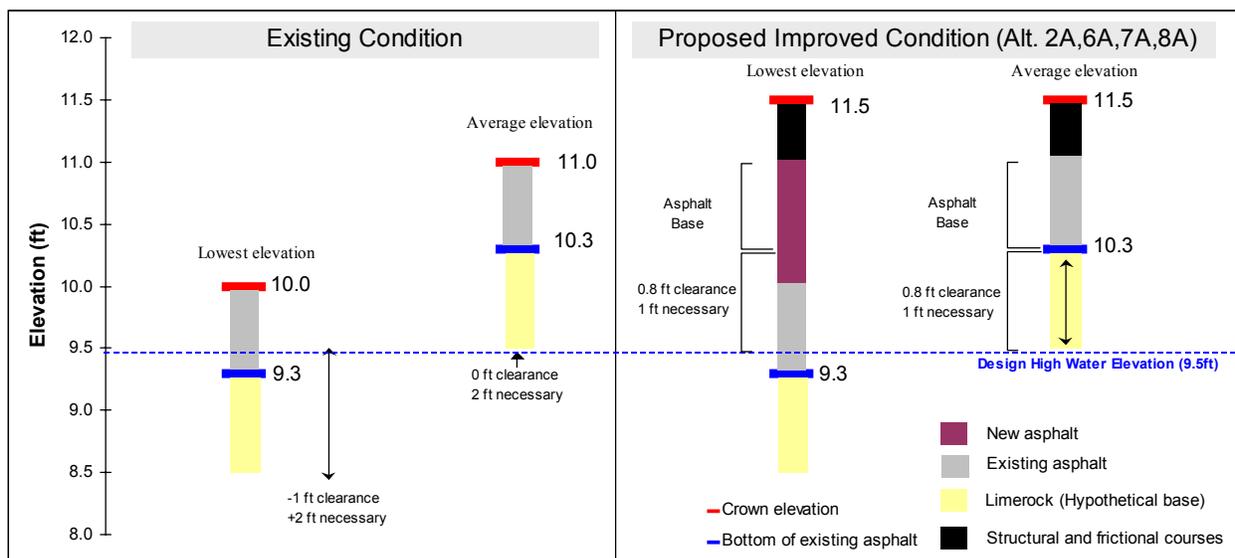


Figure 5.8. Existing and proposed improved roadbed compositions and elevations.

3, 4, 5, 6B, 7B, 8B, and 9B meet the performance criteria because they provide satisfactory clearance from the DOI design high water elevation.

The assessment of achievement of a natural flow distribution is accomplished through two measures. First, the difference between the mean velocity at the road and the modeled mean marsh velocity as measured in a transect 5 miles downstream of the road was calculated for each of the alternatives. The results are summarized in Table 5.3. At the road the velocity most closely matches the marsh velocity in Alternative 5 which is ranked highest. The area in which the velocity was higher than the marsh velocity by 3 standard deviations ($0.030 + 3*(0.005)$ ft/s) is also presented in Table 5.3. Alternative 5 produced the smallest acreage of high velocities and is therefore ranked highest.

Flood Control (Other Objective 1)

As specified in the 1989 ENP Protection and Expansion Act, mitigation of adverse impacts resulting from the MWD Project would be required. However, while the Tamiami Trail component of the MWD Project involves raising the road to mitigate for higher water levels, it does not itself produce higher water levels or more frequent high water levels. For this reason, there is no expectation that flood control might be compromised as a result of any of the alternatives under consideration in this component of the MWD Project.

Maximize compatibility with future restoration actions (Other Objective 2)

The calculation of cubic yards of fill requiring removal to achieve completely unobstructed flow path includes all fill associated with the new project road, the remaining sections of existing

Table 5.3. Flow distribution performance measures and ranks.

Alt. No.	Description	Difference between average velocity at the road and average velocity in the marsh and rank		Area with affected flow magnitude (acres) and rank	
1	4 bridge	0.037	6	623.4	6
2	4 bridge raised	0.037	3	623.4	6
3	4 bridge north	0.037	3	623.4	6
4	4 bridge south	0.037	3	623.4	6
5	Causeway	0	9	165.7	9
6	4-mile bridge	0.008	8	437.5	8
7	3000-ft bridge	0.027	4	1649.3	2
8	Box culverts	0.021 est.	6	485.8 est.	7
9	2.7-mile bridge	0.013	7	2567.7	1

road, and the L-29 levee. Fill volume was calculated by determining the cross-sectional area of the roads and levees and multiplying by the length to be removed. For example, under Alternative 5A with full road removal, only the L-29 levee would remain to be removed under CERP (1.1 million yd³) with the existing road having been completely removed under MWD. Fill volumes for all alternatives are summarized in Table 5.4. In general, alternatives that propose greater removal of the existing road under MWD have lower fill removal requirements under CERP.

The relative abilities of the alternatives to accommodate additional flow volumes either as a result of currently authorized CERP features or unauthorized but foreseen increases (245,000 acre-ft described in Sec. 601G of WRDA 2000) were based on the size of the proposed openings in the road. It was assumed that the larger openings would better handle increased flows. From best to worst the Alternatives rank as follows: Alt. 5, Alt. 6, Alt. 9, Alt. 7, Alts. 1, 2, 3, 4, and 8.

Table 5.4. Volume of fill requiring removal after MWD is completed to achieve completely unobstructed flow.

Alternative Description	Millions of Cubic Yards
Alternative 1: Without Water Quality	1.6
Alternative 2A: Without Water Quality	1.7
Alternative 2B: With Water Quality	2.0
Alternative 3A: Without Water Quality	2.3
Alternative 3B: With Water Quality	2.8
Alternative 4A: Without Water Quality	2.5
Alternative 4B: With Water Quality	2.8
Alternative 5A partial: Partial Road Removal	1.6
Alternative 5A full: Full Road Removal	1.1
Alternative 5B partial: Partial Road Removal; With Water Quality	1.6
Alternative 5B full: Full Road Removal; With Water Quality	1.2
Alternative 6A partial: Partial Road Removal	1.5
Alternative 6A full: Full Road Removal	1.6
Alternative 6B partial: Partial Road Removal; With Water Quality	1.7
Alternative 6B full: Full Road Removal; With Water Quality	1.9
Alternative 7A: Without Water Quality	1.7
Alternative 7B: With Water Quality	2.0
Alternative 8A: Without Water Quality	1.7
Alternative 8B: With Water Quality	2.1
Alternative 9A: Without Water Quality	1.5
Alternative 9B: With Water Quality	1.9

CHAPTER 6 - WETLAND FUNCTIONAL ANALYSIS

Wetland Rapid Assessment Procedure

In order to compare relative differences in wetland function between the “existing condition” and the “with-project condition”, the WRAP was employed (SFWMD 1999). The WRAP methodology has been adopted by the Corps as the most reliable and consistent approach to account for changes in wetland function for Everglades restoration projects in south Florida (letter dated August 4, 1999). An interagency WRAP Team was established in October 2000, and included representatives from the FWS, Corps, NPS, SFWMD, and Miami-Dade County Department of Environmental Resources Management (DERM). These representatives consisted of experienced biologists, ecologists, and botanists who have applied the WRAP procedure on numerous occasions and are knowledgeable of wetland ecology in south Florida.

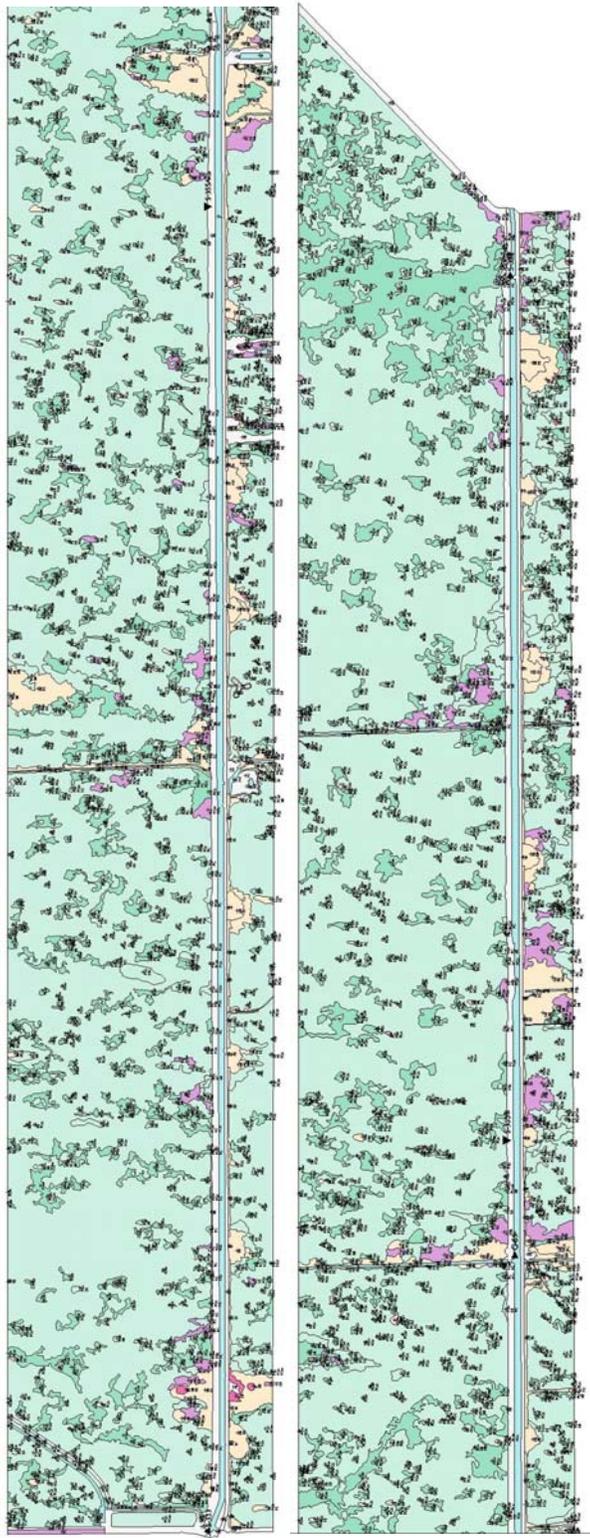
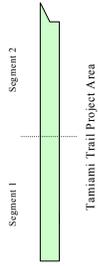
WRAP is a matrix developed to assist in the functional evaluation of wetland sites. The matrix can be used in combination with professional judgment to provide an accurate and consistent evaluation of wetland sites. The WRAP matrix establishes a numerical ranking for individual ecological and anthropogenic factors (variables) that can strongly influence wetland function. The numerical output for the variables is then used to evaluate current wetland condition. Each wetland type is rated according to its attributes and characteristics. WRAP variables include the following: 1) wildlife utilization, 2) wetland overstory/shrub canopy of desirable species, 3) wetland vegetative ground cover of desirable species, 4) adjacent upland/wetland buffer, 5) field indicators of wetland hydrology, and 6) water quality input and treatment systems. The acreage of each wetland habitat type (polygon) is then multiplied by the acreage of that habitat type to derive “functional units” for comparison purposes.

In November 2000 and December 2000, the WRAP Team conducted a series of on-site field investigations, consisting of 11 survey sites representative of the wetland habitat types (polygons) in the project area to establish the “existing condition” wetland functional conditions. On January 31 and February 1, 2000, the WRAP Team convened to calculate the “with-project” wetland functional projections for the 26 alternatives proposed for the project. The results of the WRAP assessment are described below.

Wetland Polygon Delineation

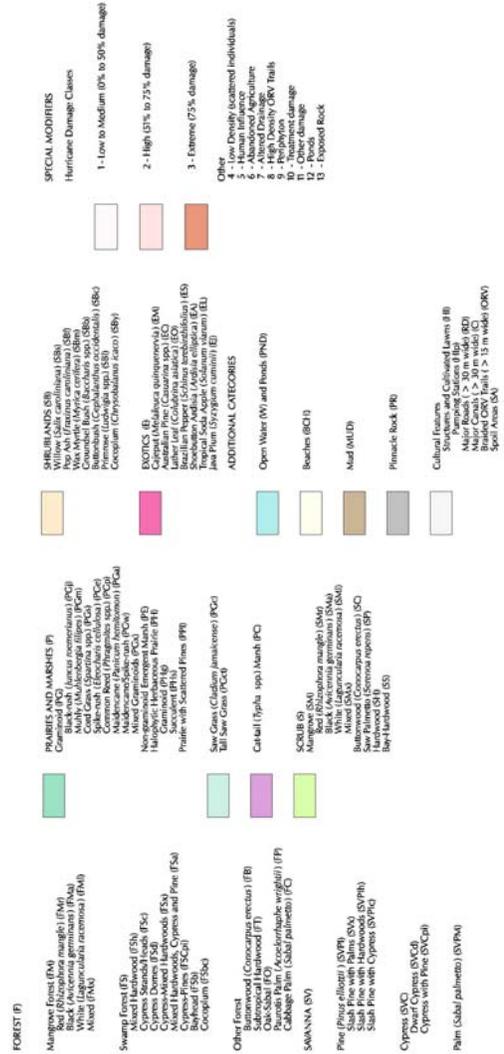
The WRAP Team utilized hard copy maps of wetland vegetation prepared by staff at the SFWMD (Figure 6.1). The study area included the entire 10.7 miles of the eastern section of Tamiami Trail extending approximately 100 ft into the wetlands on the north and south sides of the highway. Up to three categories of vegetation representing the dominate, co-dominant, and third dominant categories of vegetation were used to label wetland polygons. Color infrared aerial photography (1:24,000 scale) taken in 1995 was used as the base. After field verifying the wetlands on the south side of Tamiami Trail, the WRAP Team decided the ENP mapping should be re-done due to discrepancies in vegetative composition. The ENP mapping had previously been contracted to the University of Georgia Center for Remote Sensing and Mapping by the

Figure 6.1- Tamiami Trail WRAP Area



Seg. 1

Seg. 2



Everglades Division
Prepared by Ken Rancney

South Florida Natural Resources Center. SFWMD staff re-mapped the ENP wetlands and a seamless GIS plot was provided to the WRAP Team for use in the field.

The Corps' contractor prepared CADD maps for each of the project alternatives, which were overlain on the wetland polygon map. The acres of wetland impacts, by alternative and wetland polygon type, were then calculated for each alternative. Wetland polygon types impacted by the project and scored by the WRAP Team included:

Prairies and Marshes

Sawgrass (PGc)/(PGw*)

Cattail (PC)

(PGw*)

Broadleaf and floating Emergents (PE)

Cattail (PC/Sawgrass [PGc] mix)

PGw* – Mix of shallow open water which can include spikerush, maidencane, sparse low stature sawgrass and/or cattail, sparse arrowhead and pickerel weed, and sparse white water lily.

Shrublands and Exotics

Shrubland mix (SB)

Pond Apple (SBa)/Willow (SBs) mix

Brazilian pepper (ES)/Shrubland (SB) mix

WRAP Scoring Methodology

Wetland polygons were scored on-site by the WRAP Team after ground-truthing in accordance with the WRAP protocol (WRAP Procedure, Technical Publication REG-001, 2nd ed., April 1999). Final polygon scores were reached by consensus after discussing all appropriate Habitat Assessment Variables. Each polygon was evaluated on its own attributes and not compared to other polygons. Any variable that did not apply to a particular polygon was designated "NA" (not applicable). The WRAP scores for each polygon were then totaled and divided by the total maximum score for all variables to establish the final WRAP score. WRAP scores, by polygon, were then multiplied by the acres of that polygon impacted to determine Functional Units (FU) lost. Total FU's lost were then calculated for all affected polygons for each Project Alternative in order to compare relative wetland losses between all alternatives.

Results

Existing Condition Functional Analysis

Table 6.1 below provides the Existing Condition WRAP scores for each polygon within the study area. On average, existing condition WRAP scores were slightly higher in WCA-3B (0.74) when compared to ENP (0.62). This difference is attributable primarily to the location of

US 41 adjacent to ENP, an acknowledgement by the WRAP Team that the ENP is the recipient of highway runoff, and the general lack of a minimum 30-foot buffer between the highway and the adjacent wetlands. As a result, the WRAP variables of Wildlife Utilization, Adjacent Upland/Wetland Buffer, and Water Quality scored consistently lower in the ENP wetlands when compared to the WCA-3B wetlands.

Existing condition WRAP scores ranged from a high of 0.83 for the sawgrass/emergent marsh and forested wetland (pond apple/willow) habitat types to a low of 0.48 for cattail dominated habitat. For perspective, a wetland habitat type with a score of 0.83 means that the wetland is functioning at 83 percent of its maximum potential of 1.0, whereas a wetland habitat type with a score of 0.48 is functioning at 48 percent (about one-half) of its maximum potential. Except for those wetlands fringing the highway and those wetlands dominated by nuisance and exotic vegetation, existing condition of the wetlands in the project area is generally quite good.

Table 6.1. Existing Condition WRAP wetland functional scores for 11 wetland polygons on the north (WCA 3B) and south (ENP) sides of the eastern 11 mile section of Tamiami Trail (November 14-15 and December 19, 2000).

Water Conservation Area 3B			Everglades National Park		
Site	Coordinates	Score	Site	Coordinates	Score
1-3B (PC/PGc)	547546 2849389	0.68	1-ENP (PGc/ PGw)	532858 2849250	0.70
2-3B (PE)	547280 2849386	0.80	2-ENP (SB)	541784 2849272	0.69
3-3B (PGc/ PGw)	546090 2849372	0.78	3-ENP (SB)	545591 2849287	0.69
4-3B (SBa/ SBs)	541983 2849359	0.83	4-ENP (PC)	550370 2849489	0.48
5-3B (PGw)	540538 2849358	0.83	5-ENP (ES/Sb)	549707 2849308	0.54
6-3B (PC)	535733 2849341	0.53			

With-Project Condition Functional Analysis

On January 31, 2000, and February 1, 2000, the WRAP Team reconvened to conduct the With-Project WRAP. This effort included a review of 26 total alternative design/water quality options that had varying degrees of effects on wetland function. Prior to conducting the With-Project WRAP, the WRAP Team agreed upon the following set of assumptions:

Assumptions:

1. The WRAP projected into the future to the Standard Project Life of 50 years;
2. Construction would average two to four years, depending on the alternative;
3. The MWD Project is in place;
4. Except for the Airboat Association, all concessions/radio towers would be removed;
5. Water quality (primarily nutrients) in the study area would be improved as a result of on-going efforts in the upstream portion of the Everglades (e.g. EAA Stormwater Treatment Areas);
6. Water quality treatment for highway runoff would likely be necessary;
7. Exotic and nuisance vegetation in the study area would be controlled within the next 50 years; and,
8. Traffic volume on US 41 would more than double.

In order to conduct a comprehensive WRAP assessment, in addition to the direct effects on wetland resources from the project alternatives, the WRAP also included: 1) an assessment of secondary adverse effects on adjacent wetlands due to highway relocation to WCA-3B; 2) an assessment of secondary beneficial effects of highway relocation out of ENP; 3) an assessment of the temporal wetland functional losses associated with temporary bypass roads; 4) an assessment of the wetland restoration potential of removal of concessions and radio towers inside ENP; 5) an assessment of the wetland restoration potential of partial and full restoration of US 41 (Alternative 5); and 6) an assessment of the new four-mile bridge alternative proposed by FWS/NPS/FWC.

The full results of these assessments are found in Appendix C. A summary of the major findings is displayed below in Table 6.2.

Wetland Functional Gains Associated with Alternative 5 (Elevated Causeway)

The WRAP Team concluded that Alternative 5 had negligible direct wetland functional losses. Wetland losses associated with driving pilings were considered minimal (approximately 0.9 acres). On the other hand, the WRAP Team assessed the wetland functional gains associated with the partial and full removal of the existing Tamiami Trail (Table 6.2).

Wetland Restoration Potential in Everglades National Park

In addition to assessing the direct and indirect wetland functional effects of the Tamiami Trail Project, the WRAP Team identified eight developed sites in ENP which are scheduled to be purchased and potentially restored (Table 6.3). Two additional sites, The Airboat Association of Florida and SFWMD radio tower were not included in this assessment, since they will remain operational into the foreseeable future. The WRAP Team envisioned the restored areas would include a wetland/tree island mosaic in a ratio of approximately 70 percent wetlands and 30 percent tree island. It is recommended that some fill areas be retained, contoured, and planted with appropriate tropical hardwood trees to increase overall habitat diversity.

Table 6.2. Summary of With-Project Wetland Rapid Assessment Procedure (WRAP) Functional Units (FU) Lost and Gained, Tamiami Trail Project, Modified Water Deliveries Project.

Alternative	Direct Effects (FU)	Indirect Effects (FU)	Total Functional Units Lost
Alternative 1 (existing alignment and profile)			
1- w/o WQ Treatment	--	2.92	2.92
Alternative 2 (existing alignment)			
2a – w/o WQ Treatment	7.18	2.92	10.10
2b– w/ WQ Treatment	34.55	2.92	37.48
2b1 – w/ WQ Treatment	30.70	2.92	33.62
2b2 – w/ WQ Treatment	5.45	2.92	8.37
2b3 – w/ WQ Treatment	5.45	2.92	8.37
2b4 – w/ WQ Treatment	5.45	2.92	8.37
2b5 – w/ WQ Treatment	5.45	2.92	8.37
2b6 – w/ WQ Treatment	5.42	2.92	8.34
Alternative 3 (north alignment)			
3a – w/o WQ treatment	11.06	7.76	18.82
3b – w/ WQ Treatment	22.39	7.76	30.15
3b1 – w/ WQ Treatment	17.64	7.76	25.40
3b2 – w/ WQ Treatment	8.24	7.76	16.00
3b3 – w/ WQ Treatment	10.48	7.76	18.24
3b4 – w/ WQ Treatment	7.43	7.76	15.19
3b5 – w/ WQ Treatment	8.03	7.76	15.79
3b6 – w/ WQ Treatment	8.10	7.76	15.86
Alternative 4 (south alignment)			
4a – w/o WQ Treatment	46.86	+ 6.43	40.43
4b – w/ WQ Treatment	71.07	+ 6.43	64.64
4b1 – w/ WQ Treatment	42.91	+ 6.43	36.49
4b2 – w/ WQb2	42.95	+ 6.43	36.52
4b3 – w/WQ Treatment	42.92	+ 6.43	36.49
4b4 – w/ WQ Treatment	42.03	+ 6.43	35.60
4b5 – w/ WQ Treatment	42.94	+ 6.43	36.51
4b6 – w/ WQ Treatment	42.92	+ 6.43	36.49

Table 6.2 cont.

Alternative	Direct Effects (FU)	Indirect Effects (FU)	Total Functional Units Lost
Alternative 6 (four-mile bridge)			
6a	6.60	--	6.60
6b	22.77	--	22.77
6b1	20.87	--	20.87
6b2 - 6b6	3.34	--	3.34
6b3 - w/ WQb3	3.34	--	3.34
6b4 - w/ WQb4	3.34	--	3.34
6b5 - w/ WQb5	3.34	--	3.34
6b6 - w/ WQb6	3.54	--	3.54
Alternative 7			
7a – w/o WQ Treatment	3.42	--	3.42
7b – w/ Original WQ	49.55	--	49.55
7b1 – w/ WQ b1	7.18	--	7.18
7b2 – w/ WQ b2	3.42	--	3.42
7b3 – w/ WQb3	7.18	--	7.18
7b4 – w/ WQb4	7.18	--	7.18
7b5 – w/ WQb5	3.42	--	3.42
7b6 – w/WQb6	3.42	--	3.42
Alternative 8			
8a – w/o WQ Treatment	3.51	--	3.51
8b – w/ Original WQ	46.56	--	46.56
8b1 – w/ WQ b1	7.47	--	7.47
8b2 – w/ WQ b2	3.51	--	3.51
8b3 – w/ WQb3	7.47	--	7.47
8b4 – w/ WQb4	7.47	--	7.47
8b5 – w/ WQb5	3.51	--	3.51
8b6 – w/WQb6	3.51	--	3.51
Alternative 9			
9a – w/o WQ Treatment	1.91	--	1.91
9b – w/ Original WQ	33.35	--	33.35
9b1 – w/ WQ b1	4.74	--	4.74
9b2 – w/ WQ b2	1.93	--	1.93
9b3 – w/ WQb3	4.47	--	4.47
9b4 – w/ WQb4	4.47	--	4.47
9b5 – w/ WQb5	1.93	--	1.93
9b6 – w/WQb6	1.93	--	1.93

Table 6.2 cont.

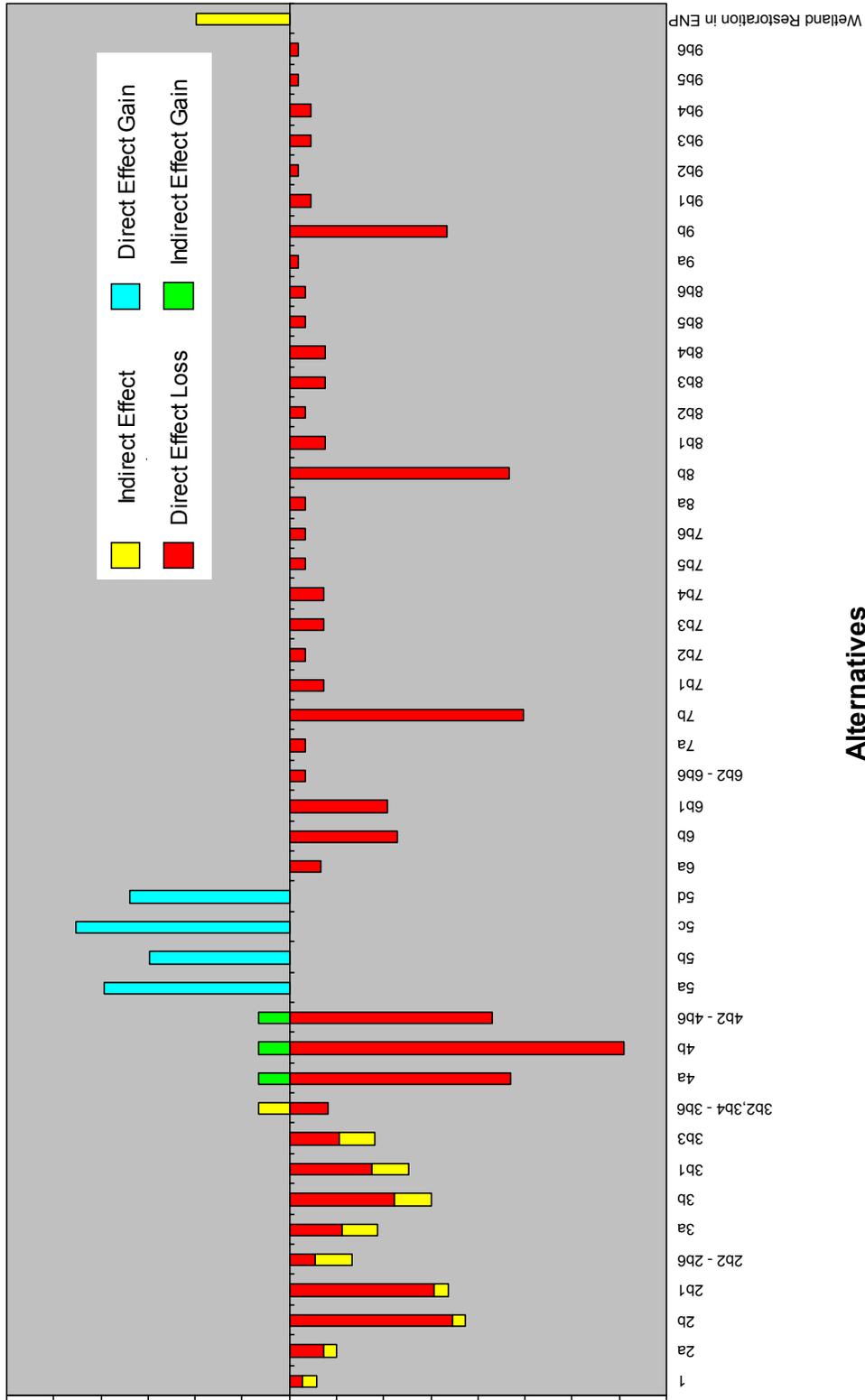
Alternative 5 (elevated causeway)		
Alternative	Acres Restored	Functional Units Gained
5a – w/o WQ Treatment; w/ a Berm	57.3	39.35
5b - w/ WQ Treatment; w/ a Berm	43.0	29.54
5c – w/o WQ Treatment; w/o a Berm	65.9	45.27
5d – w/ WQ Treatment; w/o a Berm	49.4	33.93

Comparison of Alternatives

Figure 6.2 graphically displays the overall wetland functional losses and gains between Alternatives 1, 2, 3, 4, 5, and 6, including the various water quality treatment options, and wetland functional gains from restoring wetland function at eight sites in ENP. Based on the WRAP wetland functional assessment, Alternative 4b (with dry retention water quality treatment) had the most significant wetland functional losses (- 64.64 FU). On the other hand, Alternative 5 (elevated causeway with full restoration of existing US 41) had the most significant wetland functional gains (+ 45.27 FU). The difference between these two alternatives is a total of 109.91 FU. The ranking of all the alternatives from a wetland functional loss/gain perspective is displayed in Table 6.4

Table 6.3. Summary of Potential Wetland Functional Units Gained by Restoring Eight Existing Developed Sites in Everglades National Park, South of the Eastern Section of Tamiami Trail Between the S-334 and the L-67.

Site (from East to West)	Acres Restored	Functional Units Gained
1) Radio Tower (acreage not complete)	0.668	0.47
2) Coopertown Airboat Concession	1.391	0.96
3) Unnamed Site (Adjacent to Coopertown)	0.429	0.30
4) Gator Park Airboat Concession	8.134	5.65
5) Unnamed Site East of Frog City	0.572	0.40
6) Frog City (Owned by NPS)	6.836	4.76
7) Safari Airboat Concession	8.520	5.93
8) Radio Tower (West of Safari)	1.762	1.23
TOTAL POTENTIAL WETLAND FUNCTIONAL UNITS GAINED:		19.70



Alternatives

Figure 6.2. Comparison of wetland functional loss/gain for six alternatives and functional units gained from restoration of eight sites in ENP, Tamiami Trail Project, Modified Waters Deliveries project.

Wetland Functional Losses for Alternatives Without Water Quality Treatment

Based on the ranking of total wetland functional units lost/gained by each alternative without water quality treatment, it is clearly evident that Alternative 5 (elevated causeway) is the most favorable in that a *net gain in wetland function is realized*. All the remaining alternatives exhibited varying degrees of wetland functional losses. If water quality treatment is not required, the ranking of alternatives is relatively straightforward. From most favorable to least favorable, the ranking is as follows: Alternative 5, 1, 6, 2, 3, 4. As stated above, Alternative 5 results in a substantial wetland functional gain due to either the partial or total removal of the existing Tamiami Trail. Alternative 1 (existing alignment and profile), which does not require water quality treatment, has relatively minor wetland functional loss (- 2.92 FU) attributable to temporary bypass roads and no other direct losses. Alternative 6 (four-mile bridge) also has relatively minor wetland functional losses (- 6.60 FU) due to the fact that the existing alignment is used and four miles of US 41 is removed. The remaining Alternatives (2, 3, and 4) have progressively larger wetland functional losses due to either elevating the existing profile or relocating the alignment south into ENP or north into WCA-3B. Alternative 4 (shifting the alignment south into ENP) has the greatest wetland functional loss (- 64.64 FU), which equates to an overall net loss of 109.91 FU when compared to the elevated causeway (Alternative 5).

Wetland Functional Losses for Alternatives With Water Quality Treatment

On average, the addition of water quality treatment to Alternative 5 decreases wetland functional gains by 25 percent (a loss in gain of 10.58 FU). For the remaining alternatives with dry retention water quality treatment, wetland functional losses are increased by slightly over 41 percent (22.79 FU). Thus, the dry retention water quality treatment option, on average, represents a sizeable portion of the wetland functional losses associated with Alternatives 2, 3, 4, and 6.

Comparing the Alternatives with the “creative” water quality treatment options/alignments is more complex. As designed, these options, in most cases, significantly reduce wetland functional losses. Comparing the average FU losses from the dry retention water quality treatment option to the average FU losses of the “creative” water quality treatment options, wetland functional losses are decreased by approximately 53 percent (20.68 FU). Thus, the “creative” water quality treatment options can substantially reduce wetland functional losses; however, this reduction has to be weighed against the possible loss of water quality treatment capability.

The effect the remaining “creative” water quality treatment options have on wetland function is summarized as follows:

- **Option b1 (Shift Alignment and Compress Swale/South Side):** Compared to Option b (original dry retention), Option b1 reduces wetland functional losses by about 25 percent (9.68 FU) on average. For Alternative 4 specifically, Option b1 reduced wetland functional losses by 28.15 FU, or approximately 54 percent.

Table 6.4. Rankings of Tamiami Trail Project Alternatives (with and without water quality treatment) based on Losses/Gains of Wetland Functional Units.

Ranking of Alternatives w/o WQ Treatment (1 = best; 10 = worst)			Ranking of Alternatives w/ WQ Treatment (1 = best; 29 = worst)		
Rank	Alternative	Functional Units	Rank	Alternative	Functional Units
1	5a (full)	+ 45.27	1	Alternative	Functional Units
2	5a (part)	+ 39.35	2	5d	+ 33.93
3	9a	- 1.91	3	5b	+ 29.54
4	7a	-1.93	4	9b2, 9b5, 9b6	- 1.93
5	1	- 2.92	5	6b2-b5	-3.34
6	8a	- 3.42	6	7b2, 7b5, 7b6	- 3.42
7	6a (full and partial)	- 6.60	7	8b2, 8b5, 8b6	- 3.51
8	2a	- 11.10	8	6b6	- 3.54
9	3a	- 18.82	9	9b1, 9b3, 9b4	- 4.47
10	4a	- 40.43	10	7b1, 7b3, 7b4	- 7.18
			11	8b1, 8b3, 8b4	- 7.47
			12	2b6	- 8.34
			13	2b2-b5	- 8.87
			14	3b6	- 15.86
			15	3b5	- 15.79
			16	3b4	- 15.91
			17	3b2	- 16.00
			18	3b3	- 18.24
			19	6b1	- 20.87
			20	6b	- 22.77
			21	3b1	- 25.40
			22	3b	- 30.15
			23	2b1	- 33.62
			24	4b4	- 35.60
			25	4b1, 4b3, 4b6	- 36.49
			26	4b5	- 36.51
			27	4b2	- 36.52
			28	2b	- 37.48
			29	4b	- 64.64

- **Option b2 (Shift Alignment and Compress Swale/North Side):** Compared to Option b (original dry retention), Option b2 reduces wetland functional losses by about 56 percent (21.71 FU) on average. The most significant wetland functional loss reduction for Option b2 compared to Option b is Alternative 2, where wetland functional loss is reduced by 78 percent (29.11 FU).
- **Option b3 (Shift Typical Section North into L-29 Canal):** Compared to Option b (original dry retention), Option b3 reduces wetland functional losses by 57 percent (22.15 FU) on average. The most significant wetland functional loss reduction for Option b3 compared to Option b is again Alternative 2, where wetland functional loss is reduced by 78 percent (29.11 FU).
- **Option b4 (Grass Strips):** Compared to Option b (original dry retention), Option b4 reduces wetland functional losses by 59 percent (22.96 FU) on average. The most significant wetland functional loss reduction for Option b4 compared to Option b is again Alternative 2, where wetland functional loss is reduced by 78 percent (29.11 FU).
- **Option b5 (Exfiltration Trenches with Curb and Gutter):** Compared to Option b (original dry retention), Option b5 reduces wetland functional losses by 59 percent (22.76 FU) on average. The most significant wetland functional loss reduction for Option b5 compared to Option b is again Alternative 2, where wetland functional loss is reduced by 78 percent (29.11 FU).
- **Option b6 (Exfiltration Trenches with Shoulder Gutter):** Compared to Option b (original dry retention), Option b6 reduces wetland functional losses by 59 percent (22.70 FU) on average. The most significant wetland functional loss reduction for Option b5 compared to Option b is again Alternative 2, where wetland functional loss is reduced by slightly more than 78 percent (29.42 FU).

In summary, based on average wetland functional unit losses, the water quality options are ranked in Table 6.5.

Restoring Wetland Function in Everglades National Park

Based on the WRAP results of restoring the eight concession and radio tower sites described in Table 6.3, a *net gain* of 19.70 FU can be achieved. Factoring these results into the overall assessment of FU gains/losses of the Tamiami Trail Alternatives significantly changes the overall resultant wetland functional unit totals, as depicted in Table 6.6.

Including the ENP restoration sites into the overall WRAP assessment results in all the Alternatives without water quality treatment, except Alternative 4, changing to a *net gain in wetland function*. For Alternative 5, a total net gain of 65.97 FU is realized. On average, for Alternatives 1, 2, 3, 4, and 6, a net gain of 37.03 FU is achieved. Only Alternative 4 has a loss in wetland function (- 20.77 FU); however, the loss of wetland function for Alternative 4 is decreased by 50 percent when the ENP restoration is included.

Table 6.5. Ranking of Water Quality Treatment Options Based on Average Wetland Functional Units Lost, Tamiami Trail Project, Modified Water deliveries Project.

Water Quality Treatment Option	Ranking	Average Functional Units Lost
Grass Strips (b4)	1	15.80
Exfiltration Trenches w/ Curb and Gutter (b5)	2	16.00
Exfiltration Trenches w/ Shoulder Gutter (b6)	3	16.06
Shift Typical Section North into L-29 Canal (b3)	4	16.61
Shift Alignment and Compress Swale/North Side (b2)	5	17.05
Shift Alignment and Compress Swale/South Side (b1)	6	29.08
Original Dry Retention (b)	7	38.37

Wetland losses for the Alternatives with water quality are similarly reduced. For example, wetland functional losses for Alternatives 4, 2, 3, and 6 are reduced by 31, 47, 66, and 87 percent, respectively. Alternative 5 (with water quality) experiences a 37 percent increase in wetland function for a total wetland functional gain of 53.63 FU.

In summary, the integration of the ENP restoration sites as project features to be restored during Tamiami Trail Project construction: 1) eliminates wetland functional losses for all but one Al-

Table 6.6. Summary of Changes in Wetland Functional Units (FU) for Project Alternatives as a Result of Restoring Eight Sites in Everglades National Park, Tamiami Trail Project, Modified Water Deliveries Project.

Alternative	Without Water Quality Treatment (FU)	With ENP Restoration (FU)	With Water Quality Treatment (FU)¹	With ENP Reatoration (FU)
1	- 2.92	+ 16.78	--	+ 16.78
2	- 11.10	+ 8.60	- 37.48	- 19.90
3	- 18.82	+ 0.88	- 30.15	- 10.45
4	- 40.43	- 20.27	- 64.64	- 44.90
5	+ 45.27 ²	+ 65.97	+ 33.93	+ 53.63
6	- 6.60	+ 13.10	- 22.77	- 3.07

¹ Dry Retention Water Quality Treatment

² Full removal of US 41

ternative (Alternative 4) without water quality; 2) reduces wetland functional losses for the Alternatives with water quality by 31 to 87 percent; and 3) increases Alternative 5 (with water quality) wetland functional gains by 37 percent.

Exotic Vegetation Removal

The WRAP Team documented the presence of exotic vegetation in the project area as part of the wetland functional assessment. The dominant exotic species of vegetation was identified as Brazilian pepper. This small tree-sized exotic dominated (greater than 50 percent) the Tamiami Trail highway shoulder along the entire 10.7-mile project length for a width averaging between 10 to 30 feet. The shoulder also was mixed with *Ficus* and scattered bay trees. This highway shoulder fringe provides habitat for primarily passerine birds, provides a vegetative buffer between the highway and the marsh, and provides a corridor for east-west wildlife movement parallel to the highway. Wildlife skeletal remains (turtles, birds) were observed during surveys along the highway shoulder (see WRAP Sheet 5-ENP in Appendix F).

On the WCA-3B side of the highway corridor, a similar although less Brazilian pepper infested fringe also is present. The WRAP assessment found that Brazilian pepper, when present, represented less than 5 percent of the vegetative overstory (see WRAP Sheets 1-3B to 6-3B in Appendix F). The fringe along the L-29 Levee and marsh was 40 to 50 feet in width. This vegetated fringe also provides habitat for primarily passerine birds, provides a vegetative buffer between the levee and the marsh, and provides a corridor for east-west wildlife movement parallel to the levee.

Based on the WRAP survey data, an Exotic Removal Performance Measure was developed to compare the acres of exotic vegetation removed by alternative. The measure is based on the width of exotic vegetation and the relative dominance of Brazilian pepper present, by alternative. The results of this performance measure is found in the Matrix of Alternative Performance (page 109).

It should be noted that the ability of a given alternative to permanently remove exotic vegetation is based on the assumption that an Exotic Vegetation Maintenance Plan will be implemented as part of the Recommended Plan. Without such a plan, exotic vegetation would re-infest the highway fringes, and the existing condition would persist in the with-project condition.

Discussion

The WRAP results clearly demonstrate that Alternative 5 (elevated causeway), with or without water quality treatment, is the preferred alternative from a wetland perspective. This is particularly the case when US 41 is removed in its entirety (see Figure 6.2). Alternative 5 is the only alternative that exhibits wetland functional gains; all other alternatives exhibit varying degrees of wetland functional losses. Alternative 4 (shifting the alignment into ENP) had the greatest wetland functional losses (- 64.64 FU with dry retention water quality treatment). Alternative 1 (existing alignment without water quality treatment) exhibited the smallest wetland functional losses (- 2.92).

It is estimated that the US 41 highway/canal corridor has eliminated approximately 530 acres of historic Everglades. This habitat consisted of a ridge and slough mosaic interspersed with tree islands. In addition to the direct effects, the construction of Tamiami Trail in 1929 and the subsequent dredging of the L-29 Canal/Levee has indirectly affected an undetermined amount of adjacent wetlands through sedimentation and hydrologic changes. A review of 1940's photography of the Tamiami Trail corridor reveals that the Everglades ridge and slough landscape adjacent to Tamiami Trail had been so significantly altered at that time that those landscape features were indiscernible (Ken Rutchey, SFWMD, pers. comm.).

The Federally Recommended Plan should fully integrate features that will restore the historic Everglades wetland landscape to the maximum possible degree. For example, the historic locations of ridges and sloughs bisected by the US 41/L-29 Canal/Levee corridor should be fully investigated and a plan developed to reconnect those landscape features as much as possible. The location of historic tree islands should also be determined and a plan developed to restore tree island habitat. These plans should ultimately be carried forward in the CERP Decompartmentalization (Phase 1) planning process. In effect, this restoration project should be more than just meeting a particular discharge target under Tamiami Trail; it also should be an ecological restoration project taking into account the effects of flow on landscape features and ecological processes.

In the planning for the restoration of Tamiami Trail, it is also important to factor in the potential wetland functional gains derived from restoring wetland function in ENP. As demonstrated by the WRAP assessment, restoring wetland function in ENP effectively mitigates for all but one alternative (Alternative 4) without water quality, and increases the wetland functional gains for Alternative 5 by 37 percent.

The ENP will be developing a General Management Plan for the ENP expansion lands over the next several years. The WRAP assessment in this report will need to be factored into that Plan to take advantage of restoring wetland function on ENP lands.

Finally, when planning for the restoration of Tamiami Trail, it is important to avoid direct wetland functional losses by keeping any new work within the footprint of the existing disturbed corridor as much as possible. This disturbance includes all construction activities, in addition to the direct road work, including staging areas, haul roads, and any temporary project features.

CHAPTER 7- WILDLIFE MORTALITY AND CONNECTIVITY

Study Purpose

On December 19 and 20, 2000, and April 18, 2001, biologists from the FWS, FWC, and Corps conducted a series of wildlife mortality surveys along five miles of Tamiami Trail. The purpose of the surveys was to document the classes and relative numbers and locations of animals (identified to species where possible) subject to mortality to assist with highway design and the placement of wildlife mortality reduction features.

Methodology

The surveys consisted of biologists walking the north and south shoulders of the highway and systematically documenting wildlife remains. The surveys were conducted during daylight hours in one-half mile segments at five locations: Site 1: one-half mile on each side of an agricultural canal four miles west of S-334; Site 2: Flight 592 Memorial extending one mile eastward; Site 3: L-30 Canal extending one mile west; Site 4: one-half mile on each side of the Tamiami Trail Wood Stork Colony; and, Site 5: one-half mile on each side of the Blue Shanty canal.

All remains found were identified whether freshly killed or previously killed. Some individuals were freshly killed (within weeks), while other remains were likely up to a year old.

Results

The results of the wildlife mortality surveys are presented in Tables 7.1 – 7.5. A total of 369 animal remains were identified within the surveyed five-mile reaches of Tamiami Trail. An average of 74 animal remains were found per mile of highway within the five-mile reach, or almost one-half of the total project length. Extrapolated over the entire project length (10.7 miles), 790 animal mortalities are realized.

On average, the north side of the highway resulted in 47 percent of all mortality, while the south side averaged 53 percent. Turtles accounted for 59 percent of all observed mortality. Fifty-six percent of all turtle mortality was associated with the north side of the highway. Turtle mortality averaged 43.4 individuals per mile, or 460 turtles extrapolated over the 10.7-mile length of highway. Twenty individual alligator remains were located during the surveys. Six mammal remains were clustered on the south side of Tamiami Trail at the Flight 592 Memorial site. This site has a vegetated buffer on the south side and the L-67s on the north side forming a corridor for terrestrial wildlife crossing Tamiami Trail.

Table 7.1. Site 1: Wildlife remains identified 1/2 mile on each side of Agricultural Canal south of Recreational Area 4 miles west of S-334 (December 19, 2000).

NORTH SIDE OF TAMIAMI TRAIL			
Class/Species	East ½ mile	West ½ mile	Total
Turtles	16	12	28
Snakes	1	2	3
Frogs	1	1	2
Alligators	0	0	0
Birds	0	0	0
Mammals	0	1	1
Unidentified	1	4	5
SOUTH SIDE OF TAMIAMI TRAIL			
Turtles	4	6	10
Snakes	0	3	3
Frogs	0	0	0
Alligators	0	1	1
Birds	4	1	5
Mammals	0	0	0
Unidentified	2	1	3
Total			61

Table 7.2. Site 2: Wildlife remains identified along 1 mile of Tamiami Trail beginning at the Flight 592 Memorial adjacent to the L-67 Canals and ending 1/2 mile east of Osceola Camp (December 20, 2000). (Begin: 532864 N; 2849266 E. End: 534500 N; 2849254 E)

NORTH SIDE OF TAMIAMI TRAIL			
Class/Species	East ½ mile	West ½ mile	Total
Turtles	11	7	18
Snakes	0	0	0
Frogs	0	0	0
Alligators	0	0	0
Birds	3	0	3
Mammals	0	1	1
Unidentified	0	0	0

Table 7.2. Site 2: cont..

SOUTH SIDE OF TAMIAMI TRAIL			
Class/Species	East ½ mile	West ½ mile	Total
Turtles	5	4	9
Snakes	0	0	0
Frogs	0	0	0
Alligators	1	1	2
Birds	1	0	1
Mammals	2	4	6
Unidentified	2	2	4
Total			44

Table 7.3. Site 3: Wildlife remains identified on December 20, 2000 along 1 mile of Tamiami Trail beginning at the L-30 Canal extending 1 mile west and ending at a bank of culverts (Begin: 550299 N; 2849310 E. End: 548615 N; 2849297 E).

NORTH SIDE OF TAMIAMI TRAIL			
Class/Species	East ½ mile	West ½ mile	Total
Turtles	38	20	58
Snakes	0	0	0
Frogs	0	0	0
Alligators	0	0	0
Birds	3	0	3
Mammals	3	0	3
Unidentified	0	1	1
SOUTH SIDE OF TAMIAMI TRAIL			
Turtles	18	4	22
Snakes	0	0	0
Frogs	0	0	0
Alligators	1	1	2
Birds	1	2	3
Mammals	2	1	3
Unidentified	1	1	2
Total			97

Total # of individuals = 65 North + 32 South = 97

North side = 67% of the mortality.

Turtles represent 82% of the mortality (63% of turtles found on north side).

Species identified: 1- opossum, 1- armadillo, 1 - raccoon, 1- dog

Table 7.4. Wildlife remains identified by FWC on April 18, 2001, along 1 mile of Tamiami Trail (between culverts #44 to #46 at the Blue Shanty Canal [culvert #45]).

NORTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	18	3	21
Snakes	1	0	1
Frogs	0	0	0
Alligators	2	2	2
Birds	0	0	0
Mammals	0	1	1
Unidentified	1	1	2
SOUTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	19	12	31
Snakes	4	2	6
Frogs	0	0	0
Alligators	2	1	3
Birds	3	3	6
Mammals	1	5	6
Unidentified	1	0	1
Total			80

Table 7.5. Wildlife remains identified by FWC on April 18, 2001, along 1 mile of Tamiami Trail (between culverts #56 to #54 at the Tamiami Trail wood stork colony [culvert #55]).

NORTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	16	20	36
Snakes	5	3	8
Frogs	2	1	3
Alligators	1	2	3
Birds	4	6	10
Mammals	0	0	0
Unidentified	1	1	2
SOUTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	9	15	24
Snakes	23	7	30
Frogs	0	0	0
Alligators	2	2	4
Birds	4	3	7
Mammals	0	0	0
Unidentified	0	0	0
Total			127

During the April 18, 2001, survey by FWC the marsh in ENP dried to approximately one foot below the ground surface. Likewise, the marsh in WCA-3B had completely dried out. The drying of pools and shallow ditches near the highway likely resulted in the movement greater numbers of water-dependent reptiles in search of new aquatic refugia. Reptile activity during this time of year is also typically greater than during the winter due to higher ambient air temperature, while cooler temperatures at night would promote snake movement onto the pavement to absorb the warmth captured there during the day. The survey results support conclusion, as 88 percent of the 51 individual snakes identified were found during the April survey.

For the purpose of establishing a Wildlife Mortality Performance Measure, it was estimated that the individuals identified along Tamiami Trail represented approximately 50 percent of the total annual mortality due to the fact that roadkill individuals, particularly snakes and frogs, are predated (there are numerous vultures roosting on the L-29 Levee), and injured animals wander off the highway before dying and are not identified. Thus, 148 individuals per mile per year was the average roadkill rate used to establish the relative performance of each alternative for reducing roadkill along Tamiami Trail.

Discussion

Trombulak and Frissel (2000) recently reviewed the scientific literature regarding the ecological effects of roads on terrestrial and aquatic communities. This comprehensive review concluded that roads affect terrestrial and aquatic ecosystems in seven general ways: 1) increased mortality from road construction, 2) increased mortality from collisions with vehicles, 3) modification of animal behavior, 4) alteration of the physical environment, 5) alteration of the chemical environment, 6) spread of exotic species, and 7) increased alteration and use of habitat by humans.

These general effects overlap somewhat. In some cases animals modify their behavior and avoid roads. Roads may facilitate the spread of invasive species by disrupting native communities and altering physical habitats. Roads may fragment populations through roadkill and avoidance. Despite the difficulty of categorizing discretely the causal basis in every example, these seven categories provide a useful framework for assessing what is known and unknown about the ecological effects of roads. The discussion below focuses on criterion 2; increased mortality from collisions with vehicles, as it relates to the proposed modification of Tamiami Trail.

Mortality from Collisions with Vehicles

Mortality of animals from collision with vehicles is well documented. Many reviews of the taxonomic breadth of the victims of vehicle collision have been published (*e.g.* Groot *et al.* 1996). Few, if any, terrestrial species of animal are immune. Large mammals ranging in size from moose to armadillos are the best-documented roadkills, probably due to interest in their demography and to their size (Bellis and Graves 1971; Puglisi *et al.* 1974; Davies *et al.* 1987; Bangs *et al.* 1989).

Published accounts of roadkill bird species include raptors (hawks and owls), wading birds and tropical forest birds (Novelli *et al.* 1988) to name a few. The endangered American crocodile

has experienced considerable roadkill on Card Sound Road in Miami-Dade County, Florida (Kushlan 1988). Roadkill is nonspecific with respect to age, sex, and condition of the animal (Bangs *et al.* 1989).

Amphibians and some reptiles may be especially vulnerable to roadkill because their life histories often involve migration between wetland and upland habitats, and individuals are inconspicuous and sometimes slow-moving. Roads can be demographic barriers that cause habitat and population fragmentation. In the Netherlands, for example, roads with high traffic volume negatively impact occupancy of ponds by moor frogs (Vos and Chardon 1998). In Ontario, the local abundance of toads and frogs is inversely related to traffic density on adjacent roads, but the incidence of roadkill relative to abundance is higher on highly trafficked roads (Fahrig *et al.* 1995). Thus, even though populations in high-traffic areas have apparently been depressed from cumulative road mortality, they continue to suffer higher proportionate rates of roadkill.

Mitigation measures have been employed in different locations with varying degrees of success (Yanes *et al.* 1994). For example, underpasses on Interstate 75 in Florida have been partially successful in reducing roadkill of Florida panthers (Foster and Humphrey 1991). Despite mitigation efforts, roads are likely to be a persistent source of mortality for many species. In general, mortality increases with traffic volume (Rosen and Lowe 1994; Fahrig *et al.* 1995). Some species are less likely to be killed on high-speed roads than on medium-speed roads because the former usually have vegetation cleared back further from the road's shoulder creating less attractive habitat and greater visibility for both animals and drivers. Other species, however, are attracted to the modified habitat alongside and in the medians of high-speed roads (Cowardin *et al.* 1985) resulting in population sinks.

Road Mortality on Tamiami Trail

There has been no systematic study of wildlife roadkill along Tamiami Trail. The roadkill survey in this report represents a cursory look at the issue of Tamiami Trail road mortality. For example, the smaller amphibians and reptiles killed on this highway are easily scavenged by predators and are not well represented in a survey of this nature (*i.e.*, numerous vultures roost along the L-29 Levee and along adjacent telephones poles). Likewise, turtle remains are persistent and are more readily counted in the roadkill results presented here.

There are, however, published and unpublished reports of roadkill from areas adjacent to Tamiami Trail. For example, (Bernadino and Dalrymple 1992) examined the impact of seasonal visitation to ENP on the snake community of the Pa-hay-okee wetlands adjacent to Shark River Slough. This study found that 73 percent of all snakes observed on the Park's main road were either injured or dead (1,172 individuals from 16 taxa) within the study area. This study recommended various mitigation measures to reduce roadkill including construction of wildlife underpasses, road closure during peak snake migration, and reduced speed zones. Fencing and funneling of snakes (and other reptiles and amphibians) to the underpass locations were recommended. The upper surface of the recommended underpasses (flush to the road surface) has slots that allow light penetration and near-ambient temperatures to be reached within the tunnels (Brehm 1989).

Another study conducted in ENP (Meshaka, unpub. data, in prep.) examined mammal roadkill along a 40-mile stretch of the Park's entrance road for a period of one year (February 1996 to January 1997). During this period, 106 raccoons, 37 opossum, 7 grey fox, 22 whited-tail deer, 1 bobcat, 4 marsh rabbit, 3 armadillo, 2 rodents and 1 feral cat were counted, for a total of 183 mammals. Keep in mind that this level of mortality occurred inside the Park where vehicle speeds are reduced and closely regulated.

Roadkill data collected for a period of about 10 years (July 1990 to September 2000) at Fakahatchee Strand State Preserve, which is bisected by US 41, documented that a total of 1,171 mammals, birds, reptiles, and amphibians had been killed by collisions with vehicles on Jane's Scenic Drive (Mike Owen, pers. comm.). Jane's Scenic Drive is a gravel County Road posted at 35 mph. Even under these conditions, the following number of taxa and individuals have been recorded as roadkill on this gravel road: 283 mammals (including one State threatened Everglades mink, 12 white-tailed deer, 7 river otter, 2 bobcats, and 1 coyote); 148 birds (including bitterns, hawks, ducks, limpkins, and other passerines); 713 reptiles (including 578 snakes representing 22 taxa, one of which was an endangered eastern indigo snake, 42 lizards, and 23 alligators); and 24 amphibians (frogs and toads).

Based on the compilation of state-wide road mortality data by the State Bureau of Natural and Cultural Resources in State Parks and Preserves over the past nine years, 35,299 species of mammals, herps, and birds have been killed on 439.8 miles of roads in State managed lands in Florida (see Appendix G). During the 1999-2000 reporting period 3,036 individuals were recorded, including at least 13 species of State rare and endangered species: gopher tortoise, Everglades mink, Sherman's fox squirrel, white-crown pigeon, eastern indigo snake, and American crocodile. Road mortality is considered a serious challenge to conserving native park wildlife.

Reducing Mortality on Tamiami Trail

Tamiami Trail (US 41) is a high-speed, two lane highway posted at 55 mph. Traffic volume is currently 5,200 vehicles per day and is projected to increase to 9,000 per day (almost double) by 2020. Bounded on the north side by the L-29 Canal, aquatic organisms leaving the canal and entering the highway are susceptible to vehicle collisions. Thus, it is not surprising that species of turtles dominated the roadkill count for the survey conducted for this report. Likewise, being bounded on the south by Everglades marsh, both aquatic and terrestrial species entering the highway have the potential to be hit by fast-moving vehicles. To add to this, driver visibility and highway shoulder widths are minimal.

The wildlife mortality and connectivity features presented in this report (the two wildlife underpasses with land bridges and the herp barriers) are designed to significantly reduce roadkill on Tamiami Trail. The herp barrier design is based on the herp barrier constructed along a 2-mile stretch of US 441 where it crosses Paynes Prairie State Preserve near Gainesville, Florida.

Mortality studies along this 2-mile stretch of US 441 at Paynes Prairie documented more than 36,000 roadkill individuals from 82 taxa of vertebrates, of which over 50 percent were wetland vertebrate species, that had fallen victim to collisions with vehicles. Eighty-eight percent of all roadkill individuals were species of amphibians. This study concluded that the continual loss of

wetland species is suspected to lead to population and marsh community instability. These losses may cause abnormal shifts in the positions of adjacent individuals as they attempt to fill “holes” left by killed individuals, thus bringing ever more animals into contact with the roadway, creating short- and long-term population sinks for many of these species. Wildlife kills also lead to changes in food pyramids in the marsh by affecting predator and prey densities and by attracting bird and mammal predators and scavengers to the highway, a habitat that would otherwise be avoided.

The Paynes Prairie “Ecopassage” project has now been completed by FDOT. Preliminary data indicate a drop in wildlife mortality along US 441. Success of the Ecopassage is currently being documented by the U.S. Geological Survey under contract to the FDOT through year-long pre- and post-construction roadkill surveys and monitoring of wildlife use of the passages under the highway.

The Paynes Prairie herp barrier design, in particular, would greatly reduce species of turtles, amphibians and reptiles being killed and injured by vehicles along Tamiami Trail, based on the limited mortality survey conducted as part of this report. Any large, continuous opening (*e.g.* several miles of causeway) would substantially reduce roadkill and increase overall wildlife connectivity. Needless to say, the longer the causeway, the more compatible Tamiami Trail will become for wildlife movement and roadkill reduction. Alternatives which provide minimal openings under Tamiami Trail (*e.g.* box culverts), unless numerous, would not be anticipated to significantly reduce this mortality, unless road mortality reduction features such as those recommended in this report are integrated into project design.

The two wildlife underpasses proposed to be located at the eastern and western ends of the study area are targeted to safely pass terrestrial species under Tamiami Trail. FDOT has implemented this design on US 29 and other locations around Florida. The 50-foot wide structures, each with a 24-foot wide land bridge to facilitate passage of animals across the L-29 Canal, would also enhance north-south wildlife movement along the eastern periphery of WCA-3B and along the L-67 extension levees.

Without question, the full causeway alternative (Alternative 5), if implemented, would preclude the need for wildlife mortality features, as the full 11 miles of marsh between the central and southern Everglades would be connected and vehicle collisions virtually eliminated.

Therefore, unless wildlife features similar to those recommended in this report are incorporated in an alternative that provides less than full connectivity (all alternatives except the full causeway Alternative 5), long-term road mortality will continue to occur along the Tamiami Trail corridor.

Finally, a more detailed study of road mortality issues associated with Tamiami Trail is recommended to understand the full scope of wildlife collisions with vehicles. For example, documenting mortality “hot spots” may be particularly important when designing bridged openings under Tamiami Trail.

Recommendations to Reduce Wildlife Mortality and Facilitate Connectivity

- 1) **Animal Barriers:** Based on the US 41 mortality survey, there is an established need to reduce mortality for species of reptiles (primarily turtles and snakes) and amphibians. It is apparent that most turtle mortality is associated with turtles leaving the L-29 canal and moving south across a 10 to 15-foot grass strip onto the highway. The Payne’s Prairie wildlife barrier just south of Gainesville, Florida, was designed for this purpose. It consists of a four-foot high vertical concrete wall capped with a six-inch concrete overhang to preclude species from climbing over the wall. FWS/NPS envision this barrier being placed along the length of the project area of US 41 on both the north and south sides of the highway, between the bridge/box culvert locations. The FDOT cost of constructing this barrier for the Payne’s Prairie project was about \$1 million/mile. These barriers may also have the added benefit of eliminating the toe of fill in wetlands, thus reducing wetland losses. There is also a need to maintain the barrier free of brush and debris to ensure its functionality.

One concern that needs to be considered is the maintenance of a “clear zone” between the highway and the barrier. The width of this zone is based on the highway design speed. We are uncertain if there is sufficient width between the highway and the L-29 canal to meet this requirement. Our desire is to leave some littoral zone (*e.g.* 8 to 10 feet) between the edge of the canal and the barrier as habitat for various aquatic organisms (*e.g.* turtle nesting substrate). This needs to be coordinated with FDOT.

- 2) **Wildlife Underpasses:** Based on wildlife mortality surveys, discussion with FWC experts, and review of design plans from other wildlife underpasses around the State, it is recommended that two underpasses be located under US 41 to both reduce wildlife mortality and increase wildlife connectivity between WCA-3B and ENP.
- 3) **Underpass Locations:** The first underpass is recommended at the eastern end of the project near the intersection of the L-29 canal and the L-30 canal. This “T” shaped canal configuration is a significant impediment to north-south wildlife movement between the WCA-3B levee and the L-31 levee. An underpass at this location and land bridge over the L-29 canal would greatly facilitate the movement of terrestrial species.

A second underpass is recommended at the western end of the project to facilitate wildlife movement across US 41. A number of wildlife remains were found at this location (to the east of the bend in the highway). Wildlife moving along the L-67 levee appear to be experiencing higher rates of mortality when confronted by US 41. This underpass would facilitate north-south movements of wildlife.

- 4) **Underpass Design:** FWS and NPS recommend the adoption of the wildlife underpass design utilized by FDOT on US 29 (Appendix D). Based on the final design drawings, the underpasses consist of a 50-foot concrete slab bridge placed in the highway alignment. Clearance from the ground elevation to the bottom of the bridge is 8 feet. The

ends of the bridge are supported by vertical concrete sheetpile walls, with a pile support in the center of the bridge. This design was selected to maximize light penetration under the bridge and to provide sufficient height to pass some of the larger mammals.

Fencing will be needed to funnel wildlife to the underpasses. Based on the wildlife species anticipated to use the underpasses, we recommend that a 6-foot chain link fence, buried one foot into the ground, extend 1/2 mile on each side of the crossing locations on both the north and south sides of US 41. Our preliminary estimate is that one underpass could be constructed for \$500,000. Maintenance of the underpass/fencing will be needed, but is not anticipated to be a significant cost. FDOT normally contracts the maintenance to firms specializing in that type of work.

- 5) **Land Bridges Over the L-29 Canal:** For the eastern and western underpasses, we recommend land bridges be constructed over the L-29 canal. A design successfully utilized by FDOT at other canal crossings consists of a 24-foot wide concrete bridge with 2 feet of soil spread on its surface for vegetation to grow. These bridges would be designed for a minimal load bearing capacity. It is recommended that telephone pole posts be placed at each end of the bridge to prevent auto/ATV access. The planting of shrubs along the land bridge would facilitate wildlife passage. Maintenance of these features is expected to be minimal.
- 6) **Littoral Shelves:** It is recommended that vegetated littoral shelves (*i.e.* 15-ft wide and varying from 1 to 2 ft in depth) be excavated to enhance the vertical-walled L-29 canal. This feature would benefit wading birds, fishes, reptiles, and amphibians residing in the canal, as well as water quality.

CHAPTER 8 - FEDERAL AND STATE-LISTED THREATENED AND ENDANGERED SPECIES, AND STATE SPECIES OF SPECIAL CONCERN

Federally Listed Species

Federally listed species which are known to occur or could occur in the action area (Figure 8.1) or be affected by construction and operation of the proposed action include: the endangered snail kite, wood stork, CSSS, Florida panther, West Indian manatee, and the threatened eastern indigo snake.

Status of Section 7 Consultation

On October 11, 2000, the Corps requested the FWS provide a list of threatened and endangered which are likely to occur in the Tamiami Trail Project. In a Planning Aid Letter, dated November 14, 2000, the FWS responded to this request that the endangered snail kite, endangered wood stork, and threatened eastern indigo snake travel, reside, and/or forage on lands in the project area. While not directly residing in the project area, the endangered CSSS could be affected by the Tamiami Trail Project if the final design constrains flows into NESS.

The FWS has recently been informed of a manatee mortality in the L-29 canal. This manatee died of cold-related stress sometime during the December/January cold weather event. Based on information from FWC (Penny Husted, pers. comm.), this manatee apparently migrated from Lake Okeechobee, where gates are open due to drought conditions, through a series of canals/structures, into the L-67 canals, and eventually to the L-29 canal. While this is an unusual event (the only record of a manatee in the eastern reach of the L-29 canal), it attests to the fact that manatees can be found within the project area.

The Florida panther is found in the project area. In accordance with the Standard Local Operating Procedures, dated August 18, 2000, between the Corps and FWS for conducting section 7 consultations, the Tamiami Trail Project falls within the Consultation Area for the Florida panther. Therefore, this endangered species will also need to be considered in the Corps' Biological Assessment.

The FWS also recommended the *Standard Construction Protection Measures for the Eastern Indigo Snake* be included in the project design in order to minimize or avoid any potential adverse effects on this species (Appendix E).

As a result of ongoing informal consultation, the FWS recommends the Federal action incorporate the wood stork construction timing and set-back criteria into project scheduling, design, and construction as described below.

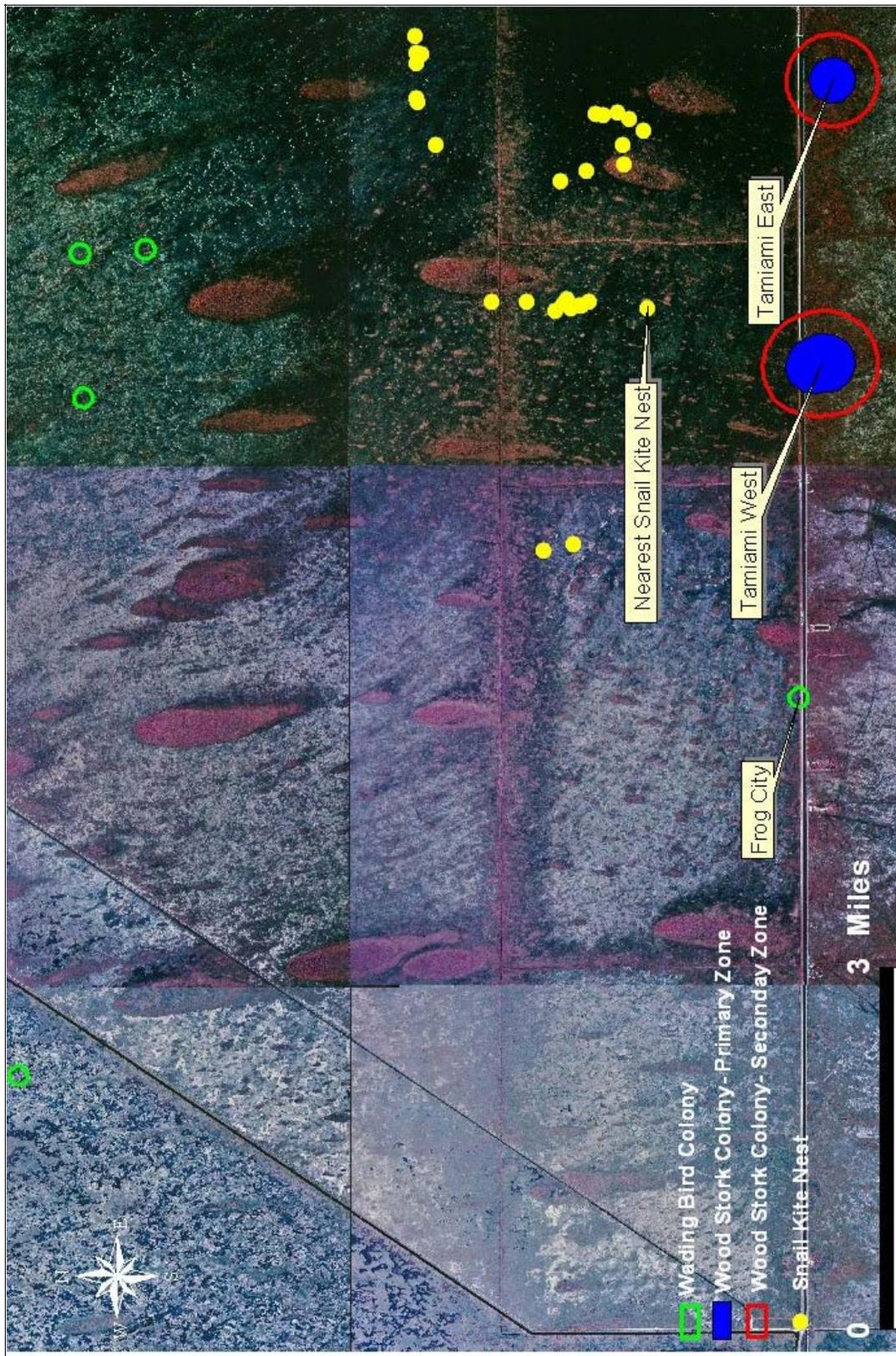


Figure 8.1. Action Area

On July 24, 2002, in response to the Corps' Biological Assessment, dated May 30, 2002, the FWS concurred with the Corps' determination that implementing the Federal action is not likely to adversely affect federally listed species. On April 17, 2003, the Corps again requested concurrence from the FWS under section 7 of the ESA that implementation of Alternative 7A would not adversely affect federally listed species. The Corps agreed to implement the construction restrictions for the wood stork, continue monitoring the snail kite, and implement construction protection measures for the manatee and eastern indigo snake. The FWS concurred with this determination by letter dated May 22, 2003, thus concluding section 7 consultation for the Tamiami Trail Project.

Endangered Wood Stork Colonies

The FWS has applied the *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Guidelines) (Ogden 1990) to the Tamiami West Colony based on photography provided by Dr. Peter Fredericks, University of Florida, of the colony during the 1999 nesting season. The FWS has also applied the Guidelines to the smaller Tamiami East Colony based on mapped coordinates. Based on the digitized colony boundary, Primary and Secondary Zones were established for both colonies in accordance with the Guidelines. From the photograph of the Tamiami West Colony, it was apparent that wood storks nested as close as 300 feet south of Tamiami Trail during the 2000 nesting season, when an estimated 1,300 storks nested at this site. The Tamiami East and West colonies are mixed wading bird colonies also supporting nesting snowy egrets, great egrets, white ibis, and tricolored herons.

Primary Zone

The Primary Zone is the most critical area, and must be managed according to the Guidelines to insure the colony site survives. Human activities inside the Primary Zone during the wood stork nesting season, in particular, should be conducted according to the Guidelines. Primary Zones normally extend between 1,000 and 1,500 feet in all directions from the colony boundaries based on the presence or absence of visual barriers between the colony and the disturbance. In no case should the Primary Zone be less than 500 feet. In the case of the Tamiami East and West colonies, a distance of 1,000 feet was chosen due to the visual barrier of the pond apple forest between the colony and Tamiami Trail, and the fact that wood storks appear to have become somewhat acclimated to highway traffic noise.

Secondary Zone

Secondary Zones extend outward from the Primary Zone 1,000 to 2,000 feet, or to a radius of 2,500 feet from the outer edge of the colony. Restrictions in this zone are needed to minimize disturbances that might impact the Primary Zone, and to protect essential areas outside the Primary Zone. The Secondary Zone may be used by wood storks for collecting nesting material, for roosting, loafing, and feeding (especially important for newly fledged young). For the application of the Guidelines to the Tamiami Trail Project, a distance of 1,000 feet from the Primary Zone, extending in all directions, was chosen for both colonies for the reasons described above for the Primary Zone.

Guidelines Applied to the Tamiami West Colony

As mapped in the manner described above, the Tamiami West Colony Primary and Secondary Zones overlap varying linear distances of the highway depending on the alternative (Figure 8.2.). Table 8.1 provides these linear distances, by alternative.

Table 8.1. Summary of Linear Distances of Overlap of Primary and Secondary Zones on US 41 for the Tamiami West Wood Stork Colony, Tamiami Trail Project, Modified Water Deliveries Project.

Alternative	Linear Feet of US 41 In the Primary Zone	Linear Feet of US 41 In the Secondary Zone
3 (North Alignment in WCA-3B)	2,040	2,214
1, 2, 5, 6, 7, 8, 9 (Existing Alignment)	2,295	2,122
4 (Southern Alignment in ENP)	2,763	1,701

Restrictions

The Guidelines specifically restrict such activities as “The construction of any building, roadway, tower, power line, canal, etc.”, which are to be implemented when the colony is active (nesting is occurring). Therefore, between February (or the onset of nesting activity) and through the onset of the rainy season (or when the young have fledged), highway construction should not be permitted in the reach of the highway affected by that alternative. The initiation and cessation of nesting can only be accurately determined in the field by a qualified observer (s). Also, any activity that reduces the area, depth, or length of flooding in wetlands under and surrounding the colony should also be restricted during the nesting season.

For the Secondary Zone, it is recommended that no unauthorized human activity (on foot, airboat, or off-road vehicle [ORV]) occur at any time of the year within the reach of highway affected by that alternative on the south side of the highway and particularly during the nesting season.

In summary, the wood stork restrictions for the Tamiami West Colony include:

- 1) **Primary Zone:** Between February (or the onset of nesting activity) and through the onset of the rainy season (or when the young have fledged), highway construction (*e.g.* heavy/human equipment activity, pile driving, blasting) should not be permitted in the reach of the highway affected by that alternative;

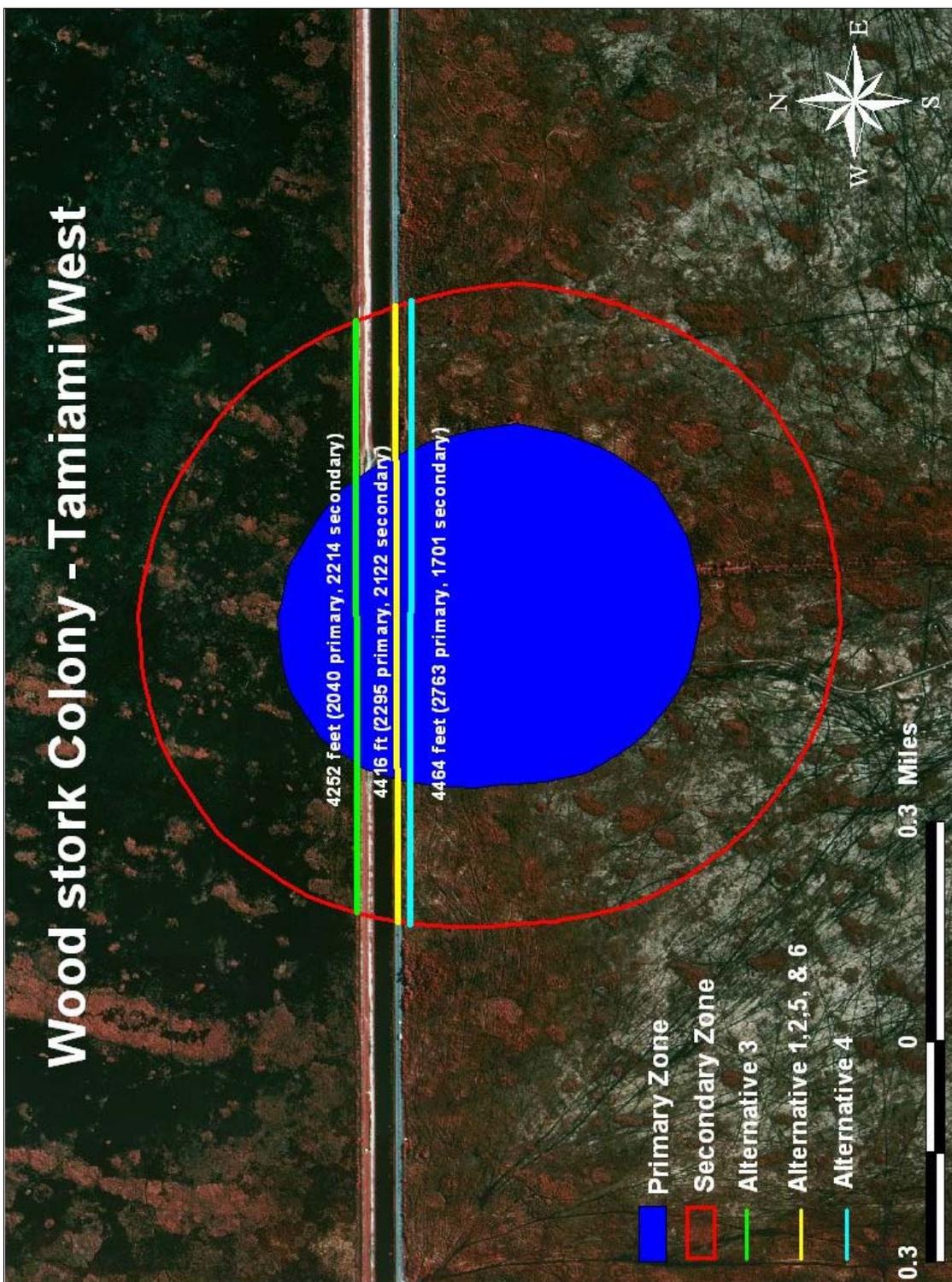


Figure 8.2. Tamiami west wood stork colony

- 2) **Secondary Zone:** No unauthorized human activity (on foot, airboat, or ORV) should occur at any time of the year within the reach of highway affected by that alternative on the south side of the highway and particularly during the nesting season.
- 3) **Length of Restrictions:** These restrictions shall remain in effect during the construction phase of the Tamiami Trail Project, which is 18 – 48 months depending on the final alternative selected;
- 4) **Qualified Observer:** Subject to the approval of the FWS and FWC, a qualified observer(s) shall be stationed onsite during the construction phase of the Tamiami Trail Project, which is 18 – 48 months depending on the final alternative selected. The observer shall monitor wood stork activity and shall notify the FWS, FWC, and the Corps if wood stork behavior is modified such that roosting, nest building, breeding, nesting and/or fledging of young is disrupted or otherwise interfered with;
- 5) **Modification of Restrictions:** If new information becomes available concerning the Tamiami West Wood Stork Colony, the Corps, FWS, and FWC should immediately contact each other to determine what modifications, if any, are warranted.

Guidelines Applied to the Tamiami East Colony

The Primary Zone of the Tamiami East Colony does not overlap any of the three alternative alignments for the Tamiami Trail Project (Figure 8.2.). Thus, no wood stork Primary Zone restrictions apply to highway construction activities in the vicinity of this colony, unless otherwise determined to be necessary by a qualified onsite observer(s). The Secondary Zone, however, does overlap varying linear distances of the highway depending on the alternative. Table 4.3 below provides these linear distances, by alternative.

For the Secondary Zone, it is recommended that no unauthorized human activity (on foot, airboat, or ORV) occur at any time of the year within the reach of highway affected by that alternative, particularly to the south side of the highway, and particularly during the nesting season.

In summary, the wood stork restrictions for the Tamiami East Colony include:

- 1) **Secondary Zone:** No unauthorized human activity (on foot, airboat, or ORV) should occur at any time of the year within the reach of highway affected by that alternative on the south side of the highway and particularly during the nesting season.
- 2) **Length of Restrictions:** These restrictions shall remain in effect during the construction phase of the Tamiami Trail Project, which is 18 – 48 months depending on the final alternative selected;

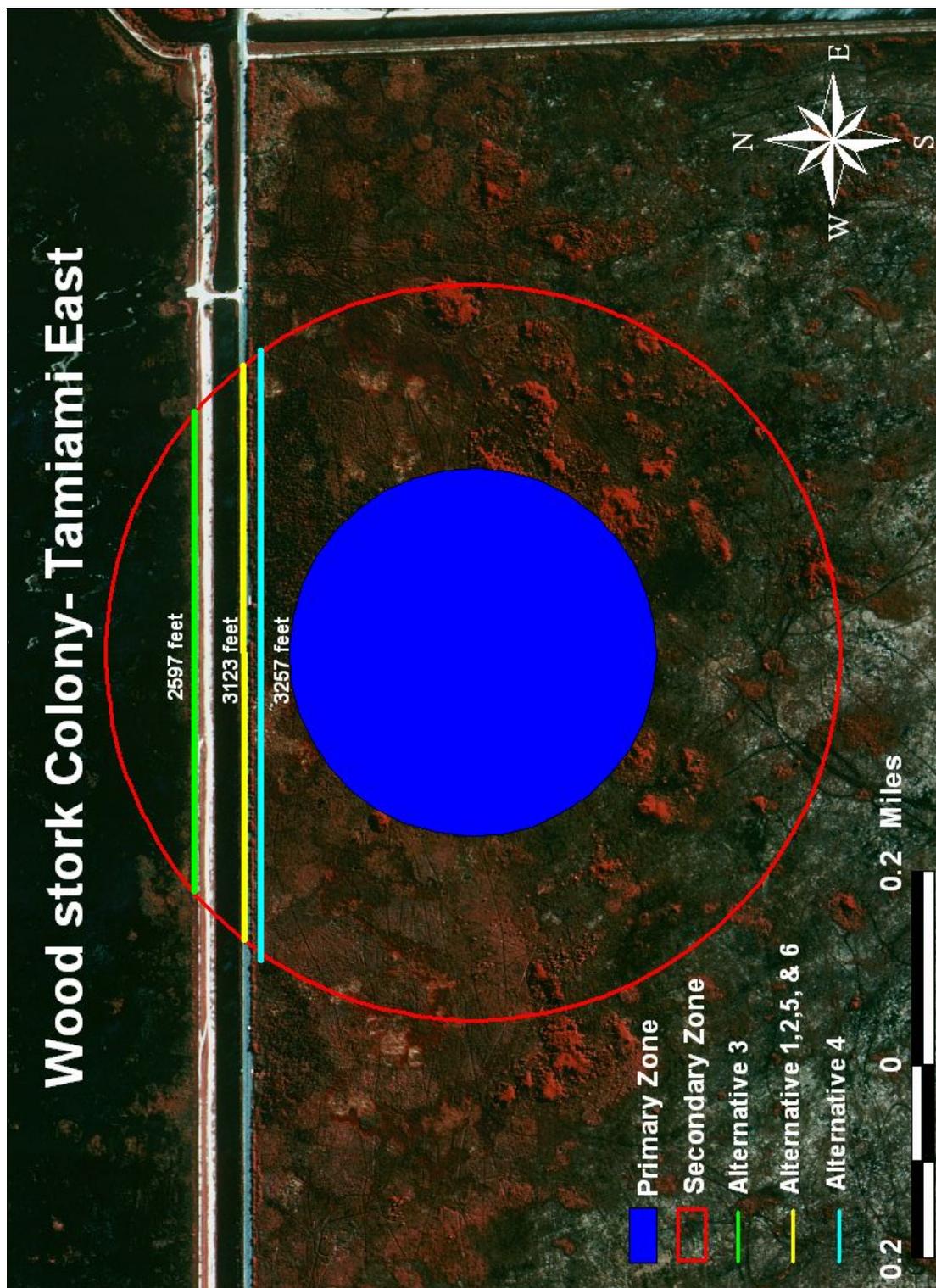


Figure 8.3. Tamiami east stork colony

Table 8.2. Summary of Linear Distances of Overlap of Primary and Secondary Zones on US 41 for the Tamiami East Wood Stork Colony, Tamiami Trail Project, Modified Water Deliveries Project.

Alternative	Linear Feet of US 41 In the Primary Zone	Linear Feet of US 41 In the Secondary Zone
3 (North Alignment in WCA-3B)	--	2,597
1, 2, 5, 6, 7, 8, 9 (Existing Alignment)	--	3,123
4 (Southern Alignment in ENP)	--	3,257

- 3) **Qualified Observer:** Subject to the approval of the FWS and FWC, a qualified observer(s) shall be stationed onsite during the construction phase of the Tamiami Trail Project, which is 18 – 48 months depending on the final alternative selected. The observer shall monitor wood stork activity and shall notify the FWS, FWC, and the Corps if wood stork behavior is modified such that roosting, nest building, breeding, nesting and/or fledging of young is disrupted or otherwise interfered with;
- 4) **Modification of Restrictions:** If new information becomes available concerning the Tamiami West wood stork colony, the Corps, FWS and FWC should immediately contact each other to determine what modifications, if any, are warranted.

Snail Kite

Based on the most recent snail kite nesting data, the closest snail kite nest to the Tamiami Trail Project is located in WCA-3B 6,586 feet north of the Alternative 3 alignment, as depicted in Figure 8.1. Because the closest known snail kite nest is located over one mile north of the action area, the FWS does not recommend, at this time, that any specific precautions be put in place regarding additional snail kite conservation. The FWS and FWC will continue to monitor snail kite nesting in subsequent nesting seasons in the project area, and will immediately notify the Corps if new information would warrant a change in this determination.

State-Listed Threatened and Endangered Species, and Species of Special Concern

In a letter dated October 18, 2000, the FWC has identified six avian species of special concern which may nest or otherwise be found in the vicinity of Tamiami Trail between the S-334 and the L-67s: tricolored heron (*Egretta tricolor*), snowy egret, little blue heron, limpkin, roseate spoonbill (*Ajaia ajaja*), and white ibis. In addition, the snail kite and wood stork, both listed by FWC as endangered, are also known to occur in the area.

The American alligator (listed as a species of special concern) and the Everglades mink (listed as threatened) also are found along the Tamiami Trail corridor.

Frog City Wading Bird Colony

This small colony (Figure 8.4) is situated in WCA-3B close to the L-29 Levee approximately 1/4 mile west of the Tiger Tail Miccosukee Indian Camp. This small willow head supports nesting by tricolored herons and great egrets. These migratory birds are also protected under the provisions of the Migratory Bird Treaty Act. As such, they are protected species under the jurisdiction of FWS.

The FWC and FWS have applied the *Set-back Distances to Protect Nesting Bird Colonies from Human Disturbance* (Rogers and Smith 1994). These Guidelines establish a 125 meter (410 feet) Buffer Zone around mixed wading bird colonies where human disturbance should be restricted during the nesting season, and during periods where wading birds are roosting at the colony site. The Buffer Zone for the Frog City Colony overlaps varying linear distances of the highway depending on the alternative. Table 8.3 provides these linear distances and linear distances of project alternatives from the colony, by alternative.



Figure 8.4. Frog City Wading Bird Colony

Of particular concern for the Frog City Colony is that the Alternative 3 is located 15 feet from the colony. If this alternative alignment is selected, the Frog City Colony would certainly be abandoned by species of wading birds. Therefore, the FWS and FWC recommend that Alternative 3 be eliminated from further consideration as a viable project alternative due to the signifi-

Table 8.3. Summary of Linear Distances of Overlap of the Buffer Zone on US 41 and Linear Distances from Project Alternatives for the Frog City Colony, Tamiami Trail Project, Modified Water Deliveries Project.

Alternative	Linear Feet of US 41 In the Buffer Zone	Distance from Colony to Project Alternatives
3 (North Alignment in WCA 3B)	--	2,597
1, 2, 5, 6, 7, 8, 9 (Existing Alignment)	--	3,123
4 (Southern Alignment in ENP)	--	3,257

cant adverse effects on State-listed and federally protected species (in addition to overall wetland functional losses and disruption to WCA-3B fish and wildlife resources described in other chapters of this Final FWCA Report).

For Alternatives 1, 2, 4, 5, 6, 7, 8, and 9 which are all located south of the L-29 Levee/Canal, the FWS and FWC do not recommend any Buffer Zone restrictions be applied to the Frog City Colony. This recommendation is supported by the fact that the colony is protected from highway construction noise by the approximate 20-foot high L-29 Levee, and that the wading birds nesting at this colony have acclimated to continuous highway traffic and noise.

In summary, the FWS and FWC provide the following recommendations for the Frog City Colony for the Tamiami Trail Project:

- 1) **Alternative 3 (North alignment in WCA-3B):** It is recommended that Alternative 3 be eliminated from further consideration as a project alternative for the Tamiami Trail Project due to the resultant abandonment of the Frog City Colony and the protected species it supports;
- 2) **Buffer Zone:** No Buffer Zone restrictions are recommended for the Frog City Colony for Alternatives 1, 2, 4, 5, 6, 7, 8, and 9 during the construction phase of the Tamiami Trail Project;
- 3) **Qualified Observer:** Subject to the approval of the FWS and FWC, a qualified observer(s) shall be stationed onsite during the construction phase of the Tamiami Trail Project, which is 18 – 48 months depending on the final alternative selected. The observer shall monitor wading bird activity and shall notify the FWS, FWC, and the Corps if wading bird behavior is modified such that roosting, nest building, breeding, nesting and/or fledging of young is disrupted or otherwise interfered with; and

- 4) **New Information:** If new information becomes available concerning the Frog City Colony, the Corps, FWS and FWC should immediately contact each other to determine what actions, if any, are warranted.

CHAPTER 9 - RECREATIONAL EFFECTS

Introduction

Recreational opportunities in the study area consist primarily of fishing for largemouth bass and other fish species (Centrarchids and catfish) along the L-29 canal, culverts under the Tamiami Trail and in WCA-3B, hunting for whitetail deer, frogging and some waterfowl hunting in WCA-3B, sightseeing/birding, and recreational airboating in both WCA-3B and ENP. Much of the recreational fishing is by bank fishermen along the L-29 canal, while access to culvert fishing on the south side of Tamiami Trail is limited by the narrowness of the highway shoulder and overall safety concerns.

Recreational fishing and hunting is managed by FWC in accordance with state wildlife laws. Recreational airboating in ENP is available from three commercial concessions located on the south side of Tamiami Trail: Airboat Association of Florida, Everglades Safari, and Gatorland. No recreational hunting is allowed south of Tamiami Trail in ENP lands and boating access is currently allowed only for the three concessions.

Under the existing condition in the study area, approximately 10.5 miles of the north bank of the L-29 canal and 10.7 miles of the south bank of the L-29 canal are accessible for fishing/sightseeing. All of the existing culvert outfall sites are also accessible for fishing. The existing Tamiami Trail provides little to no sightseeing opportunities.

There are three airboat ramps in the project area, one at S-334, one at S-333, and a ramp (#153) located at the L-29 levee recreation area approximately three miles west of the S-334. The S-334 and S-333 ramps are “marsh ramps” providing access to WCA-3B, while the #153 ramp is a “canal ramp” providing access to the L-29 canal. In addition to these three ramps, there are three additional ramps adjacent to the project area: one at S-12D approximately 1/2 west of the S-333, one in the L-67A canal south of S-333 and one in the L-67C canal approximately 1/4 mile north on the L-67 levee. All six ramps have been permitted by the FWC and are under an agreement with SFWMD. This agreement between FWC and SFWMD requires that if access to any ramp is lost by changes in the water management system, the SFWMD will replace that ramp at a location determined to be suitable by FWC.

Based on instantaneous angler counts along the Tamiami Trail by FWC from January to June 1999, bank fishing effort was concentrated in two primary areas within the 11-mile study area: 1) the 1.5 miles of Tamiami Trail from Krome Avenue to the S-334 structure, and 2) the 1.0 mile beginning approximately 10 miles west of Krome Avenue to the S-333 structure (Figure 9.1). The intervening 9.5 miles of Tamiami Trail experienced nominal fishing pressure during the 6-month angler survey. Only the extreme eastern and western ends of the study area support significant bank fishing. Therefore, the long-term effects of the Tamiami Trail Project on bank fishing should be minimal.

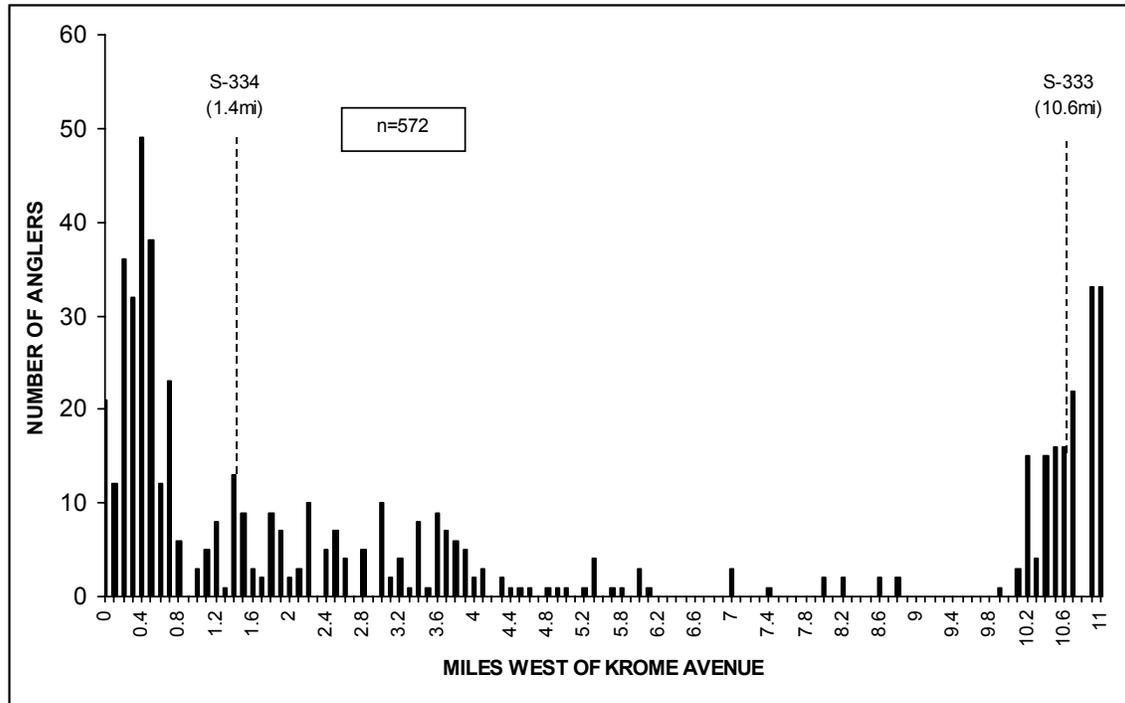


Figure 9.1. Distribution of totaled average instantaneous angler counts along Tamiami Trail (US 41) between Krome Avenue and S-333, from January to June 1999, in one-tenth increments (FWC, John Fury, unpublished data).

Future recreational use in WCA-3A is likely to change as CERP components are implemented. With generally deeper water levels in WCA-3B, white-tailed deer hunting is likely to decline as the deer herd diminishes in size. However, providing sufficient conveyance through the Tamiami Trail corridor is likely to lessen adverse effects to deer. Likewise, fishing opportunities, frogging, alligator hunting, and waterfowl hunting are likely to increase as water levels gradually increase.

Summary of Effects of Proposed Alternatives on Recreation

Alternative 1 (Existing Alignment and Profile)

Alternative 1 results in little or no change to existing conditions and would have minimal effect on current recreational activities in the study area. All existing airboat ramps would remain accessible, and the entire north and south banks of the L-29 canal (10.5 miles on the north bank and 10.7 miles on the south bank) remain accessible for bank fishing, except during the construction period of 18 to 24 months. Culvert fishing on the south side of Tamiami Trail would also be inaccessible during the construction period. Alternative 1 would provide no increased sightseeing opportunities.

Alternative 2 (Existing Alignment and Raised Profile)

All airboat ramps remain accessible under this alternative. Approximately 10.5 miles of the north bank of the L-29 canal would remain accessible for bank fishing. However, access to 10.7 miles of the south bank of the L-29 canal and the culvert outfalls for fishing would not be accessible during highway construction (18 to 24 months). The culvert fishing sites would remain open under this alternative. Accessibility to the four bridge cuts for fishing is unknown. Alternative 2 would provide limited sightseeing opportunities at the four bridge locations.

Alternative 3 (Relocate Highway North into WCA 3B)

The airboat ramps at S-333 and S-334 remain accessible, while access to airboat ramp #153 is limited during the 30-month construction period. There is also the likelihood that the #153 ramp parking area will be reduced after construction, thus limiting access. The south bank of the L-29 canal and the culvert outfall fishing sites remain accessible. Pending completion of breaches in the old Tamiami Trail, access to the south bank of the L-29 canal and culvert outfall site would be limited to 2 miles on the east and 1.5 miles to the west. Alternative 3 offers full panoramic views of WCA-3B along its entire length.

Alternative 4 (Shift Highway to the South into ENP)

The recreational effects of this alternative are similar to Alternative 2, above.

Alternative 5 (Elevated Causeway)

All airboat ramps remain accessible under this alternative. Approximately 10.5 miles of the north bank of the L-29 canal remains accessible, while the south bank would be inaccessible during the 48-month construction period. Pending completion of breaches in the old Tamiami Trail, access to the south bank of the L-29 canal and culvert outfall site would be limited to 1 mile on the east and 1/2 mile to the west. Alternative 5 would provide full panoramic sightseeing to both WCA-3B and ENP for the entire length.

Alternative 6 (Four-Mile Bridge)

Alternative 6 has similar effects as Alternative 2, above, except for the 3 3/4-mile section of highway removal. At this location, there would be fewer culvert outfalls available for fishing; however, fishing at the ends of the bridge and at the Airboat Association of Florida would offset some of this lost opportunity. The four-mile bridge would provide substantial panoramic sightseeing opportunities of both WCA-3B and ENP.

Alternative 7 (3,000-Foot Bridge)

This bridge alternative calls for constructing an elevated structure slightly more than 1/2 mile long. All airboat ramps remain accessible, and 10.5 miles of bank fishing from the north side of the L-29 Levee remains accessible. The south bank is inaccessible during the 24-month con-

struction period; however, after construction, 10.1 miles of fishing along the south bank would become accessible for fishing. Sightseeing opportunities would increase slightly above existing conditions, but would remain overall limited.

Alternative 8 (Box Culverts)

Except during the construction period of 18 to 24 months, impacts to recreational opportunities are minimal. All three airboat ramps remain accessible, and bank fishing along the entire project length remain accessible after construction. Sightseeing opportunities are considered poor, with limited views of the Everglades marshes.

Alternative 9 (2.7-Mile Bridge)

All three airboat ramps remain accessible, and 8 miles of bank fishing on the south bank and the entirety of the north bank remain accessible during the 24- to 30-month construction period. After construction, 8 miles of the south bank will be accessible for bank fishing opportunities. Sightseeing opportunities would increase significantly with panoramic views of ENP and WCA-3B along the 2.7-mile bridge, and are considered overall good.

Wildlife Barrier/Wildlife Connectivity Features

Features to reduce wildlife mortality and increase wildlife connectivity (see Chapter 3) are proposed for all Alternatives except Alternative 5. Alternative 5, by design, would forego the need for these features, since full wildlife connectivity would be realized with the elevated causeway design. The effect these features would have on recreation for the remaining Alternatives is deemed to be similar. The wildlife barrier (4 ft in height) may hinder access for some bank fishermen, while the wildlife land bridges should provide additional fishing opportunities. Replacement of an unknown number of culverts by an unknown number of box culverts has the potential to reduce culvert outfall fishing potential; however, fishing opportunities are likely to increase at the box culvert sites and may be safer due to the existing narrow shoulder and unsafe conditions at the culvert outfall sites.

In summary, Table 9.1 depicts the significant recreational factors to be included in the comparison of Tamiami Trail Project alternatives. During construction, recreational opportunities would be affected for all alternatives. Sightseeing opportunities are most compatible with Alternatives 5, 6, and 7. Boat ramps will remain accessible for all alternatives, with Alternative 3 affecting available parking at one ramp. Bank fishing opportunities on the south bank of the L-29 canal will be affected during construction; however, as described above, bank fishing activity is centered at the S-334 and S-333 structures and thus overall bank fishing impacts will be minimized. Fishing at the culvert outfalls will be effected to varying degrees, but are expected to be off-set by fishing opportunities generated by the addition of bridges and/or box culverts elsewhere in the highway alignment.

Table 9.1. Summary of effects of Tamiami Trail Project on recreation.

Alternative					
	Bank Fishing (miles)	Boat Ramps (number)	Culvert Outfalls (number/miles)	Sightseeing (qualitative)	Construction (months)
1	North: 10.5 South: 10.7	3 – remain accessible	Closed during construction Miles: 10.7	Poor (1)	18–24: outfalls, N/S bank fishing inaccessible
2	North: 10.5 South: 10.7	3 – remain accessible	Closed during construction Miles: 10.7	Limited (2)	18-24: South bank inaccessible
3	North: 10.5 South: 3.5	3 – 1 ramp parking reduced	Open during construction East: 2 miles West: 1.5 miles	Good (3) WCA 3B	30 months: 1 ramp inaccessible
4	North: 10.5 South: 3.5	3 – remain accessible	Closed during construction Miles: 10.7	Limited (2)	18-24: South bank inaccessible
5	North: 10.5 South: 1.5	3 – remain accessible	Open during construction East: 1 mile West: 0.5 mile	Excellent (5)	48: South bank inaccessible
6	North: 10.5 South: 7.0	3 – remain accessible	Open during construction East 5 miles West: 2 miles	Very Good (4)	24-30: South bank inaccessible
7	North 10.5 South 10.1	3 – remain accessible	Open during construction East: 6 miles West: 4.1 miles	Limited (2)	24: South bank inaccessible
8	North: 10.5 South: 10.7	3 – remain accessible	Closed during construction Miles: 10.7	Poor (1)	18-24: South bank inaccessible
9	North: 10.5 South: 8.0	3 – remain accessible	Open during construction East: 3 miles West: 5 miles	Good (3)	24-30: South bank inaccessible

Discussion

Bank/Culvert Fishing

The primary area of concern related to short-term recreational impacts focuses on maintaining access to bank fishing and culvert outfalls along the L-29 canal during the 18- to 30-month construction phase of the Tamiami Trail Project. Construction activities, staging areas, and construction traffic will likely adversely affect fishing access along the L-29 canal. Depending on how construction is implemented, effects to the fishing public will vary.

During construction, the south bank of the L-29 canal will be inaccessible for Alternatives 2, 4, 5, 6, and 8. For Alternative 1, both the north and south sides of the canal will be inaccessible for 18 to 24 months. Alternative 3 (shifting the roadway into WCA-3B) has no effects on bank fishing.

After construction, bank fishing access between alternatives varies due to breaching or removing portions of the old Tamiami Trail. Alternatives 1, 2, and 8 maintain full bank fishing access, due to the fact that the existing alignment is utilized. Alternatives 3, 4, 5, 6, 7, and 9 reduce bank fishing access on the south bank by between 3.5 and 9.0 miles. However, new fishing opportunities at bridge and/or box culvert locations and at breaches in the old highway should help minimize the overall long-term effects.

Maintaining recreational fishing access to culvert outfalls also varies between alternatives. For Alternatives 1 and 2, all culvert outfalls remain accessible, again due to the fact that the existing alignment is used. Alternatives 3, 4, 5, and 6 decrease the number of miles that culvert outfalls are accessible. The case of Alternative 5 (full causeway) culvert outfall access is limited to only 1.5 miles.

For perspective, it is important to keep in mind that the heaviest bank fishing pressure is located to the east of the S-334 and to the west of the S-333 (see Figure 9.1). Based on the 1999 angler counts by FWC, approximately 62 percent of all bank fishing activity along the 11-mile stretch occurs to the east of S-334 and west S-333. Because of the uneven distribution of fishing activity, adverse effects on the fishing public will be somewhat minimized.

Finally, the fate of recreational fishing, as we know it today, is likely to be dramatically altered during CERP implementation. The Decentralization Project (Phase I) envisions totally degrading the L-29 levee and backfilling the L-29 canal. This situation may improve airboating, but fishing along canal banks and culvert outfalls will be eliminated, for all practical purposes.

Boat Ramps

The three boat ramps in the study area will remain accessible after construction is completed, and should also be accessible during construction. Alternative 3 is likely to effect available parking at the #153 ramp, but access at this location will remain. Therefore, in the short-term, airboat access will be maintained.

During CERP implementation, it is likely that the #153 ramp will be degraded. However, air-boating in WCA-3B should improve, as water levels slowly increase with an increase in CERP flows.

Sightseeing

In general, those alternatives (Alternatives 5, 6, and 9) which provide sections of elevated causeway across the marsh will provide more sightseeing (panoramic views) opportunities. Alternatives 1, 2, 4, 7, and 9 will provide limited sightseeing opportunities, whereas Alternative 3 will provide scenic views of WCA-3B.

CHAPTER 10 - EVALUATION OF ALTERNATIVE PERFORMANCE

Evaluation Process Used to Select the Department of the Interior's Recommended Plan

The DOI alternative evaluation process was designed to allow for the identification of an alternative that maximizes performance for the stated project objectives, while also maintaining compatibility with the project constraints. This process was performed in recognition that future, yet-to-be identified, modifications to Tamiami Trail are authorized for implementation as part of the CERP Project Decentralization (Phase 1). Given the objectives presented earlier in this report and the constraints detailed below, the following five-step screening process was utilized to identify the DOI Recommended Plan:

Step 1: All alternatives (with and without water quality treatment features) were initially evaluated for their ability to comply with the FDOT road safety requirements. All alternatives not mitigating for the potential road damage due to the elevated water levels associated with the MWD Project were eliminated from further consideration by the DOI.

Step 2: All remaining alternatives (with and without water quality treatment features) were then evaluated for the quantity of wetland function lost in ENP and WCA-3B. All alternatives resulting in a significant loss of wetland function due to implementation were eliminated from further consideration by the DOI.

Step 3: All remaining alternatives (with and without water quality treatment features) were next evaluated for relative performance based on the performance measures associated with the environmental objectives exclusively. This evaluation was performed to identify the Environmentally Preferred Alternative in a manner independent of the other project objectives.

Step 4: Based on the relative performance of the alternatives with respect to environmental performance, the alternatives were further screened based on fiscal constraints imposed by the NPS. All alternatives with construction costs that DOI considered beyond the capability of the NPS to fund were eliminated from further consideration.

Step 5: All remaining alternative plans were then assessed for relative performance for both environmental and other project objectives. Through the use of this evaluation process, the DOI Recommended Plan ultimately identified was the alternative that provided the maximum level performance for all project objectives while remaining within the limits imposed by the project constraints. In the view of the DOI, the final Recommended Plan is also the most compatible alternative with future CERP efforts to restore Tamiami Trail and reconnect the central and southern Everglades.

Project Constraints Affecting Alternative Selection

Several constraints were addressed in the evaluation and selection of a DOI Recommended Plan for Tamiami Trail. These constraints include:

1. the road safety considerations identified by the FDOT;
2. the potential need for water quality treatment of road runoff and the impact of these facilities on existing wetland resources; and,
3. the limited amount of funding available to the project from the NPS.

Each of these constraints is explained below.

Road Safety

The design water level elevation assumed by the Corps for all modifications to Tamiami Trail associated with the MWD Project is 9.3 feet. This water level is considerably higher than past and current levels of operations in the L-29 canal (7.5 feet). Furthermore, water levels during extreme events may result in overtopping the existing road surface elevation following implementation of the MWD Project. It is the opinion of the FDOT that either of these conditions present a significant safety concern. Persistent higher water levels in the L-29 canal will cause the road sub-grade to be saturated with sufficient frequency to potentially result in road failure, and overtopping during extreme events could be a potential hazard for motorists traveling along the highway.

Water Quality Treatment and Wetland Impacts

The waters upstream of the Tamiami Trail are designated as Class III (Recreational Waters) while the downstream waters in ENP are designated as Outstanding Florida Waters (OFW). Surface water quality standards of the State of Florida mandate that there be no degradation of the ambient water quality in OFW. Based on the fact that the predicted contaminant concentrations for Tamiami Trail were consistently lower than criteria for Class III waters, the Corps (PBS&J 2001) concluded “that there will be little impact on the quality of the water in the vicinity of Tamiami Trail.”

However, predicted contaminant concentrations of copper, iron, lead, and zinc in 2000 are higher than the minimum recorded concentrations in ENP, an OFW, indicating the potential for water quality degradation, with chromium added to the list by 2020. However, the Corps maintains (see Tamiami Trail GRR/SEIS) that because this project does not increase the number of travel lanes (impervious road surface area remains unchanged by the project), and the project is not responsible for growth in traffic, water quality treatment is not required for this project.

The water quality treatment design selected and evaluated by the Corps specifies construction of dry retention facilities adjacent to the roadway to capture and treat potentially contaminated runoff. Since one of the design requirements established by the Corps included retaining the full

conveyance capacity of the L-29 canal, the dry retention facilities had to be located in areas of existing wetlands, either in ENP (Alternatives 2, and 4 through 9) or WCA-3B (Alternative 3).

The assumptions and selected water quality treatment facility design remain a concern to the DOI. The conceptual plans for the CERP Decentralization Phase 2 Project specify the degradation of both the L-29 canal and levee. In order to minimize the loss of wetlands, the DOI prefers that any water quality treatment facilities be located in areas that are presently disturbed and not in areas of undisturbed wetlands. Furthermore, DOI is concerned that there appears to be a persistent, yet unanswered, question regarding whether water quality treatment will be required for the project. Until these issues can be resolved, DOI is not supportive of facilities that result in a loss of wetlands from either ENP or WCA-3B.

NPS Fiscal Limitations

While the 1989 ENP Expansion and Protection Act states that the MWD Project features are “justified by the environmental benefits to be derived by the Everglades ecosystem in general and by ENP in particular and shall not require further economic justification...”, the DOI also recognizes the fact that limited funds are available to the project from the NPS. The June 2001 version of the Capital Asset Plan (OMB Circular A-11 Exhibit 300[b], Modified Water Deliveries) indicates that the current level of funding available from the NPS for the Tamiami Trail component of the MWD Project is \$22.708 million. While this level of funding does not represent the final amount that could potentially be made available by the NPS, it is problematic to request and secure appropriations for alternatives that significantly exceed this amount.

Evaluation of Alternative Performance

Performance Measure Scoring Methodology

Numerous performance measures having widely disparate units were used in the evaluation of the proposed alternative plans in meeting the multiple projective objectives. The performance measure units range from the highly quantitative, such as acres impacted, to the less exact, such as a relative score based on best professional judgment. In order to present all of the performance measures for all of the objectives into a unified evaluation tool, all performance measures were combined into a series of matrices for purposes of comparing alternatives. These matrices were then used in conjunction with the project constraints and the evaluation methodology described above to identify the DOI’s Recommended Plan.

Data for all performance measures for each objective were incorporated into a single matrix (Table 10.1) for each of the alternative plans evaluated. For alternatives remaining after the initial screenings for road safety and wetland impacts, the alternatives were assigned a numeric performance score. The values of the performance score is provided in Table 10.2 and is based on the relative performance of each of the alternatives from worst (low numeric score) to best (high numeric score) corresponding to the relative performance for the given performance measure. The scores assigned to the alternatives were made to maintain the numeric range corre-

sponding to the total number of alternatives evaluated as well as provide the greatest numeric separation of the alternatives. The exact value of the performance score was made through the use of the following scoring algorithm:

$$score = n + \frac{n + (m - 1)}{(p - 1)} + (m - 1)$$

where n is the number of alternatives of a lower score, m is the number of alternatives sharing score, and p is the total number of alternatives considered. The lowest performing alternative was assigned a score of 1 and the remaining alternatives were scored according to the expression above. Non-integer results were rounded up to the next highest integer.

Screening of Alternatives Based on Road Safety

As stated earlier, the DOI will not consider implementation of any alternative that could result in the unmitigated deterioration of the road or other conditions that would result in a hazard to the continued use of the Tamiami Trail. With the exception of Alternative 1, all of the proposed alternative plans provide a mechanism to mitigate for potential damage to the road sub-grade or for overtopping of the road surface. Alternatives 2 through 4 and Alternative 8 provide for additional fill to raise the existing highway. Alternatives 5, 6, 7, and 9 specify an elevated highway in the form of a “skyway” for all or portions of the roadway and any sections not included in the skyway would be raised through the addition of fill material. Based on these designs and the DOI position on road safety, only Alternative 1 fails to meet the criteria for acceptability. For this reason, Alternative 1 was not considered in any of the alternative evaluations and therefore not included in the matrices found in Tables 10.1 and 10.2.

Screening of Alternatives Due to Wetland Impacts

All alternatives designated with a “B” in Tables 10.1 and 10.2 (e.g. Alternative 2B) include water quality treatment facilities. These facilities are in the form of a dry detention system constructed adjacent to the modified road surface and generally increase the road cross-section by more than 50 percent. Due to the assumption made by the Corps not to encroach on the existing areas occupied by either the L-29 canal or the L-29 levee, all of the treatment facilities were located in the unaltered wetlands of either ENP or WCA-3B. The loss of wetlands associated with each of the alternatives is presented in Figure 10.1.

The range in acres lost due to alternative implementation varies from minimal, such as Alternatives 5 and 6, to more than 100 acres for Alternative 4B. These impacts, coupled with the uncertain position of DEP regarding water quality treatment as a project requirement and the DOI concern that lands currently occupied by the L-29 canal/levee may be restored to wetlands during future CERP implementation, result in the DOI concluding that it is premature to construct any alternative that causes a significant loss of wetlands. It should also be noted that each of the alternatives designed to provide water quality treatment also resulted in a substantial decrease in wetland function when compared to the alternative not designed to treat runoff from the road (see Figure 6.2). Therefore, the DOI eliminated Alternatives 2B, 4A, 4B, 6B Partial, 6B Full, 7B, 8B, and 9B from further consideration.

Table 10.1. Performance Data Matrix

	Units	Alternatives																			
		2		3		4		5				6				7		8		9	
		A	B	A	B	A	B	A	A	B	B	A	A	B	B	A	B	A	B	A	B
Environmental Project Objectives																					
1. Minimize adverse effects to federally listed species with the Endangered Species Act (Snail kite, Wood stork, Eastern indigo snake [pending Biological Assessment and effect from Corps])																					
A. Impact to East Colony of Wood Stork																					
Primary Zone	linear ft.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Secondary Zone	linear ft.	3,123	3,123	2,597	2,597	3,257	3,257	3,123	3,123	3,123	3,123	3,123	3,123	3,123	3,123	3,123	3,123	3,123	3,123	3,123	3,123
B. Impact to West Colony of Wood Stork																					
Primary Zone	linear ft.	2,295	2,295	2,040	2,040	2,763	2,763	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295
Secondary Zone	linear ft.	2,122	2,122	2,214	2,214	1,701	1,701	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122
C. Impact to Snail Kite nesting locations																					
Pending the Corps' Biological Assessment																					
D. Construction restrictions in the East Colony due to Wood stork nesting and fledging																					
Primary Zone	No. Days	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Secondary Zone	No. Days	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
E. Construction restrictions in the West Colony due to Wood stork nesting and fledging																					
Primary Zone	No. Days	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Secondary Zone	No. Days	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
F. Implement Standard Construction Protection Measures for the Eastern Indigo Snake																					
Pending the Corps' Biological Assessment																					
2. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999																					
A. Design flow passing under the eastern section of Tamiami Trail (between the S-334 and the L-67s) meets 60 percent of the regulatory portion of the rainfall formula derived total flows across the Tamiami Trail.																					
yes/no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
3. Ensure no adverse effects to state listed endangered or threatened species of special concern consistent with State Statutes																					
A. Impact to Frog City Wading Bird Colony Buffer Zone																					
linear ft.	449	449	817	817	102	102	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449
B. Distance from the Frog City Wading Bird Colony																					
linear ft.	331	331	15	15	403	403	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331
4. Allow for restoration consistent with the 1989 ENP Protection and Expansion Act																					
A. NESS Stage: Maintain the level and frequency of stage as modeled by the 8.5 SMA MODBRANCH model D13R 1995 simulation (D13R_C111_356_1995_95ops)																					
yes/no	yes*	yes	yes	yes	yes*	yes	yes	yes	yes	yes	yes	yes*	yes*	yes	yes	yes*	yes	yes*	yes	yes*	yes
B. Water Deliveries to ENP: Maintain a discharge capacity equivalent to historical (1939-1963 bridge flows) 1/10 year event, or 4458 cfs. (equivalent to about a 1/200 year event according to SFWMM D13R derived return frequencies.)																					
yes/no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Table 10.1 cont. Performance Data Matrix

	Units	Alternatives																			
		2		3		4		5				6				7		8		9	
		A	B	A	B	A	B	A	A	B	B	A	A	B	B	A	B	A	B	A	B
Environmental Project Objectives																					
4. cont.. Allow for restoration consistent with the 1989 ENP Protection and Expansion Act																					
C. Area with affected flow magnitude	Acres	623.4	623.4	623.4	623.4	623.4	623.4	165.7	165.7	165.7	165.7	437.5	437.5	437.5	437.5	1649.3	1649.3	485.8 est	485.8 est	2567.7	2567.7
D. Difference between average velocity at the road and average velocity in the marsh.	ft/s	0.044	0.044	0.044	0.044	0.044	0.044	0.001	0.001	0.001	0.001	0.018	0.018	0.018	0.018	0.038	0.038	0.036	0.036	0.023	0.023
5. Enhance and restore ecological Function																					
A. Wetland Function Units gain or loss	FU	-11.1	-61.75	-18.82	-30.15	-40.43	-64.64	39.35	45.27	29.54	33.93	-6.60042	-6.60042	-22.7757	-22.7757	-3.42	-49.55	-3.51	-46.56	-1.91	-33.35
B. N/S connectivity Between WCA-3b and ENP for aquatic fish and wildlife	linear ft.	1412	1412	5649.6	5649.6	1412.4	1412.4	55366.8	55366.08	42372	42372	20338.56	20338.56	20338.56	20338.56	3000	3000	240	400	14256	14256
C. Exotic and nuisance vegetation removed	acres	12.96	12.96	0.17	6.48	12.96	12.96	0.33	12.96	0.33	12.96	8.12	12.96	8.12	12.96	12.96	12.96	12.96	12.96	12.96	12.96
D. Reduction in wildlife Mortality	No.	40	40	158	158	40	40	1584	1584	1584	1584	570	570	570	570	84	84	7	7	400	400
6. Minimize permanent loss of wetlands in ENP and WCA-3B																					
A. Wetland permanently lost in ENP	Acres	11.8	49.32	0.00	0.00	68.45	103.87	0	0	0	0	0.3	0.3	46	46	3	67.7	2.3	74	2.77	48.87
B. Wetlands permanently lost in WCA-3B	Acres	0	0	14.29	28.94	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Project Objectives																					
1. Ensure no reduction in authorized flood control benefits																					
A. Acres with altered flood protection	acres	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Maximize compatibility with future restoration actions																					
A. Cubic yards of fill requiring removal to achieve completely unobstructed flow path (including removal of L-29 levee.)	mil yd ³	1.7	2	2.3	2.8	2.5	2.8	1.6	1.1	1.6	1.2	1.5	1.6	1.7	1.9	1.7	2	1.7	2.1	1.5	1.9
B. Ability to accommodate additional flow capacity required by currently authorized CERP project features.	Score	1	1	1	1	1	1	5	5	5	5	4	4	4	4	2	2	1	1	3	3
C. Ability to accommodate flow volume of 245,000 ac ft. as described in Sec. 601G of WRDA 2000	Score	1	1	1	1	1	1	5	5	5	5	4	4	4	4	2	2	1	1	3	3

Table 10.1 cont. Performance Data Matrix

	Units	Alternative																			
		2		3		4		5				6				7		8		9	
		A	B	A	B	A	B	A	A	B	B	A	A	B	B	A	B	A	B	A	B
Other Project Objectives																					
3. Maximize consistency with other Modified Water Deliveries components																					
A. Ability to meet implementation schedule (satisfies RPA requirements)	yes/no	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes									
B. Construction duration and implementation time (construction completed by 2005)	yes/no	yes	yes	yes	yes	yes	yes	no	no	no	no	yes									
4. Minimize impacts associated with construction																					
A. Total duration of construction as measured in months	Months	24	24	30	30	24	24	48	48	48	48	30	30	30	30	24	24	24	28	28	28
B. Allows for turbidity control	yes/no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
5. Minimize adverse socio-economic effects																					
A. Noise impacts to the Miccosukee Tiger Tail Camp (noise abatement critiria exceeded)	yes/no	no	no	yes	yes	no															
B. Noise impacts to the Miccosukee Osceola Camp (noise abatement critiria exceeded)	yes/no	no	yes	no	no	yes	yes	no	yes	yes	no	yes	no	yes	no						
C. Provide access to Miccosukee Tiger Tail Camp	yes/no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
D. Provide access to Miccosukee Osceola Camp	yes/no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
6. Minimize recreational effects																					
A. Miles of available bank fishing																					
North	Miles	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
South	Miles	10.7	10.7	3.5	3.5	3.5	3.5	1.5	1.5	1.5	1.5	7.0	7.0	7.0	7.0	10.1	10.1	10.7	10.7	8	8
B. Number of accessible boat ramps	No.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
C. Miles of available culvert outfall fishing	Miles	10.7	10.7	3.5	3.5	10.7	10.7	1.5	1.5	1.5	1.5	7.0	7.0	7.0	7.0	4.7	4.7	10.7	10.7	8	8
D. Sightseeing opportunities (1 poor- 5 excellent)	Rank	2	2	3	3	2	2	5	5	5	5	4	4	4	4	2	2	1	1	3	3
E. Maximum months of disruption due to construction	Month	24	24	30	30	24	24	48	48	48	48	30	30	30	30	24	24	24	24	30	30

Table 10.2. Performance score matrix

	Alternatives											
	2	3		5				6		7	8	9
	A	A	B	A	A	B	B	A	A	A	A	A
Environmental Project Objectives												
1. Minimize adverse effects to federally listed species with the Endangered Species Act (Snail kite, Wood stork, Eastern indigo snake [pending Biological Assessment and effect from Corps])												
A. Impact to East Colony of Wood Stork												
Primary Zone	1	1	1	1	1	1	1	1	1	1	1	1
Secondary Zone	1	12	12	1	1	1	1	1	1	1	1	1
B. Impact to West Colony of Wood Stork												
Primary Zone	1	12	12	1	1	1	1	1	1	1	1	1
Secondary Zone	12	1	1	12	12	12	12	12	12	12	12	12
C. Impact to Snail Kite nesting locations												
Pending the Corps' Biological Assessment												
D. Construction restrictions in the East Colony due to Wood stork nesting and fledging												
Primary Zone	1	1	1	1	1	1	1	1	1	1	1	1
Secondary Zone	1	1	1	1	1	1	1	1	1	1	1	1
E. Construction restrictions in the West Colony due to Wood stork nesting and fledging												
Primary Zone	1	1	1	1	1	1	1	1	1	1	1	1
Secondary Zone	1	1	1	1	1	1	1	1	1	1	1	1
F. Implement Standard Construction Precautions for Eastern indigo snake												
Pending the Corps' Biological Assessment												
2. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999												
A. Design flow passing under the eastern section of Tamiami Trail (between the S-334 and the L-67s) meets 60 percent of the regulatory portion of the rainfall formula derived total flows across the Tamiami Trail.	1	1	1	1	1	1	1	1	1	1	1	1
3. Ensure no adverse effects to state listed endangered or threatened species of special concern consistent with State Statutes												
A. Impact to Frog City Wading Bird Colony Buffer Zone	12	1	1	12	12	12	12	12	12	12	12	12
B. Distance from the Frog City Wading Bird Colony	12	1	1	12	12	12	12	12	12	12	12	12
4. Allow for restoration consistent with the 1989 ENP Protection and Expansion Act												
A. NESS Stage: Maintain the level and frequency of stage as modeled by the 8.5 SMA MOD-BRANCH model D13R 1995 simulation (D13R_C111_356_1995_95ops)	1	1	1	1	1	1	1	1	1	1	1	1
B. Water Deliveries to ENP: Maintain a discharge capacity equivalent to historical (1939-1963 bridge flows) 1/10 year event, or 4458 cfs. (equivalent to about a 1/200 year event according to SFWMM D13R derived return frequencies.)	1	1	1	1	1	1	1	1	1	1	1	1

Table 10.2.

	Alternatives											
	2	3		5				6		7	8	9
	A	A	B	A	A	B	B	A	A	A	A	A
Environmental Project Objectives												
4. cont.. Allow for restoration consistent with the 1989 ENP Protection and Expansion Act												
C. Area with affected flow magnitude	5	5	5	12	12	12	12	8	8	2	6	1
D. Difference between average velocity at the road and average velocity in the marsh.	1	1	1	12	12	12	12	8	8	4	5	6
5. Enhance and restore ecological Function												
A. Wetland Function Units gain or loss	3	2	1	11	12	9	10	5	5	7	6	8
B. N/S connectivity Between WCA-3b and ENP for aquatic fish and wildlife	2	5	5	12	12	10	10	8	8	3	1	6
C. Exotic and nuisance vegetation removed	12	1	4	3	12	3	12	5	12	12	12	12
D. Reduction in wildlife Mortality	2	5	5	12	12	12	12	8	8	3	1	6
6. Minimize permanent loss of wetlands in ENP and WCA-3B												
A. Wetland permanently lost in ENP	1	12	12	12	12	12	12	6	6	2	4	3
B. Wetlands permanently lost in WCA-3B	12	2	1	12	12	12	12	12	12	12	12	12
Other Project Objectives												
1. Ensure no reduction in authorized flood control benefits												
A. Acres with altered flood protection	1	1	1	1	1	1	1	1	1	1	1	1
2. Maximize compatibility with future restoration actions												
A. Cubic yards of fill requiring removal to achieve completely unobstructed flow path (including removal of L-29 levee.)	5	2	1	8	12	8	11	10	8	5	5	10
B. Ability to accommodate additional flow capacity required by currently authorized CERP project features.	1	1	1	12	12	12	12	8	8	5	1	6
C. Ability to accommodate flow volume of 245,000 ac ft. as described in Sec. 601G of WRDA 2000	1	1	1	12	12	12	12	8	8	5	1	6

Table 10.2.

	Alternative											
	2	3		5				6	7	8	9	
	A	A	B	A	A	B	B	A	A	A	A	A
Other Project Objectives												
3. Maximize consistency with other Modified Water Deliveries components												
A. Ability to meet implementation schedule (satisfies RPA requirements)	12	12	12	12	12	1	1	12	12	12	12	12
B. Construction duration and implementation time (construction completed by 2005)	12	12	12	1	1	1	1	12	12	12	12	12
4. Minimize impacts associated with construction												
A. Total duration of construction as measured in months	12	8	8	1	1	1	1	8	8	12	12	8
B. Allows for turbidity control	1	1	1	1	1	1	1	1	1	1	1	1
5. Minimize adverse socio-economic effects												
A. Noise impacts to the Miccosukee Tiger Tail Camp (noise abatement criteria exceeded)	12	1	1	12	12	12	12	12	12	12	12	12
B. Noise impacts to the Miccosukee Osceola Camp (noise abatement criteria exceeded)	1	1	1	1	1	1	1	1	1	1	1	1
C. Provide access to Miccosukee Tiger Tail Camp	1	1	1	1	1	1	1	1	1	1	1	1
D. Provide access to Miccosukee Osceola Camp	1	1	1	1	1	1	1	1	1	1	1	1
6. Minimize recreational effects												
A. Miles of available bank fishing												
North	1	1	1	1	1	1	1	1	1	1	1	1
South	12	6	6	1	1	1	1	8	8	10	12	9
B. Number of accessible boat ramps	1	1	1	1	1	1	1	1	1	1	1	1
C. Miles of available culvert outfall fishing	12	6	6	1	1	1	1	9	9	7	12	10
D. Sightseeing opportunities (1 poor- 5 excellent)	3	6	6	12	12	12	12	8	8	3	1	6
E. Maximum months of disruption due to construction	12	9	9	1	1	1	1	9	9	12	12	9
Summary												
Environmental Objectives	28.63	18.00	18.00	43.38	42.38	45.88	44.88	35.38	37.13	30.63	31.63	33.13
Rank	10	11	11	3	4	1	2	6	5	9	8	7
Other Objectives	32.42	24.67	24.33	25.75	20.25	27.08	21.25	35.92	35.25	33.92	32.08	34.58
Rank	5	9	10	8	12	7	11	1	2	4	6	3
Total Project Objectives	61.04	42.67	42.33	69.13	62.63	72.96	66.13	71.29	72.38	64.54	63.71	67.71
Rank	10	11	12	4	9	1	6	3	2	7	8	5
<i>Cost</i>	<i>24.4</i>	<i>68</i>	<i>73.5</i>	<i>135.9</i>	<i>140</i>	<i>142.1</i>	<i>140</i>	<i>72.2</i>	<i>74.7</i>	<i>23.3</i>	<i>44.2</i>	<i>48</i>

Screening of Alternatives Based on Environmental Objectives

To evaluate each of the remaining alternatives relative performance for the environmental objectives, the performance scores found in Table 10.2 were used. First, the mean of all performance

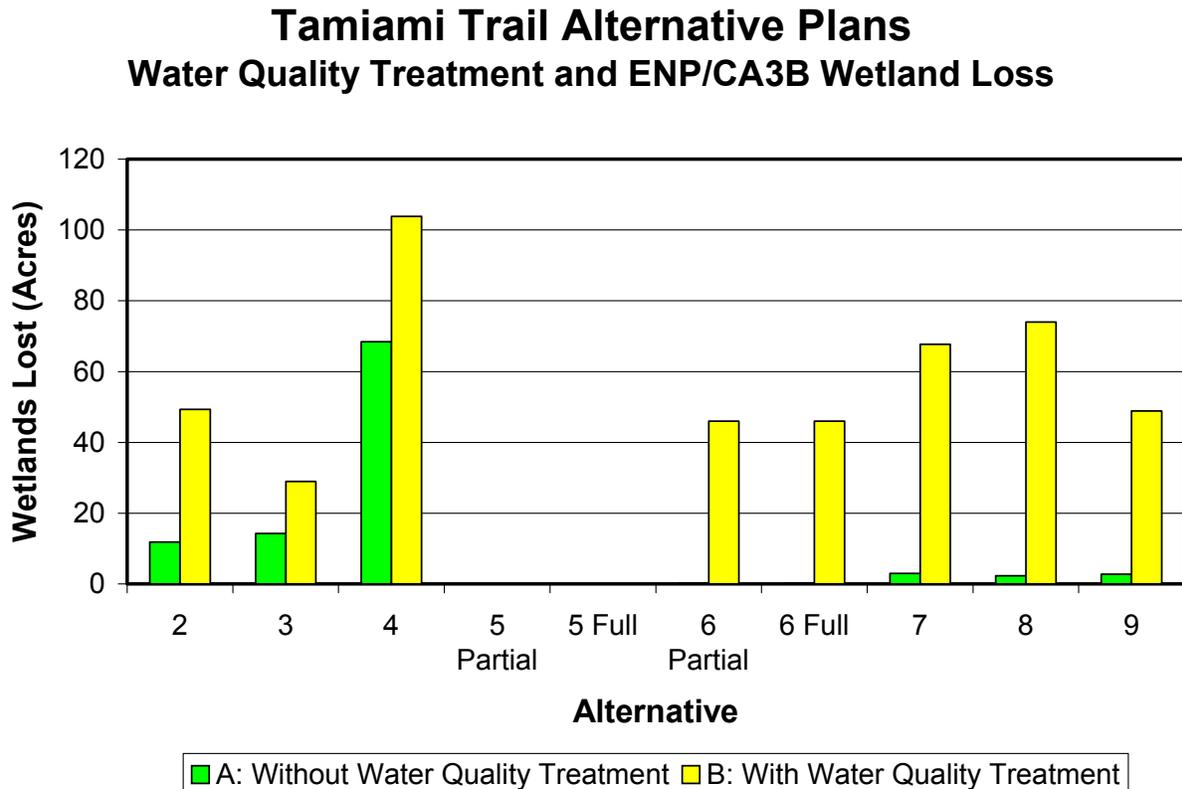


Figure 10.1. Acres of wetlands lost due to construction of the proposed Tamiami Trail Alternative Plan.

measures scores for each of the environmental objectives was calculated for each alternative. These mean scores for each objective were then summed across all environmental objectives to obtain an aggregate performance score for environmental performance. The mean performance score for each objective and the aggregate scores can also be found in Table 10.2. The composite score for environmental performance for all alternatives is graphically presented in Figure 10.2.

From the performance scores presented in Figure 10.2, Alternative 5 without water quality treatment and full removal of the existing Tamiami Trail (Alternative 5A Full or the 10.7-mile causeway) performed best for the environmental objectives examined. The composite performance score for this alternative is 46. Based on this level of performance, DOI concludes that Alternative 5A Full is the Environmentally Preferred Alternative. The alternative exhibiting the worst performance with respect to the environmental objectives is 3B (new road north of the ex-

isting alignment with water quality treatment). The composite environmental performance score for this alternative is only 18. The remaining alternatives (Alternatives 2A through 6A Full) all performed similarly for the environmental objectives.

Screening of Alternatives Based on Fiscal Constraints

Each of the alternatives retained in the previous step of the evaluation process were next assessed for relative performance for the environmental objectives in the context of the fiscal constraints imposed by the NPS. All of the retained alternatives were arranged hierarchically according to performance and plotted against the construction cost associated with each alternative. Results are presented in Figure 10.3.

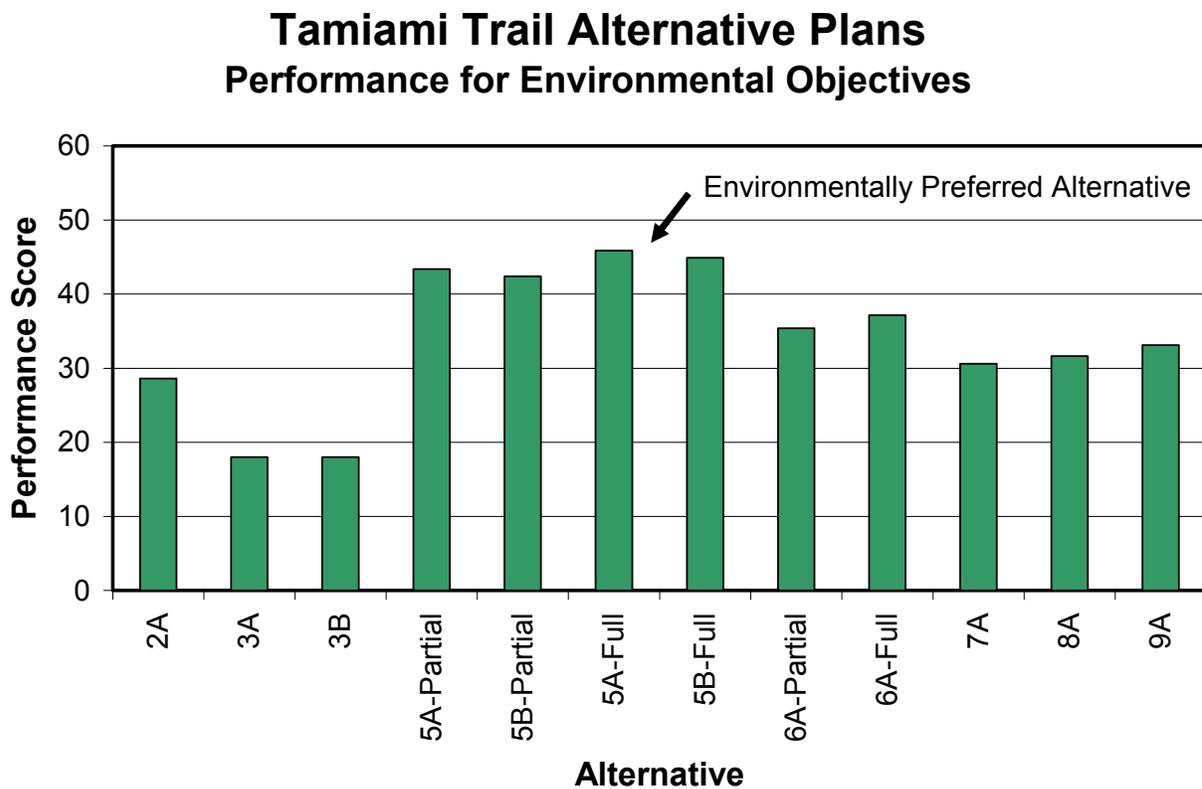


Figure 10.2. Performance for environmental objectives for Tamiami Trail alternative plans.

These results indicate that, with the exception of Alternative 3A, alternatives exhibiting the best performance in meeting the environmental objectives also had the highest construction costs. As an example, the alternative exhibiting the best performance for the environmental objectives, Alternative 5A Full (Environmentally Preferred Alternative) has a construction cost of \$146.6 million. This level of funding exceeds the current amount available (\$22.7 million) from the

NPS by more than seven times. While all of these alternatives exceed the current funding level of the NPS, many of the alternatives exceed this amount by more than three-fold. It is the opinion of the DOI that alternatives that significantly exceeded the current level of funding, are beyond the capability of the NPS and were eliminated from further consideration (Alternatives 3A, 3B, 5A Full, 5A Partial, 6A Full, and 6A).

Should additional funding be made available from other sources, the DOI would amend this position to include alternatives that clearly exhibited superior performance for the environmental objectives. However, in the absence of additional sources of funding only Alternatives 2A, 7A, 8A, and 9A were retained by the DOI for further consideration.

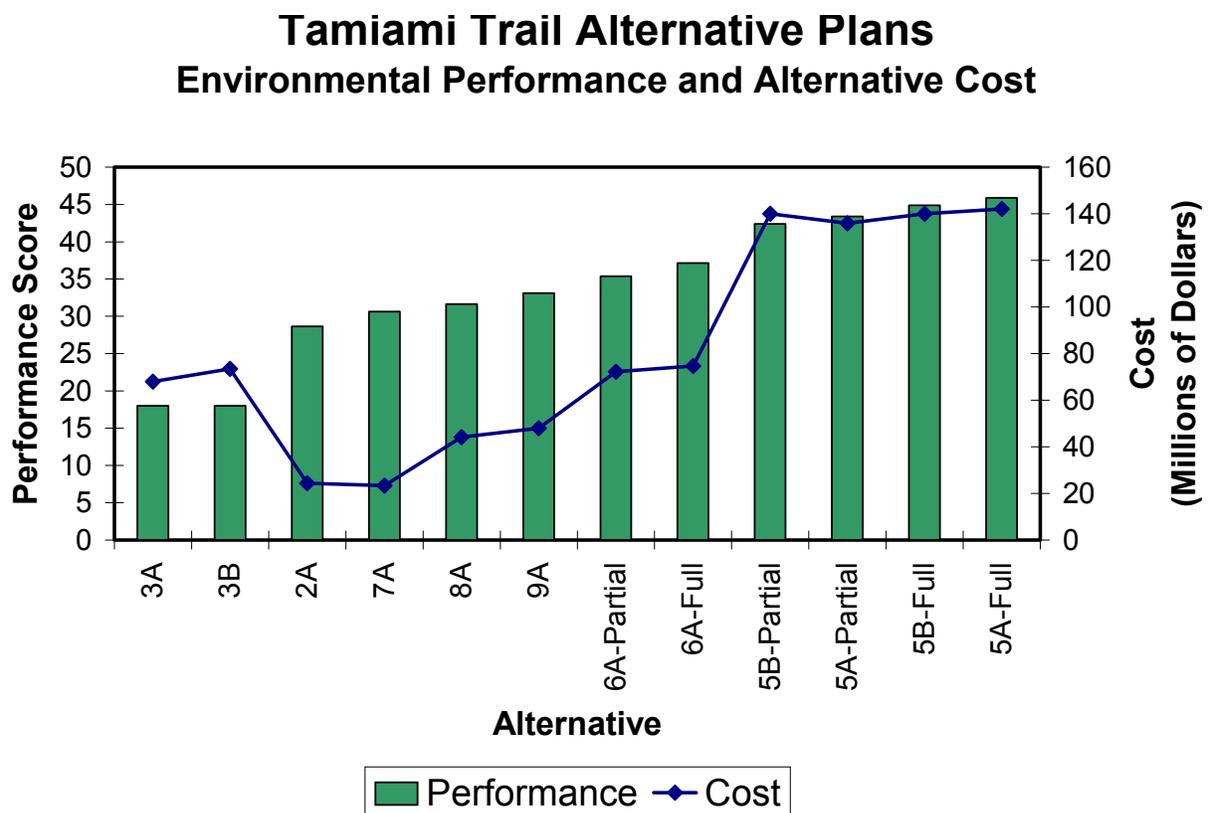


Figure 10.3. Performance for environmental objectives for Tamiami Trail alternative plans arranged hierarchically and the associated construction costs for each alternative.

Evaluation of Alternatives Based on All Project Objectives and Fiscal Constraints

The alternatives remaining from the fiscal constraint screening were next evaluated for performance for all of the project objectives, environmental and other. The mean scores and the aggregate scores for the Other Project Objectives were calculated in an identical manner as the envi-

ronmental objectives discussed earlier. Results of these calculations are also presented in Table 10.2 and arranged hierarchically in Figure 10.4.

According to the relative performance of each of the four alternatives. Based on the relative performance of the remaining alternatives for all project objectives, Figure 10.4 illustrates that the four remaining alternatives provided a very similar level of performance. Performance scores for these alternatives ranged from 61 for Alternative 2A (4 new bridges with raised road profile) to just 68 for Alternative 9A (2.7-Mile elevated bridge with raised profile).

Since each of the remaining four alternatives exhibited a similar level of total performance for the project objectives, the DOI again considered the construction costs for these alternatives in order to select the DOI Recommended Plan. The comparison of performance and construction costs is presented in Figure 10.5.

The comparison of cost and total performance indicates that Alternative 7A provides the second highest level of total performance for the least cost. While Alternative 9A may provide the highest level of performance for the remaining alternatives, the cost for construction of Alternative 9A is \$48 million. This cost for Alternative 9A is more than twice the cost of Alternative 7A but had a performance score similar to Alternative 7A. For this reason, DOI selects Alternative 7A as the Recommended Plan. This decision is identical to the Recommended Plan identified by the Corps in the Draft GRR/SEIS.

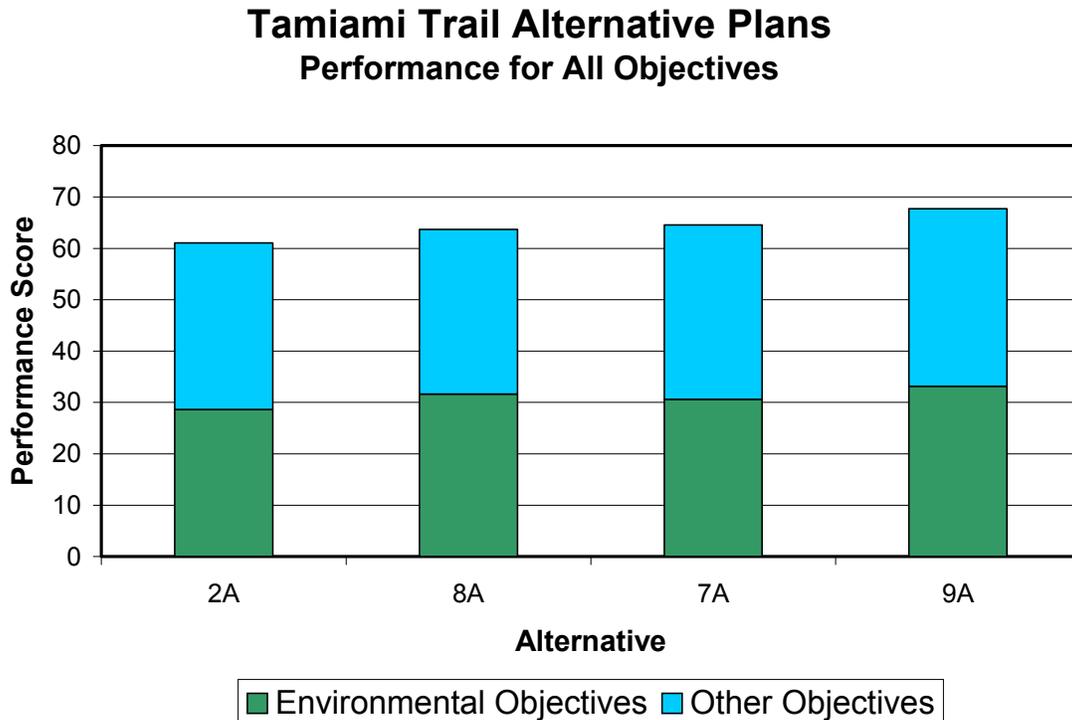


Figure 10.4. Performance for environmental and other project objectives for Tamiami Trail alternative plans retained after initial performance assessments and constraint screening.

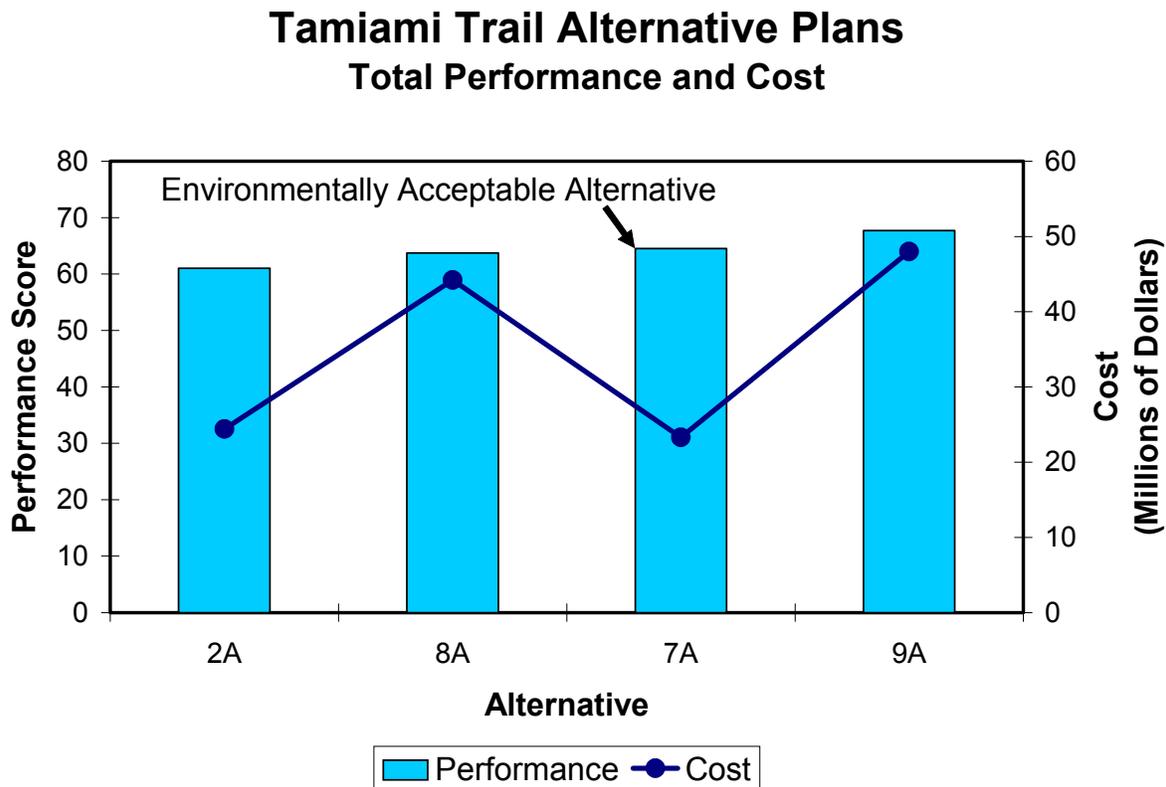


Figure 10.5. Performance for environmental and other project objectives for Tamiami Trail alternative plans retained and the associated construction costs for each alternative.

Summaries of Alternative Performance

The results of the analysis of the Tamiami Trail alternatives are provided below in a bullet format to highlight the important performance characteristics of each alternative. DOI has also provided the Final FWCA Report designation for each of the alternatives.

Alternative 1 - Existing Alignment and Profile with Four Bridges **Failed to Meet FDOT Highway Safety Criteria**

- Results in a loss of 2.92 wetland Fus.
- North-south connectivity is 2 percent of the 10.7-mile project length.
- Wood storks would not be affected by construction activities.
- Full bank fishing will remain accessible, but will be closed on the south side during the 18- to 24-month construction window; all boat ramps will remain; sightseeing opportunities are considered poor.
- Only 0.33 acres of exotic vegetation would be removed.
- Wildlife mortality remains a concern with a reduction of only 40 individuals, or a 2.5 percent reduction.

- Likely to structurally fail under predicted high stage conditions.
- Increases flow velocity in 623.4 acres.
- Increases average velocity at the road by 0.037 ft/s over marsh velocity.
- Construction cost is \$13.5 million.

Alternative 2 - Existing Alignment with Raised Profile and Four Bridges
Acceptable Performance for Environmental and Other Project Objectives
Poor Relative Performance for Fiscal Constraints

- Results in a loss of 11.1 wetland FUs without water quality and 61.75 FUs with water quality.
- North-south connectivity is 2 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- Recreation effects are similar to Alternative 1, with sightseeing opportunities considered limited.
- 12.96 acres of exotic vegetation would be removed.
- Wildlife mortality remains a concern with a reduction of only 40 individuals, or a 2.5 percent reduction.
- Increases flow velocity in 623.4 acres.
- Increases average velocity at the road by 0.037 ft/s over marsh velocity.
- Construction cost for Alternative 2A is \$24.4 million.
- Construction cost for Alternative 2B is \$58.6 million.

Alternative 3 - North Roadway Alignment in WCA-3B
Poor Performance for Environmental Objectives
Poor Relative Performance for Fiscal Constraints

- Results in a loss of 18.82 wetland FUs without water quality and 30.15 FUs with water quality.
- North-south connectivity is 10 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- The Frog City wading bird rookery would be directly affected, resulting in abandonment.
- Recreation effects include permanent reduced parking at one boat ramp, one boat ramp inaccessible during the 30 month construction window, south bank fishing limited to 3.5 miles and sightseeing opportunities in WCA-3B considered good.
- 0.17 acres of exotic vegetation would be removed without water quality and 6.48 acres with water quality.
- Wildlife mortality remains a concern with a reduction of 158 individuals, or a 10 percent reduction.
- Increases flow velocity in 623.4 acres.
- Increases average velocity at the road by 0.037 ft/s over marsh velocity.

- Construction cost for Alternative 3A is \$68 million.
- Construction cost for Alternative 3B is 73.5 million.

Alternative 4 - South Roadway Alignment in ENP

Failed to Meet Wetland Loss Requirements

- Results in a loss of 40.43 wetland FUs without water quality and 64.64 FUs with water quality.
- North-south connectivity is 2.5 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- All three boat ramps accessible, south bank fishing is inaccessible during the 18 to 24-month construction window, south bank fishing limited to 3.5 miles and sightseeing opportunities considered limited.
- 12.96 acres of exotic vegetation would be removed both with and without water quality.
- Wildlife mortality remains a concern with a reduction of 40 individuals, or a 2.5 percent reduction.
- Increases flow velocity in 623.4 acres.
- Increases average velocity at the road by 0.037 ft/s over marsh velocity.
- Construction cost for Alternative 4A is \$45.2 million.
- Construction cost for alternative 4B is \$47.1 million.

Alternative 5 – Elevated 10.7-Mile Roadway

Environmentally Preferred Alternative Without Regard to Fiscal Constraints

- Results in a gain of 45.27 wetland FUs without water quality and 33.93 FUs with water quality.
- North-south connectivity is 100 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- All three boat ramps accessible, south bank fishing is inaccessible during the 48-month construction window, south bank fishing limited to 1.5 miles, and sightseeing opportunities considered excellent.
- 12.96 acres of exotic vegetation would be removed for full road removal both with and without water quality, and 0.33 acres removed for partial road removal both with and without water quality.
- Wildlife mortality is nearly eliminated with a reduction of 1,584 individuals, or a 100 percent reduction.
- Increases flow velocity in 165.7 acres.
- No increase in average velocity at the road over marsh velocity.
- Construction cost for Alternative 5A Partial is \$135.9 million, 5B Partial is \$140.3 million.
- Construction cost for Alternative 5A Full is \$142.4 million, 5B Full is \$146.8 million.

Alternative 6 - Four-Mile Bridge

Performs Well for Environmental Objectives Without Regard to Fiscal Concerns

- Results in a loss of 1.9 wetland FUs without water quality and 33.36 FUs with water quality.
- North-south connectivity is 37 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- All three boat ramps accessible, south bank fishing is inaccessible during the 24 to 30-month construction window, south bank fishing limited to 7 miles, and sightseeing opportunities considered very good.
- 0.96 acres of exotic vegetation would be removed for full road removal both with and without water quality, and 8.12 acres removed for partial road removal both with and without water quality.
- Wildlife mortality is significantly improved with a reduction of 570 individuals, or a 36 percent reduction.
- Increases flow velocity in 437.5 acres.
- Increases average velocity at the road by 0.008 ft/s over marsh velocity.
- Construction cost for Alternative 6A Partial is \$72.2 million, 6B Partial is \$80.1 million.
- Construction cost for Alternative 6A Full is \$74.7 million, 6B Full is \$82.6 million.

Alternative 7 - 3000-Foot Bridge

DOI Recommended Plan-Environmentally Acceptable Alternative

Performs Well for Environmental and other Project Objectives

Best Relative Performance for Fiscal Constraints

- Results in a loss of only 3.42 wetland FUs.
- North-south connectivity is 5.4 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- All three boat ramps accessible, south bank fishing is inaccessible during the 24-month construction window, south bank fishing limited to 10.1 miles and sightseeing opportunities considered limited.
- 12.96 acres of exotic vegetation would be removed both with and without water quality.
- Wildlife mortality remains a concern with a reduction of 84 individuals, or a 5.3 percent reduction.
- Increases flow velocity in 1649.3 acres.
- Increases average velocity at the road by 0.027 ft/s over marsh velocity.
- Construction cost for Alternative 7A is \$23.3 million.
- Construction cost for Alternative 7B is \$50.5 million.

Alternative 8 - Box culverts**Acceptable Performance for Environmental and Other Project Objectives****Poor Relative Performance for Cost Constraints**

- Results in a loss of 3.51 wetland FUs without water quality and 46.56 FUs with water quality.
- North-south connectivity is 0.4 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- All three boat ramps accessible, south bank fishing is inaccessible during the 18 to 24-month construction window; south bank fishing remains 10.7 miles and sightseeing opportunities considered poor.
- 12.96 acres of exotic vegetation would be removed both with and without water quality.
- Wildlife mortality remains a concern with a reduction of 7 individuals, or a 0.4 percent reduction.
- Increases flow velocity in an estimated 485.8 acres.
- Increases average velocity at the road by an estimated 0.021 ft/s over marsh velocity
- Construction cost for Alternative 8A is \$44.3 million.
- Construction cost for Alternative 8B is \$96.4 million.

Alternative 9 - 2.7-Mile Bridge**Acceptable Performance for Environmental and Other Project Objectives****Poor Relative Performance for Cost Constraints**

- Results in a loss of 1.91 wetland FUs without water quality and 33.35 FUs with water quality.
- North-south connectivity is 25.7 percent of the 10.7-mile project length.
- Wood storks would be affected during highway construction and the wood stork restrictions would apply.
- All three boat ramps accessible, south bank fishing is inaccessible during the 24-30 month construction window; south bank fishing limited to 8.0 miles, and sightseeing opportunities considered good.
- 12.96 acres of exotic vegetation would be removed both with and without water quality.
- Wildlife mortality is improved with a reduction of 400 individuals, or a 25.2 percent reduction.
- Increases flow velocity in 2567.7 acres.
- Increases average velocity at the road by 0.013 ft/s over marsh velocity.
- Construction cost for Alternative 9A is \$48.0 million.
- Construction cost for Alternative 9B is \$69.7 million.

CHAPTER 11 – VIEWS AND RECOMMENDATIONS OF THE FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

The FWC submitted a Final FWCA Report for the Tamiami Trail Project on June 24, 2003. The views and recommendations of the FWC are consistent and compatible with those of FWS, as summarized below:

1. It is recommended that selection of the final alternative be as compatible as possible with the CERP Decompartmentalization Project, and that a real estate agreement with FDOT be pursued in lieu of raising the profile of US 41.
2. Implementation of a water quality monitoring plan to ascertain whether water quality treatment would be desirable in the future is recommended.
3. While FWC is concerned about loss of public recreational fishing opportunities along Tamiami Trail, it is recognized that Alternative 7a is expected to have minimal impacts on this recreational use. However, construction of staging areas should be designed to not block access to existing boat ramp and parking facilities.
4. It is recommended that the proposed bridge be located east of the Blue Shanty Canal, and that the western end of the bridge span, equipped with a wildlife undercrossing shelf beneath it, be located immediately east of the Everglades Safari Airboat concession to aid in the reduction of wildlife mortality, particularly of the threatened Everglades mink.
5. It is recommended that surveys be conducted on an annual basis by qualified biologists to determine whether any nesting efforts of State- and federally protected bird species, or Everglades mink nests, would potentially be affected, prior to the commencement of construction activities.
6. Alternatives 2b, 3a, 4a, 4b, 6b, 7b, and 8b produce an unacceptable amount of wetland functional loss, result in permanent impacts to wading bird rookeries, and have the potential to impact the threatened Everglades mink population; therefore, the FWC recommends that these alternatives be removed from further consideration as ecologically viable alternatives.
7. FWC recommends that a more detailed wildlife mortality study on Tamiami Trail be conducted prior to the completion of the Decompartmentalization Phase I project design plans.
8. Any reduction in recreational access or use of the Francis S. Taylor Wildlife Management Area that occurs in connection with the project would need to be compensated for on terms amenable to FWC. The FWC urges the Corps to devise a program whereby the development of recreational potential, adequate to meet anticipated public-use requirements, is more fully incorporated into project plans.

CHAPTER 12 - DEPARTMENT OF THE INTERIOR'S VIEWS AND RECOMMENDATIONS FOR THE TAMAMI TRAIL COMPONENT OF THE MODIFIED WATERS DELIVERIES TO EVERGLADES NATIONAL PARK

The overall goal of the Tamiami Trail component of the MWD Project is to construct the needed modifications to the existing roadway to allow for the restoration of more natural conditions in a manner consistent with the 1989 Everglades National Park Protection and Expansion Act. According to the Act, the purpose of the project is to construct modifications to the C&SF Project “to improve delivery of water to Everglades National Park (ENP) and, to the extent practicable, restore the natural hydrological conditions within the park.” This Final FWCA Report, coupled with the FWC report, represents the Secretary of the Interior’s views and recommendations to Congress in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (PL 85-624). Project constraints included highway safety, wetland losses associated with proposed water quality treatment facilities, and funding limits imposed by the NPS.

Nine alternatives were evaluated using 36 performance measures associated with 12 project objectives. The 12 project objectives were classified by the DOI into two general categories: Environmental Objectives and Other Project Objectives. Environmental Objectives are project objectives that the DOI considers as providing significant environmental enhancement or ecosystem restoration consistent with the project authorizing legislation or other Federal/State statutory requirements. Other Project Objectives are project objectives that the DOI considers as maximizing the overall benefits of the project, but do not contribute to significant environmental enhancement or ecosystem restoration.

Data from the analysis of these performance measures represents a broad array of information provided through numerous sources, and represents the best available information at the time of this final report. Each of the alternatives was evaluated initially for performance in meeting the environmental objectives of the project for the explicit purpose of identifying the environmentally preferred alternative. Subsequent evaluations utilized a broader set of project objectives and constraints in order to identify an alternative that would be environmentally acceptable in meeting the overall goal of the project but also within limits imposed by the project constraints.

I. DOI Final Position on Alternatives

A. Environmentally Preferred Alternative Without Regard to Fiscal Constraints: Alternative 5A with Full Removal of the Existing Highway

The DOI concludes that Alternative 5 (10.7-mile elevated highway) exhibits superior performance in meeting the stated environmental objectives when compared to the other proposed alter-

natives. The DOI preliminary position is that Alternative 5A Full is the environmentally preferred alternative as evidenced by the following:

1. Alternative 5A Full provides the highest degree of unrestricted flow across the entire 10.7-mile project corridor between WCA 3B and ENP.
2. Alternative 5A Full provides for the maximum wetland functional gain. All other alternatives result in a loss of wetland function compared to this alternative.
3. Alternative 5A Full provides for a net gain in wetlands acres due to implementation.
4. Alternative 5A Full establishes full and permanent connectivity between the central and southern Everglades, providing benefits for the restoration of marsh flow regimes, enabling full wildlife movement, providing the greatest potential to restore the ridge and slough landscape, and providing the highest potential for eliminating wildlife mortality.
5. Alternative 5A Full does not require any retrofitting of project features and therefore has the highest potential for compatibility with future CERP features.
6. Alternative 5A Full maintains sufficient recreational opportunities, and provides for significant scenic views and appreciation of America's Everglades for the benefit of the public.
7. While the DOI maintains that Alternative 5A Full provides the best performance in meeting the Environmental Objectives of the project, the DOI also recognizes that fiscal constraints prevent the NPS from providing full financial support for implementation. However, the DOI also maintains that should additional funding be made available to the project, implementation of Alternative 5A Full should be reconsidered.

B. Environmentally Acceptable Alternative: Corps Recommended Plan: Alternative 7A

The Corps has identified Alternative 7A (3000-foot bridge without water quality treatment) as the recommended plan. It is the position of the DOI that Alternative 7A is environmentally acceptable, performing sufficiently well for all project objectives and within the limits imposed by the project constraints as evidenced by the following:

1. Alternative 7A meets the FDOT concern for road safety by providing necessary mitigation to offset the adverse impacts to road safety associated with the projected high water following implementation of the MWD Project
2. Alternative 7A results in only 46 acres of wetlands lost due to implementation. This wetland loss is less than other alternatives providing similar levels of overall performance for the project objectives.
3. Alternative 7A provides the acceptable performance for all project objectives for the funds expended. The estimated construction costs are also within the capability of the limited funding available from the NPS.

4. While the DOI has concerns with the distortions in both the direction and velocity of flow patterns that extend over approximately 1650 acres in NESS due to Alternative 7A, DOI anticipates that these distortions can be remedied through future CERP related modifications.
5. While the DOI has concerns that the current configuration of Alternative 7A provides only 5.4 percent of the potential connectivity between WCA-3B and NESS, DOI anticipates that additional connectivity can be provided through future CERP related modifications.
6. While the DOI has concerns that the current configuration of Alternative 7A specifies the need to raise the profile of more than 10 miles of existing highway that is potentially incompatible with future CERP related modifications, the DOI anticipates that the Corps will enter into an agreement with FDOT to prevent expending approximately \$16.4 million for these potentially unneeded project features.

C. Other Alternatives

Alternative 1

The DOI concludes that Alternative 1 fails to meet the minimum requirements needed to provide a safe highway. DOI recommends that Alternative 1 be removed from further consideration based on the following:

1. Alternative 1 fails to provide mitigation for potential damages to the road sub-grade due to the projected high water levels following implementation of the MWD Project.
2. Alternative 1 fails to provide mitigation for potential hazards to transportation resulting from overtopping of the road surface due to the projected high water levels following implementation of the MWD Project.

Alternatives 3A and 3B

The DOI concludes that Alternatives 3A and 3B perform poorly for the environmental objectives and fiscal constraints. The DOI recommends that these alternatives be removed from further consideration based on the following:

1. Alternatives 3A and 3B had poor relative aggregate scores for the environmental project objectives. Alternatives 3A and 3B had the lowest performance scores for the environmental objectives when compared to the other alternatives examined.
2. Alternatives 3A and 3B had higher construction costs when compared to other alternatives which provide a higher level of performance for the environmental objectives.

Alternatives 2B, 4A, 4B, 6B Partial, 6B Full, 7B, 8B, and 9B

The DOI concludes that Alternatives 2B, 4A, 4B, 6B Partial, 6B Full, 7B, 8B, and 9B have an unacceptable level of wetland loss associated with their construction. Therefore, the DOI recommends that these alternatives be removed from further consideration based on the following:

1. Alternative 4A specifies construction of a new road south of the existing road alignment in ENP. This alternative would result in the destruction of approximately 68 acres of pristine wetlands within ENP.
2. Alternatives 2B, 4B, 6B Partial, 6B Full, 7B, 8B, and 9B all specify the construction of potentially unneeded water quality treatment facilities in ENP. These alternatives would result in the destruction of between 46 and 104 acres of pristine wetlands within ENP. DOI maintains that the need for water quality treatment is, at present, uncertain and that therefore the level of impact associated with the construction of the treatment facilities is unacceptable. Should the water quality treatment facilities be recommended or required by the DEP, DOI recommends that these facilities be constructed in conjunction with the CERP related Tamiami Trail modifications when the areas now occupied by the L-29 canal and L-29 levee could be made available for the construction of these facilities.

Alternatives 5A Partial, 5B Partial, 6A Full, and 6A Partial

The DOI concludes that each of these alternatives performs well for the environmental objectives of the project. However, the DOI also recognizes that fiscal constraints prevent the NPS from providing support for their implementation. However, the DOI also maintains that should additional funding be made available to the project, implementation of these alternatives should be reconsidered.

Alternatives 2A, 8A, and 9A

The DOI concludes that Alternatives 2A, 8A, and 9A all perform similarly well for the environmental and other objectives of the project. Also these alternatives exhibited a similar level of performance when compared to the Recommended Plan, Alternative 7A. However, the construction costs for Alternatives 2A, 8A, and 9A all exceed the costs for construction of Alternative 7A and the funding constraints of NPS. Therefore, the DOI recommends these alternatives be removed from further consideration due to the overall improved performance of Alternative 7A with regard to the project's fiscal constraints.

II. DOI Final Recommendations for Implementation of the Recommended Plan, Alternative 7A

A. MWD and CERP Modifications to Tamiami Trail

The DOI understands that only limited improvements can be made to Tamiami Trail under the current funding levels of the MWD Project. This fact is clearly evident when one considers that

the NPS has only programmed \$22.7 million for the Tamiami Trail component of the Project and the costs for the DOI’s environmentally preferred alternative (Alternative 5A Full) exceed \$147 million.

The DOI also understands that the WRDA 2000 WCA-3 Decentralization Project (Phase 1) also provides a separate authority for modifications to Tamiami Trail. The primary purpose of this CERP project is to remove many of the barriers to natural flow in WCA-3A and 3B, including L-67 A&C, L-29 as well as Tamiami Trail. Through careful planning, the combined effect of the authority of the MWD Project and WRDA 2000 will allow for a unique opportunity to implement a level of restoration for the central and southern Everglades currently impacted by Tamiami Trail that is not available under each authority when used independently.

In recognition of these facts, the DOI envisions that the modifications to Tamiami Trail will occur in two phases. The first phase of modifications will occur using the funding from the NPS to construct the Alternative 7A features, assuming the Recommended Plan is retained in the Final SEIS/GRR and Record of Decision. The second phase of Tamiami Trail modifications will occur using the separate authority of the WRDA 2000. While the DOI recognizes that these features will be identified through a separate public forum consistent with NEPA, the DOI also encourages the Corps and the SFWMD to consider the information compiled as part of the MWD alternatives analysis.

Based on this phased approach, the DOI recommends that the Corps and the DOI jointly recognize the following guiding principles for implementation of the project features associated with the unique authority for each project:

1. Only limited funding is provided by the MWD Project for modifications to the Tamiami Trail.
2. Full restoration of natural flows to NESS and ENP may only be accomplished through the implementation of MWD Project features coupled with the restoration of CERP, once the seepage control features for the projected high water levels in NESS are fully mitigated.
3. Additional funding and restoration capability is authorized by CERP Decentralization (Phase 1) for Tamiami Trail and future modifications may occur to Tamiami Trail using this authority that may augment the MWD Project features by increasing the ecological connectivity between the WCAs and ENP, thereby restoring a more natural sheetflow regime.
4. Final CERP features for Tamiami Trail have not yet been identified and any proposed modifications will be analyzed in a public forum consistent with NEPA.
5. Without prejudging the results of the Project Implementation Report (PIR) required by WRDA 2000, the intent of the MWD Tamiami Trail GRR/SEIS and the recommendations contained in this Final FWCA Report is to maximize the compatibility and avoid retrofitting of the MWD Project features with future CERP features.
6. The intent of the MWD Tamiami Trail GRR/SEIS and the recommendations contained in this Final FWCA Report is to provide a design for MWD onto which a CERP design can follow.

7. A need exists to accelerate the identification and implementation of the CERP project modifications for Tamiami Trail to better coordinate the planning and eventual construction of the features associated with the unique authorities of MWD and CERP.

B. Location of the 3000-foot Bridge

The DOI recommends that the 3000-foot bridge be located along the Tamiami Trail corridor based on the following siting criteria, in priority order: 1) facilitate hydraulic passage of flows; 2) avoid or minimize adverse effects on State- and federally listed species; 3) enhance ecological connectivity; 4) minimize wildlife mortality; and 5) maintain CERP compatibility.

Based on these criteria, the DOI examined two locations along Tamiami Trail that were discussed in detail during the planning process. The first option (Blue Shanty Canal Site) specifies the bridge beginning at the Blue Shanty Canal (Everglades Safari) and extending 3000 feet eastward. The second option (Airboat Association Site) specifies the bridge beginning at the Airboat Association and extending 3000 feet westward. The two sites are approximately 1.2 miles apart.

Blue Shanty Canal Site

Wildlife Connectivity/Mortality: From a landscape perspective, the remnant Blue Shanty Canal is the dominant interior north/south feature adjacent to the eastern 11 miles of Tamiami Trail. Field examination of the canal during the WRAP assessment revealed a shallow (*i.e.* one to three feet below ground) approximate 30-foot wide degraded canal with vegetated spoil mounds containing natural vegetation (primarily pond apple) scattered along its length. There are also natural tree islands extending north and south from the canal in WCA-3A and ENP, respectively. This man-made landscape feature, coupled with natural tree islands, effectively forms a “string of tree islands” extending over 4 miles north and south of Tamiami Trail. For this reason, the FWS and FWC have concluded this feature serves as a wildlife movement corridor. Along this corridor both upland and aquatic features are available for the passage of aquatic and terrestrial species (*i.e.*, aquatic snakes, amphibians, otter, raccoons, bobcats, etc.). This conclusion is supported by the wildlife mortality study performed for this project (seven mammal mortalities when compared to other interior sites) and recorded mortalities of the State- listed Everglades mink provided by ENP (four individuals).

Conveyance of Flows: From a flow conveyance perspective, the Blue Shanty site is located more directly downstream from the degradation of the southern 4 miles of the L-67A and C canal/levee proposed in CERP Decomartmentalization (Phase 2). Also, water captured in the Blue Shanty Canal may augment flows across this 3000-foot bridge reach after CERP implementation (removal of the L-29 canal/levee and reconnecting WCA-3A and 3B), particularly during drought events. There are also no highway culverts located in this 3000-foot reach; thus, there has been little or no sedimentation build up at culvert discharge sites, which could impede southward flows. According to local airboat operators, the area is also generally lower in elevation and retains water longer during dry-down events.

Neither bridge site is located in alignment with the S-355 weirs (they fall to the west of S-355A); however, the S-355 A-D structures are proposed for removal in CERP as part of the degradation of the L-29 levee. During the planning process, the center of the reach between the Airboat Association and the Blue Shanty Canal was selected as the site for a 400-ft bridge in one alternative examined.

Vegetation on the south side of this site is predominately sawgrass, whereas the north side is vegetated by a mixture of sawgrass, shrublands, and cattail. There also appears to be a small road leading to a fill pad on the south side of this 3000-ft reach.

Airboat Association Site

Wildlife Connectivity/Mortality: The Airboat Association site has no north/south connecting canal and tree island feature associated with it. Compared to the Blue Shanty Canal site, this site does not provide as much potential for enhancement of wildlife movement/connectivity. Likewise, it provides less potential to reduce wildlife mortality. Vegetation on the north side is dominated by sawgrass, while the south side is a mixture of shrublands, marshes, and cattail. Two significant stands of pond apple forest are located at the discharge end of two banks of culverts located in this 3000-foot reach. There are also a series of airboat trails leading south from the Airboat Association into ENP. Other than for the lack of a north/south canal, the Airboat Association and Blue Shanty sites are in proximity to each other (within one mile) and would affect similar vegetative features.

The major distinction in land use between the two sites is that continued commercial operations at the Airboat Association is “grandfathered” under the 1989 Everglades National Park Protection and Expansion Act, while operations at Everglades Safari are not. Thus, the Airboat Association is expected to continue to operate into the foreseeable future, while continued operation at the Everglades Safari is less certain. However, based on an anticipated expedited completion date for construction in 2006, this land use distinction becomes less significant since both the Everglades Safari and Airboat Association will require access for continued operation.

Conveyance of Flows: The Airboat Association site spans two banks of three culverts. As such, the six culverts would be removed as part of highway removal in this 3000-foot reach, and the benefit these culverts provide in distributing flows in a more sheetflow manner would be lost. Also, a review of the WRAP vegetation map reveals that approximately 35 percent of this 3000-foot reach is vegetated with pond apple forest. This indicates that about 35 percent of this reach has experienced sedimentation build up along the south side of the highway. This situation, coupled with the presence of pond apple forest vegetation, may impede southward flows or otherwise interfere with flow distribution.

Listed Species: Neither site would affect federally listed species; however, placement of the bridge at the Blue Shanty Canal site is expected to enhance the safe passage of and reduce mortality of the State threatened Everglades mink.

Comparison of the Two Sites

From a trade-off analysis, each location has advantages and disadvantages. Table 12.1 compares the two alternative sites based on the criteria cited above. The two sites are ranked qualitatively, from 5 (best) to 1 (worst).

Table 12.1 Comparison of the two alternative site locations.

Siting Criteria	Alternative Sites	
	Blue Shanty	Airboat Association
Passage of Flows	5	3
Avoid/Minimize Listed Species	4	3
Enhance Ecological Connectivity	5	3
Minimize Wildlife Mortality	5	3
Maintain CERP Compatibility	3	5
Total Score	22	17

This qualitative comparative analysis indicates that the Blue Shanty Canal site more fully meets the Siting Criteria (average of 88 percent of full performance with criteria) when compared to the Airboat Association site (average of 68 percent of full performance of criteria). The Blue Shanty site was found to better meet passage of flows, ecological connectivity, mortality reduction, and listed species conservation. The Airboat Association site was found to be more compatible with CERP implementation, since this site will remain in operation into the foreseeable future.

DOI Recommendations Regarding Site Selection

Based on the above analysis the DOI recommends the following:

1. Design the Recommended Plan to begin at the Blue Shanty Canal site and extend eastward for a distance of 3000 ft.
2. Conduct an interagency on-site inspection of the area prior to final site selection.
3. Construct an approximately 20-ft wide elevated cement apron to be included in the bridge design and be located on the western bridge abutment in proximity to the Blue Shanty Canal in order to facilitate safe passage of terrestrial species under the

bridge. The apron should be designed to remain above water, except under extreme high water events.

4. Develop a long-term wildlife mortality study to be implemented jointly by the DOI, Corps, FWC, SFWMD, and other interested parties to examine the long-term effects of wildlife mortality on the Tamiami Trail and to assess the usage of wildlife along the 3000-foot bridge.

C. Avoidance of Unnecessary Costs and Additional Infrastructure

The current design of the Recommended Plan (Alternative 7A) includes provisions to mitigate FDOT concerns regarding potential damage to the road sub-grade and overtopping the existing road surface due to the projected high water associated with the implementation of the MWD Project. The mitigation is in the form of raising the portion of the existing highway not elevated by the construction of the 3000-foot bridge. Specifically, Alternative 7A would raise approximately 10 miles of the existing road by approximately 2 feet through the addition of fill material and asphalt resurfacing. Depending on the plan recommended in the CERP Decompartmentalization (Phase 1) Project, the potential exists for portions of Tamiami Trail raised by the MWD Project to be removed as part of the CERP recommended plan. This would result in as much as \$16.4 million in MWD Project funding being expended on unneeded features.

To avoid the construction of potentially unneeded features while still meeting the mitigation requirements to assure highway safety, the DOI recommends the Corps enter into an agreement with the FDOT that will ensure the safety requirements of FDOT are met until the CERP project features can be identified and implemented. The DOI also recommends that the Corps closely coordinate the development of this agreement with ENP, FWS, and the Office of the Solicitor for the DOI.

III. Additional DOI Recommendations

A. Threatened and Endangered Species

1. The FWS recommends that the Construction Restrictions for wood storks and migratory birds outlined in Chapter 4 of this report be integrated into the detailed design and specifications and construction documents during implementation of this project. These Construction Restrictions are designed to avoid adverse effects to State- and federally listed species and other species of migratory waterbirds.
2. The FWS, FWC, NPS and Corps jointly develop and implement a Wood Stork Monitoring Plan to assess wood stork behavior (roosting, nest building, breeding, nesting, and fledging of young) during and after project implementation.

B. Water Quality

1. The DOI recommends that a thorough review of the available water quality data provided by the Corps be conducted by DEP for implementation of modifications to Tamiami Trail to ensure compliance with applicable water quality standards.

2. Should DEP require water quality features for the MWD Project, the DOI recommends deferring construction of these features until the fate of the L-29 canal and L-29 levee have been determined. The DOI understands that these C&SF project features may be removed through implementation of future CERP projects, thereby providing an already disturbed area for construction of the water quality treatment facilities and eliminate the need to destroy wetlands within ENP.

C. Wetland Functional Enhancement

1. While the DOI recognizes that the Tamiami Trail Project is designed to restore flows to NESS, is also recognized that construction of US 41 and the L-29 borrow canal has eliminated approximately 530 acres of historic Everglades wetland habitat. Therefore, in order to maximize the wetland restoration potential of this project, it is recommended that a wetland functional enhancement plan be developed to offset wetland losses attributable to direct construction activities associated with Alternative 7A. In this regard, Chapter 3 of this report provides specific, detailed wetland functional assessments of eight potential wetland restoration sites in ENP that may be suitable sites for enhancement. Specifically, the Frog City site, encompassing 6.8 acres of filled wetlands, is owned by NPS and, if restored, would provide enough wetland functional lift to offset the losses associated with the direct construction effects of constructing Alternative 7A. All or a portion of this site should be considered for future wetland enhancement.
2. The DOI finds that Alternative 5 (Full Causeway) enhances existing wetland function through removal of US 41, and thus maximizes wetland restoration both in the Tamiami Trail corridor and in NESS.

D. Recreation

1. The DOI recommends that if any of the three boat ramps in the project area (see Chapter 5) are impacted by project implementation, the Corps should consult with the FWC and SFWMD to establish a replacement boat ramp at the discretion of the FWC. This recommendation is consistent with the current agreement between the FWC and SFWMD.

E. Wildlife Mortality/Connectivity Features

1. The DOI recommends that those wildlife features (bridge across the L-29 canal and wildlife underpass) located to the east of the S-334 structure be included in the detailed design and construction of the Tamiami Trail Project. Wildlife connectivity is particularly lacking along the eastern periphery of the Everglades at this location, because the intersection of the L-30 canal and the L-29 canal form a barrier to north-south wildlife movement. These features would not require retrofitting as part of CERP implementation. However, these features will significantly improve wildlife movement given that CERP implemented water levels in WCA-3B and ENP will

rise thus displacing terrestrial species of wildlife to the periphery, particularly during periods of high water.

2. The remaining wildlife features presented in this report would likely require retrofitting during CERP implementation. The DOI recommends that the Corps consider these features for all alternatives (other than Alternative 5) in detailed design and specifications as integral components of the final Federally Recommended Plan.

F. Control of Exotic Vegetation

The DOI recommends that an Exotic Vegetation Removal Plan be developed jointly by the Corps, FWS, NPS, FWC, and SFWMD, in cooperation with FDOT. Removal of exotic vegetation along the Tamiami Trail corridor should be conducted.

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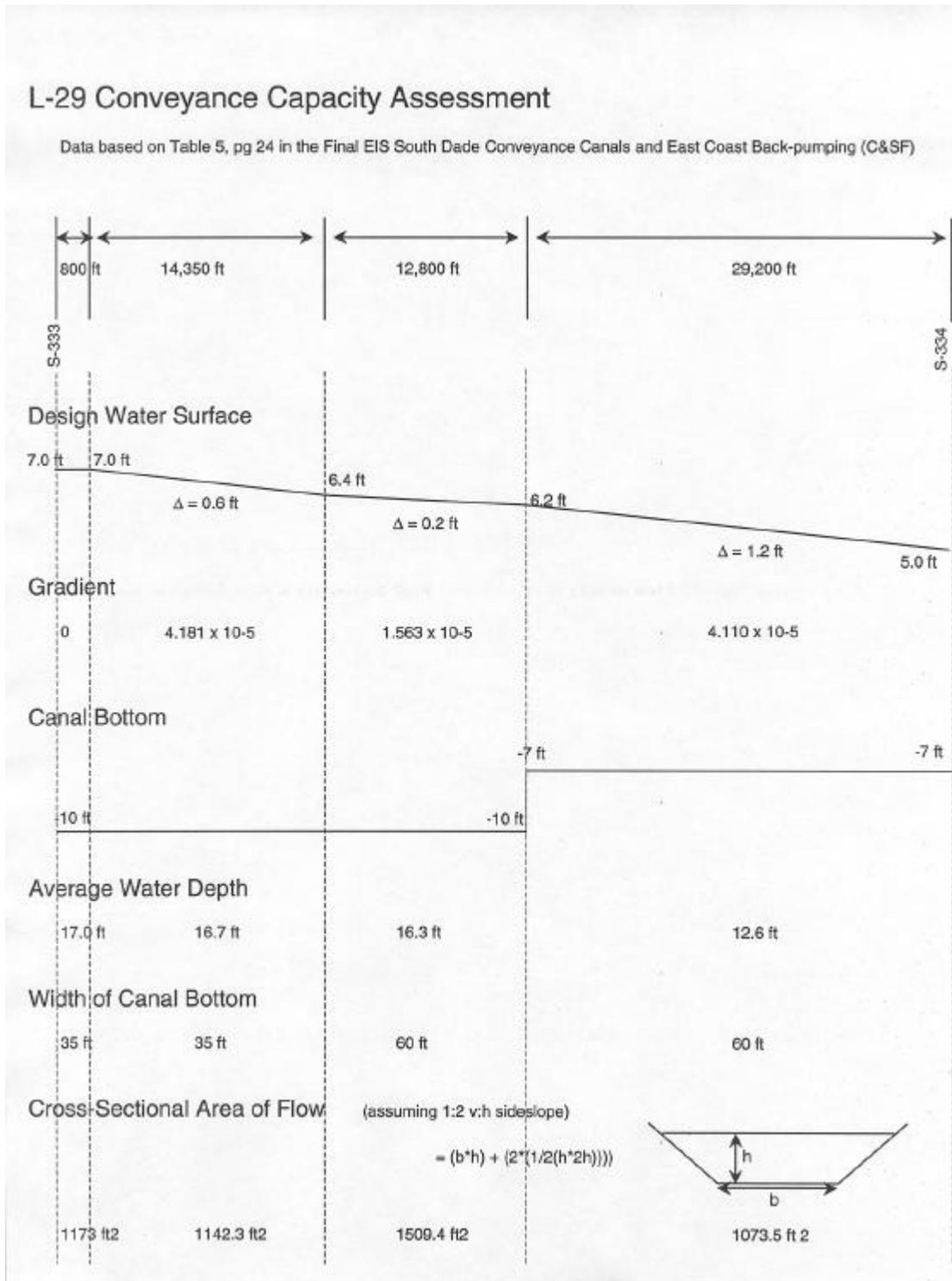
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APPENDICES

Appendix A. Historical discharge frequency analysis according to Bulletin 17B (U.S. Water Resources Council).

Available upon request at Everglades National Park.

Appendix B. L-29 conveyance requirements according to Manning's equation.



Appendix B. cont

Manning's Equation (ft)

$$Q = 1.486/n * A * R^{2/3} * S^{1/2}$$

method: Calculate A, R, based on canal dimensions

Use $n=0.023$ based on Civil Engineering Ref. Manual pg 5-23 (Appendix A) for firm gravel.

Use Q of adjacent structures

Solve for gradient (S) and compare with design S

Downstream of S-333

$$Q(\text{S-333 max design}) = 1,350 \text{ cfs}$$

$$n = 0.023$$

$$A = 1142.3 \text{ ft}^2$$

$$p = 35 + 2 \cdot 38 = 111 \text{ ft}$$

$$R = A/p = 10.3 \text{ ft}$$

$$S = 1.493 \times 10^{-5}$$

$$S(\text{design}) = 4.181 \times 10^{-5}$$

Downstream of S-334

$$Q(\text{S-334 max design}) = 1,230 \text{ cfs}$$

$$n = 0.023$$

$$A = 1073.5 \text{ ft}^2$$

$$p = 60 + 2 \cdot 28.2 = 116.3 \text{ ft}$$

$$R = A/p = 9.2 \text{ ft}$$

$$S = 1.631 \times 10^{-5}$$

$$S(\text{design}) = 4.110 \times 10^{-5}$$

Appendix C. Wetland Rapid Assessment Procedure (WRAP) Functional Units (FU) Lost and Gained, Tamiami Trail Project, Modified Water Deliveries Project.

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
2a	PGc/PGw	0.12	0.7	0.0854				
	SB	11.694	0.69	8.06886				
	PC	0	0.48	0				
	ES/SB	0.046	0.54	0.02484				
TOTAL FUNCTIONAL UNITS				8.1791	2.92			11.0991
2b w/ original WQ	PGc/PGw	5.147	0.7	3.6029				
	SB	44.005	0.69	30.36345				
	PC	0.84	0.48	0.4032				
	ES/SB	0.346	0.54	0.18684				
TOTAL FUNCTIONAL UNITS				34.55639	2.92			37.47639
2b1	PGc/PGw	2.877	0.7	2.0139				
	SB	41.06	0.69	28.3314				
	PC	0.388	0.48	0.18624				
	ES/SB	0.32	0.54	0.1728				
TOTAL FUNCTIONAL UNITS				30.70434	2.92			33.62434
2b2	PGc/PGw	0.078	0.7	0.0546				
	SB	7.81	0.69	5.3889				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				5.44782	2.92			8.36782
2b3	PGc/PGw	0.078	0.7	0.0546				
	SB	7.81	0.69	5.3889				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				5.44782	2.92			8.36782
2b4	PGc/PGw	0.078	0.7	0.0546				
	SB	7.81	0.69	5.3889				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				5.44782	2.92			8.36782
2b5	PGc/PGw	0.078	0.7	0.0546				
	SB	7.81	0.69	5.3889				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				5.44782	2.92			8.36782

Appendix C. cont.

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
2b6	PGc/PGw	0.08	0.7	0.056				
	SB	7.764	0.69	5.35716				
	PC	0	0.48	0				
	ES/SB	0.015	0.54	0.0081				
TOTAL FUNCTIONAL UNITS				5.42126	2.92			8.34126
3a	PC/PGc	0.094	0.68	0.06392				
	PE	1.567	0.8	1.2536				
	PGc/PGw	9.575	0.78	7.4685				
	SB	1.841	0.83	1.52803				
	PGW	0.342	0.83	0.28386				
	PC	0.867	0.53	0.45951				
TOTAL FUNCTIONAL UNITS				11.05742		7.76		18.81742
3b	PC/PGc	0.258	0.68	0.17544				
	PE	2.93	0.8	2.344				
	PGc/PGw	19.719	0.78	15.38082				
	SB	3.126	0.83	2.59458				
	PGW	1.196	0.83	0.99268				
	PC	1.712	0.53	0.90736				
TOTAL FUNCTIONAL UNITS				22.39488		7.76		30.15488
3b1	PC/PGc	0.183	0.68	0.12444				
	PE	2.38	0.8	1.904				
	PGc/PGw	15.501	0.78	12.09078				
	SB	2.423	0.83	2.01109				
	PGW	0.947	0.83	0.78601				
	PC	1.358	0.53	0.71974				
TOTAL FUNCTIONAL UNITS				17.63606		7.76		25.39606
3b2	PC/PGc	0.063	0.68	0.04284				
	PE	1.145	0.8	0.916				
	PGc/PGw	6.776	0.78	5.28528				
	SB	1.928	0.83	1.60024				
	PGW	0.119	0.83	0.09877				
	PC	0.567	0.53	0.30051				
TOTAL FUNCTIONAL UNITS				8.24364		7.76		16.00364
3b3	PC/PGc	0.293	0.68	0.19924				
	PE	1.145	0.8	0.916				
	PGc/PGw	7.54	0.78	5.8812				

Appendix C. cont.

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
3b3	SB	3.539	0.83	2.93737				
	PGW	0.147	0.83	0.12201				
	PC	0.797	0.53	0.42241				
TOTAL FUNCTIONAL UNITS				10.47823		7.76		18.23823
3b4	PC/PGc	0.062	0.68	0.04216				
	PE	1.113	0.8	0.8904				
	PGc/PGw	6.329	0.78	4.93662				
	SB	1.431	0.83	1.18773				
	PGW	0.119	0.83	0.09877				
	PC	0.525	0.53	0.27825				
TOTAL FUNCTIONAL UNITS				7.43393		7.76		15.19393
3b5	PC/PGc	0.062	0.68	0.04216				
	PE	1.145	0.8	0.916				
	PGc/PGw	6.748	0.78	5.26344				
	SB	1.71	0.83	1.4193				
	PGW	0.119	0.83	0.09877				
	PC	0.546	0.53	0.28938				
TOTAL FUNCTIONAL UNITS				8.02905		7.76		15.78905
3b6	PC/PGc	0.062	0.68	0.04216				
	PE	1.145	0.8	0.916				
	PGc/PGw	6.762	0.78	5.27436				
	SB	1.787	0.83	1.48321				
	PGW	0.119	0.83	0.09877				
	PC	0.546	0.53	0.28938				
TOTAL FUNCTIONAL UNITS				8.10388		7.76		15.86388
4a	PGc/PGw	19.086	0.7	13.3602				
	SB	46.542	0.69	32.11398				
	PC	2.234	0.48	1.07232				
	ES/SB	0.587	0.54	0.31698				
TOTAL FUNCTIONAL UNITS				46.86348			6.43	40.43348
4b	PGc/PGw	35.626	0.7	24.9382				
	SB	63.469	0.69	43.79361				
	PC	3.958	0.48	1.89984				
	ES/SB	0.821	0.54	0.44334				
TOTAL FUNCTIONAL UNITS				71.07499			6.43	64.64499

Appendix C. cont.

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
4b1	PGc/PGw	10.507	0.7	7.3549				
	SB	50.283	0.69	34.69527				
	PC	1.257	0.48	0.60336				
	ES/SB	0.493	0.54	0.26622				
TOTAL FUNCTIONAL UNITS				42.91975			6.43	36.48975
4b2	PGc/PGw	10.57	0.7	7.399				
	SB	50.259	0.69	34.67871				
	PC	1.258	0.48	0.60384				
	ES/SB	0.493	0.54	0.26622				
TOTAL FUNCTIONAL UNITS				42.94777			6.43	36.51777
4b3	PGc/PGw	10.508	0.7	7.3556				
	SB	50.28	0.69	34.6932				
	PC	1.251	0.48	0.60048				
	ES/SB	0.493	0.54	0.26622				
TOTAL FUNCTIONAL UNITS				42.9155			6.43	36.4855
4b4	PGc/PGw	10.495	0.7	7.3465				
	SB	49.006	0.69	33.81414				
	PC	1.258	0.48	0.60384				
	ES/SB	0.493	0.54	0.26622				
TOTAL FUNCTIONAL UNITS				42.0307			6.43	35.6007
4b5	PGc/PGw	10.507	0.7	7.3549				
	SB	50.309	0.69	34.71321				
	PC	1.262	0.48	0.60576				
	ES/SB	0.493	0.54	0.26622				
TOTAL FUNCTIONAL UNITS				42.94009			6.43	36.51009
4b6	PGc/PGw	10.506	0.7	7.3542				
	SB	50.28	0.69	34.6932				
	PC	1.257	0.48	0.60336				
	ES/SB	0.493	0.54	0.26622				
TOTAL FUNCTIONAL UNITS				42.91698			6.43	36.48698

Appendix C. cont.

Proposed Restoration of the Tamiami Trail - Alternative 5 Without Water Quality Treatment, and With a Levee for L-29 Control (57.3 Acres)			
Habitat	Acres	Wrap Score	Functional Units Gained
PGc/PGw	3.26	0.7	2.282
SB	52.92	0.69	36.5148
PC	0.699	0.48	0.33552
ES/SB	0.41	0.54	0.2214
TOTAL FUNCTIONAL UNITS			39.35372
Proposed Restoration of the Tamiami Trail - Alternative 5 With Water Quality Treatment, and With a Levee for L-29 Control (43.0 Acres)			
Habitat	Acres	Wrap Score	Functional Units Gained
PGc/PGw	2.451	0.7	1.7157
SB	39.719	0.69	27.40611
PC	0.525	0.48	0.252
ES/SB	0.31	0.54	0.1674
TOTAL FUNCTIONAL UNITS			29.54121
Proposed Restoration of the Tamiami Trail - Alternative 5 Without Water Quality Treatment, and No Levee for L-29 Control (65.9 Acres)			
Habitat	Acres	Wrap Score	Functional Units Gained
PGc/PGw	3.76	0.7	2.632
SB	60.87	0.69	42.0003
PC	0.804	0.48	0.38592
ES/SB	0.474	0.54	0.25596
TOTAL FUNCTIONAL UNITS			45.27418
Proposed Restoration of the Tamiami Trail - Alternative 5 With Water Quality Treatment, and No Levee for L-29 Control (49.4 Acres)			
Habitat	Acres	Wrap Score	Functional Units Gained
PGc/PGw	2.81	0.7	1.967
SB	45.63	0.69	31.4847
PC	0.603	0.48	0.28944
ES/SB	0.356	0.54	0.19224
TOTAL FUNCTIONAL UNITS			33.93338

Note: This information was generated by establishing a polygon south of the existing Tamiami Trail and placing the habitat types into the four categories (PGc/PGW - ES/SB). Acreage for the total land within the polygon (less HI, SA, RD and Open Water) was determined and the representative percent of the total was calculated. This percent was applied to the total available acreage (as provided by PBS&J) to generate the acres available per habitat. This was then multiplied by the WRAP Scores, the sum of which represents the Total Functional Units.

Appendix C. cont.

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
6a	PGc/PGw	0.48	0.7	0.336				
	SB	8.93	0.69	6.1617				
	PC	0.169	0.48	0.08112				
	ES/SB	0.04	0.54	0.0216				
TOTAL FUNCTIONAL UNITS				6.60042	0			6.60042
6b w original WQ	PGc/PGw	3.381	0.7	2.3667				
	SB	28.744	0.69	19.83336				
	PC	0.81	0.48	0.3888				
	ES/SB	0.346	0.54	0.18684				
TOTAL FUNCTIONAL UNITS				22.7757	0			22.7757
6b1	PGc/PGw	2.422	0.7	1.6954				
	SB	27.285	0.69	18.82665				
	PC	0.365	0.48	0.1752				
	ES/SB	0.32	0.54	0.1728				
TOTAL FUNCTIONAL UNITS				20.87005	0			20.87005
6b2	PGc/PGw	0.071	0.7	0.0497				
	SB	4.761	0.69	3.28509				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				3.33911	0			3.33911
6b3	PGc/PGw	0.071	0.7	0.0497				
	SB	4.761	0.69	3.28509				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				3.33911	0			3.33911
6b4	PGc/PGw	0.071	0.7	0.0497				
	SB	4.761	0.69	3.28509				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				3.33911	0			3.33911
6b5	PGc/PGw	0.071	0.7	0.0497				
	SB	4.761	0.69	3.28509				
	PC	0	0.48	0				
	ES/SB	0.008	0.54	0.00432				
TOTAL FUNCTIONAL UNITS				3.33911	0			3.33911

Appendix C. cont

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
PGc/PGw	PGc/PGw	PGc/ PGw	PGc/ PGw	0.0511				
SB	SB	SB	SB	3.47622				
PC	PC	PC	PC	0				
ES/SB	ES/SB	ES/SB	ES/SB	0.0081				
TOTAL FUNCTIONAL UNITS				3.53542	0			3.53542

NOTE: The acreage shown in the above table should be considered **PRELIMINARY** at this time. No engineering has been done for this alternative. Alignment information from Alternative 2 was used with the approximate 4 mile bridge excluded (with the exception of an approximate .25 mile area for the access to the Airboat Association. No temporary impacts were assumed for this analysis. This may be revised once engineering has been performed

Appendix C. cont

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
7a	PGc/PGw	0.044	0.7	0.0308				
	SB	4.914	0.69	3.39066				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.42146				3.42146
7b	PGc/PGw	17.484	0.7	12.2388				
	SB	52.016	0.69	35.89104				
	PC	2.302	0.48	1.10496				
	ES/SB	0.592	0.54	0.31968				
TOTAL FUNCTIONAL UNITS				49.55448				49.55448
7b1	PGc/PGw	0.098	0.7	0.0686				
	SB	10.28	0.69	7.0932				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
TOTAL FUNCTIONAL UNITS				7.18394				7.18394
7b2	PGc/PGw	0.044	0.7	0.0308				
	SB	4.914	0.69	3.39066				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.42146				3.42146
7b3	PGc/PGw	0.098	0.7	0.0686				
	SB	10.28	0.69	7.0932				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
TOTAL FUNCTIONAL UNITS				7.18394				7.18394
7b4	PGc/PGw	0.098	0.7	0.0686				
	SB	10.28	0.69	7.0932				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
TOTAL FUNCTIONAL UNITS				7.18394				7.18394
7b5	PGc/PGw	0.044	0.7	0.0308				
	SB	4.914	0.69	3.39066				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.42146				3.42146
7b6	PGc/PGw	0.044	0.7	0.0308				
	SB	4.914	0.69	3.39066				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.42146				3.42146

Appendix C. cont

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
8a	PGc/PGw	0.044	0.7	0.0308				
	SB	5.043	0.69	3.47967				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.51047			0	3.51047
8b	PGc/PGw	13.071	0.7	9.1497				
	SB	52.587	0.69	36.28503				
	PC	1.79	0.48	0.8592				
	ES/SB	0.504	0.54	0.27216				
TOTAL FUNCTIONAL UNITS				46.56609			0	46.56609
8b1	PGc/PGw	0.098	0.7	0.0686				
	SB	10.709	0.69	7.38921				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
TOTAL FUNCTIONAL UNITS				7.47995			0	7.47995
8b2	PGc/PGw	0.044	0.7	0.0308				
	SB	5.043	0.69	3.47967				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.51047			0	3.51047
8b3	PGc/PGw	0.098	0.7	0.0686				0
	SB	10.709	0.69	7.38921				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
TOTAL FUNCTIONAL UNITS				7.47995			0	7.47995
8b4	PGc/PGw	0.098	0.7	0.0686				
	SB	10.709	0.69	7.38921				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
TOTAL FUNCTIONAL UNITS				7.47995			0	7.47995
8b5	PGc/PGw	0.044	0.7	0.0308				
	SB	5.043	0.69	3.47967				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.51047			0	3.51047
8b6	PGc/PGw	0.044	0.7	0.0308				
	SB	5.043	0.69	3.47967				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
TOTAL FUNCTIONAL UNITS				3.51047			0	3.51047

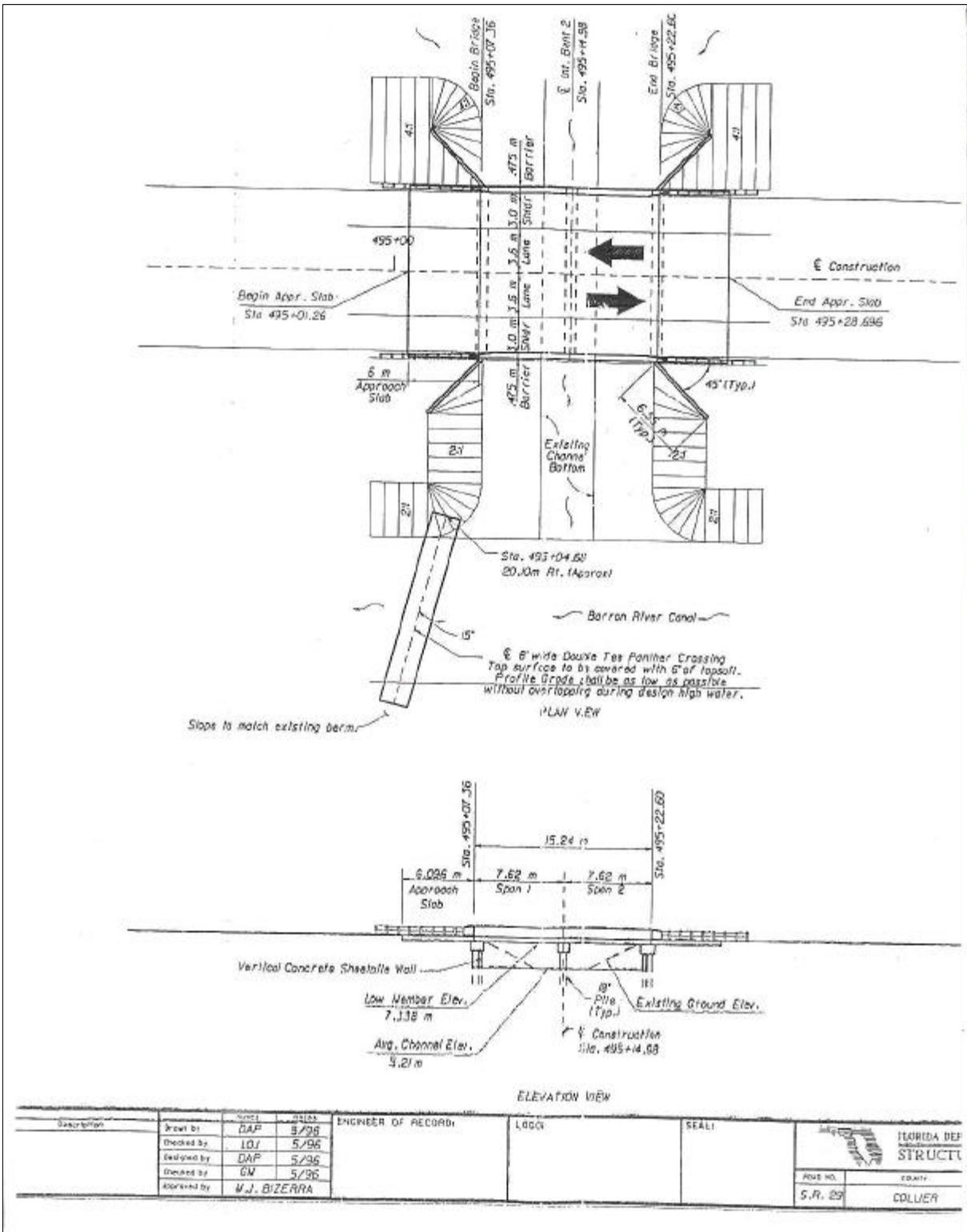
Appendix C. cont

Wetland Rapid Assessment Procedure (WRAP) Results								
DIRECT IMPACTS					INDIRECT IMPACTS (FUNCTIONAL UNITS)			TOTAL FUNCTIONAL UNITS LOST PER ALTERNATIVE
Alternative	Habitat	Acres	Wrap Score	Functional Units Lost	Temporary Impacts	Secondary Effects	Secondary Benefits	
9a	PGc/PGw	0.0039	0.7	0.00273				
	SB	2.767	0.69	1.90923				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
	TOTAL FUNCTIONAL UNITS				1.91196			
9b w original WQ	PGc/PGw	12.522	0.7	8.7654				
	SB	33.847	0.69	23.35443				
	PC	1.912	0.48	0.91776				
	ES/SB	0.592	0.54	0.31968				
	TOTAL FUNCTIONAL UNITS				33.35727			
9b1	PGc/PGw	0.087	0.7	0.0609				
	SB	6.362	0.69	4.38978				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
	TOTAL FUNCTIONAL UNITS				4.47282			
9b2	PGc/PGw	0.039	0.7	0.0273				
	SB	2.767	0.69	1.90923				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
	TOTAL FUNCTIONAL UNITS				1.93653			
9b3	PGc/PGw	0.087	0.7	0.0609				
	SB	6.362	0.69	4.38978				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
	TOTAL FUNCTIONAL UNITS				4.47282			
9b4	PGc/PGw	0.087	0.7	0.0609				
	SB	6.362	0.69	4.38978				
	PC	0	0.48	0				
	ES/SB	0.041	0.54	0.02214				
	TOTAL FUNCTIONAL UNITS				4.47282			
9b5	PGc/PGw	0.039	0.7	0.0273				
	SB	2.767	0.69	1.90923				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
	TOTAL FUNCTIONAL UNITS				1.93653			
9b6	PGc/PGw	0.039	0.7	0.0273				
	SB	2.767	0.69	1.90923				
	PC	0	0.48	0				
	ES/SB	0	0.54	0				
	TOTAL FUNCTIONAL UNITS				1.93653			

Appendix C. cont

POTENTIAL RESTORATION AREAS SOUTH OF U.S. 41 (TAMIAMI TRAIL)						
SITE NUMBER (From East to West)	HABITAT TO BE RESTORED	ACRES	WRAP SCORE	FUNCTIONAL UNITS GAINED	TOTAL FUNCTIONAL UNITS GAINED PER SITE	
1	Radio Tower (Acreage not complete as Photography did not include all of site)	PGC/PGW	0.668	0.7	0.4676	0.4676
2	Cooper Town	SBa	1.391	0.69	0.95979	0.95979
3	Unknown adjacent to Cooper Town	SBa	0.429	0.69	0.29601	0.29601
4	Gator Park	SBa	4.88	0.69	3.3672	
		PGC/PGW	3.254	0.7	2.2778	5.645
5	Unknown east of Frog City	PGC/PGW	0.572	0.7	0.4004	0.4004
6	Frog City	SBa	2.05	0.69	1.4145	
		PGC/PGW	4.786	0.7	3.3502	4.7647
7	SFWMD Radio Tower	NOT INCLUDED			0	
8	Safari Airboat	SBa	3.408	0.69	2.35152	
		PGC/PGW	5.112	0.7	3.5784	5.92992
9	Radio Tower west of Safari	PGC/PGW	1.762	0.7	1.2334	1.2334

Appendix D. Wildlife Underpass Schematic



STANDARD PROTECTION MEASURES FOR THE EASTERN INDIGO SNAKE

1. An eastern indigo snake protection/education plan shall be developed by the applicant or requestor for all construction personnel to follow. The plan shall be provided to the FWS for review and approval at least 30 days prior to any clearing activities. The educational materials for the plan may consist of a combination of posters, videos, pamphlets, and lectures (*e.g.*, an observer trained to identify eastern indigo snakes could use the protection/education plan to instruct construction personnel before any clearing activities occur). Informational signs should be posted throughout the construction site and contain the following information:
 - a. a description of the eastern indigo snake, its habits, and protection under Federal Law;
 - b. instructions not to injure, harm, harass or kill this species;
 - c. directions to cease clearing activities and allow the eastern indigo snake sufficient time to move away from the site on its own before resuming clearing; and,
 - d. telephone numbers of pertinent agencies to be contacted if a dead eastern indigo snake is encountered. The dead specimen should be thoroughly soaked in water, then frozen.
2. If not currently authorized through an Incidental Take Statement in association with a Biological Opinion, only individuals who have been either authorized by a section 10(a)(1)(A) permit issued by the FWS, or by the State of Florida through the Florida Fish and Wildlife Conservation Commission for such activities, are permitted to come in contact with or relocate an eastern indigo snake.
3. If necessary, eastern indigo snakes shall be held in captivity only long enough to transport them to a release site; at no time shall two snakes be kept in the same container during transportation.
4. An eastern indigo snake monitoring report must be submitted to the appropriate Florida Field Office within 60 days of the conclusion of clearing phases. The report should be submitted whether or not eastern indigo snakes are observed. The report should contain the following information:
 - a. any sightings of eastern indigo snakes;
 - b. summaries of any relocated snakes if relocation was approved for the project (*e.g.*, locations of where and when they were found and relocated);
 - c. other obligations required by the Florida Fish and Wildlife Conservation Commission, as stipulated in the permit.

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 1-3B **UTM:** 547546; 2849389 **Summary Score:** 0.68

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 14, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: PC/PGc: Cattail/Sawgrass Marsh

Site Description: This site is located on the north side of the L-29 Levee in WCA 3B near the eastern end of the project (across from a bank of culverts). The wetland habitat consists of cattail/sawgrass mixed prairie (60% cattail and 40% sawgrass). Some areas of sawgrass die-off noted (improper hydrology).

Score	Notes
2.5	FISH AND WILDLIFE UTILIZATION: Good wading bird use in area: two snail kites, great blue heron, little blue heron. Other birds: grackle, palm warbler, phoebe, gnatcatcher, loggerhead shrike. Apple snails, forage fishes.
NA	OVERSTORY/SHRUB CANOPY:
1.5	VEGETATIVE GROUND COVER: Up to 60% cattail, with sawgrass (some die-off). Scattered leather fern and small pond apples returning. Appears to be transitioning to increased hydrology. <i>Pontedaria, Ludwigia, Thelypteris, Nymphoides.</i>
2.0	Upland/Wetland Buffer: Approximately 40' buffer, < 5% Brazilian pepper, some willow, broomsedge. Provides some cover and foraging opportunities.
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; some pockets of standing water.
2.0	<p>Water Quality Treatment and Inputs: LU + PT/2 = WQ Score</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0</p> <p style="text-align: center;">Vegetated Levee (PT): 50% Veg. Strip = 1.0</p> <p style="text-align: center;">Pretreatment (PT): 50% Highway = <u>2.0</u></p> <p style="text-align: center;">PT Score: 3/2 = 1.5</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 2-3B **UTM:** 542280; 2849386 **Summary Score:** 0.80

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 14, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: PE: Emergent Marsh

Site Description: This site is located on the north side of the L-29 Levee in WCA 3B near the middle of the project. The wetland habitat consists of emergent marsh species, small sawgrass patches and no cattail.

Score	Notes
2.5	FISH AND WILDLIFE UTILIZATION: Good wading bird use in area: snail kites, great blue heron, ibis. Alligator (bellow). Signs of wildlife trails adjacent to old canal. Apple snails, grass shrimp, forage fishes. Some open water areas.
N/A	OVERSTORY/SHRUB CANOPY:
3.0	VEGETATIVE GROUND COVER: <i>Sagittaria</i> , <i>Paspalidium</i> , <i>Nymphae</i> , <i>Acrostichum</i> , some dead willows.
2.0	Upland/Wetland Buffer: 40' buffer. Dahoon holly, elderberry, <i>Baccharis</i> .
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; probably connected to canal. About a foot deep during inspection.
2.25	<p>Water Quality Treatment and Inputs: LU + PT/2 = WQ Score</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0</p> <p style="text-align: center;">Vegetated Levee (PT): 50% Veg. Strip = 1.0</p> <p style="text-align: center;">Pretreatment (PT): 50% Highway = <u>2.0</u></p> <p style="text-align: center;">PT Score: 3/2 = 1.5</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 3-3B **UTM:** 546090; 2849372 **Summary Score:** 0.78

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 14, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: PGc: Sawgrass Marsh

Site Description: This site is located on the north side of the L-29 Levee in WCA-3B near the western portion of the project. The wetland habitat consists of sawgrass-dominated marsh.

Score	Notes
2.5	FISH AND WILDLIFE UTILIZATION: Good wading bird use in area: snail kites, tri-colored heron, kingfisher. Apple snails, crayfish, tadpoles, grass shrimp, forage fishes. Some open water areas.
N/A	OVERSTORY/SHRUB CANOPY:
3.0	VEGETATIVE GROUND COVER: Pure sawgrass stand, scattered willow and <i>Cephalanthus</i> .
2.0	Upland/Wetland Buffer: 40' buffer. Sabal palms, some pond apples, scattered Brazilian pepper.
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; over a foot deep during inspection.
2.25	<p>Water Quality Treatment and Inputs: $LU + PT/2 = WQ \text{ Score}$</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0</p> <p style="text-align: center;">Vegetated Levee (PT): 50% Veg. Strip = 1.0</p> <p style="text-align: center;">Pretreatment (PT): 50% Highway = <u>2.0</u></p> <p style="text-align: center;">PT Score: $3/2 = 1.5$</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 4-3B **UTM:** 541983; 2849359 **Summary Score:** 0.83

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 14, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: FS/FSb: Swamp Forest/Bayhead

Site Description: This site is a large tree island and is located on the north side of the L-29 Levee in WCA-3B just west of Tiger Tail Camp. The wetland habitat consists of mature swamp forest.

Score	Notes
2.7	FISH AND WILDLIFE UTILIZATION: Good cover and nesting habitat in canopy. Cat bird and warblers. Very diverse, micro-habitat. Crayfish, tadpoles, grass shrimp, forage fishes. Open water under canopy.
3.0	OVERSTORY/SHRUB CANOPY: Mature pond apples, sweet bay, red bay, cocoplum, <i>Cephalanthus</i> , <i>Ilex cassine</i>
3.0	VEGETATIVE GROUND COVER: Royal fern, <i>Blechnum</i> , <i>Peltandra</i> , <i>Thelypteris</i> , <i>Saururus</i> .
2.0	Upland/Wetland Buffer: Vegetated buffer > 40'. <i>Ficus</i> , no Brazilian pepper noted. Some human influence by levee (trash).
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; Over a foot deep during inspection.
2.25	<p>Water Quality Treatment and Inputs: $LU + PT/2 = WQ$ Score</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0</p> <p style="text-align: center;">Vegetated Levee (PT): 50% Veg. Strip = 1.0</p> <p style="text-align: center;">Pretreatment (PT): 50% Highway = <u>2.0</u></p> <p style="text-align: center;">PT Score: $3/2 = 1.5$</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 5-3B **UTM:** 540538; 2849358 **Summary Score:** 0.83

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 14, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: PGw: Maidencane/Spike-rush Marsh

Site Description: This emergent marsh is located on the north side of the L-29 Levee in WCA-3B west of Tiger Tail Camp. The wetland habitat consists of an open-water emergent marsh.

Score	Notes
2.75	FISH AND WILDLIFE UTILIZATION: Good wading bird habitat; great blue heron, great egret. Crayfish, tadpoles, grass shrimp, forage fishes. Open water areas interspersed with marsh.
N/A	OVERSTORY/SHRUB CANOPY:
3.0	VEGETATIVE GROUND COVER: Water lily, <i>Eleocharis</i> , <i>Sagittaria</i> , <i>Utricularia</i> , <i>Pontedaria</i> , <i>Bacopa</i> , <i>Paspalidium</i> , <i>Chara</i> , small scattered pond apples. Marsh surrounded by sawgrass.
2.0	Upland/Wetland Buffer: Vegetated buffer > 40'. <i>Ficus</i> , no Brazilian pepper noted.
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; Over a foot deep during inspection.
2.25	<p>Water Quality Treatment and Inputs: $LU + PT/2 = WQ \text{ Score}$</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0</p> <p style="text-align: center;">Vegetated Levee (PT): 50% Veg. Strip = 1.0</p> <p style="text-align: center;">Pretreatment (PT): 50% Highway = <u>2.0</u></p> <p style="text-align: center;">PT Score: $3/2 = 1.5$</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 6-3B **UTM:** 533733; 2849341 **Summary Score:** 0.53

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 14, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); David Jones (ENP); Kathy Fanning (DERM)

Wetland Classification: PC: Cattail

Site Description: This cattail-dominated wetland is located on the north side of the L-29 Levee in WCA-3B approximately one-half mile east of the S-333. The wetland habitat consists of dense cattail.

Score	Notes
1.5	FISH AND WILDLIFE UTILIZATION: Too dense for dip netting. One raccoon observed on levee. Habitat provides cover and some nesting potential for some species.
N/A	OVERSTORY/SHRUB CANOPY:
0.25	VEGETATIVE GROUND COVER: > 75% cattail; Scattered willow and leather ferns.
2.0	Upland/Wetland Buffer: Vegetated buffer > 40'. <i>Ficus</i> , no Brazilian pepper noted.
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; Over a foot deep during inspection.
2.25	<p>Water Quality Treatment and Inputs: $LU + PT/2 = WQ \text{ Score}$</p> <p style="padding-left: 40px;">Land Use (LU): 50% Open space = 3.0</p> <p style="padding-left: 40px;">Vegetated Levee (PT): 50% Veg. Strip = 1.0</p> <p style="padding-left: 40px;">Pretreatment (PT): 50% Highway = <u>2.0</u></p> <p style="padding-left: 80px;">PT Score: $3/2 = 1.5$</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 1-ENP **UTM:** 532858; 2849250 **Summary Score:** 0.70

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 15, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: PGc: Sawgrass Marsh

Site Description: This site is located on the south side of US 41 in ENP at the western end of the project near the curve in US 41. The wetland habitat consists of sawgrass-dominated prairie interspersed with leather fern and scattered emergent aquatic species. Brazilian pepper (< 10%) is found along the edge of the highway. This is good quality wetland habitat (70% of full functional capacity).

Score	Notes
1.75	FISH AND WILDLIFE UTILIZATION: Great blue heron, aquatic snails, killifish, Gambusia, grass shrimp. (Wildlife utilization affected by proximity of US 41: wildlife mortality and movement).
N/A	OVERSTORY/SHRUB CANOPY:
3.0	VEGETATIVE GROUND COVER: <i>Cladium</i> , <i>Acrostichum</i> , <i>Chara</i> , <i>Pontedaria</i> , <i>Sagittaria</i> . (Ground cover functioning at full capacity).
1.0	Upland/Wetland Buffer: < 30'; <10% <i>Schinus</i> (Minimal buffer zone).
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; highway to north impedes sheetflow.
2.0	<p>Water Quality Treatment and Inputs: LU + PT/2 = WQ Score</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0</p> <p style="text-align: center;">Pretreatment (PT): 50% Highway = 1.0</p> <p>(Run-off from US 41 enters the wetland with minimal treatment).</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 2-ENP **UTM:** 541784; 284972 **Summary Score:** 0.69

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 15, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: FSb/SB: Bayhead/Shrub

Site Description: This forested wetland is located just west of this Gatorland Airboat concession. The wetland habitat consists of forested trees and shrubs with good ground cover. A red-shouldered hawk was observed perching in the canopy. The proximity of the Gatorland Airboat concession was considered to have secondary effects on wildlife utilization.

Score	Notes
2.0	FISH AND WILDLIFE UTILIZATION: Red-shouldered hawk, aquatic snails, killifish, Gambusia, grass shrimp in water column. Adequate cover and food sources.
1.75	OVERSTORY/SHRUB CANOPY: Sweet bay, swamp bay, scattered pond apple, wax myrtle, Brazilian pepper (< 10%).
3.0	VEGETATIVE GROUND COVER: Leather fern common, <i>Sagittaria</i> , some <i>Ludwigia</i> along highway edge (< 10%).
1.75	Upland/Wetland Buffer: < 30'; <10% <i>Schinus</i> , elderberry food source.
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; highway to north impedes sheetflow.
2.0	Water Quality Treatment and Inputs: $LU + PT/2 = WQ$ Score <div style="text-align: center;"> Land Use (LU): 50% Open space = 3.0 Pretreatment (PT): 50% Highway = 1.0 </div>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 3-ENP **UTM:** 545591; 2849287 **Summary Score:** 0.69

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: November 15, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); Kathy Fanning (DERM)

Wetland Classification: FS: Pond apple forest

Site Description: This site is the pond apple forest at the Tamiami West wood stork rookery. This is a mature forest at a culvert outfall. The forest begins at the edge of the highway side slope.

Score	Notes
2.0	FISH AND WILDLIFE UTILIZATION: Supports several species of nesting wading birds. Gambusia, grass shrimp, and other forage fishes in the water column.
2.0	OVERSTORY/SHRUB CANOPY: Pond apple (good number of seedlings), swamp bay, red bay, wax myrtle, <i>Ficus</i> next to highway, Brazilian pepper along highway (< 25%).
2.75	VEGETATIVE GROUND COVER: <i>Cladium</i> (scattered), <i>Acrostichum</i> , <i>Chara</i> , <i>Pontederia</i> , <i>Thelypteris</i> , <i>Leersia</i> , scattered <i>Baccharis</i> along highway.
1.75	Upland/Wetland Buffer: < 30'; <10% <i>Schinus</i> .
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present (depths over 2'); highway to north impedes sheetflow, culvert flows significant.
2.0	Water Quality Treatment and Inputs: LU + PT/2 = WQ Score Land Use (LU): 50% Open space = 3.0 Pretreatment (PT): 50% Highway = 1.0

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 4-ENP **UTM:** 545589; 2849291 **Summary Score:** 0.48

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: December 19, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); David Jones (ENP); Kathy Fanning (DERM)

Wetland Classification: PC: Cattail-dominated marsh.

Site Description: This cattail-dominated marsh is located at the eastern end of the project area about one-quarter mile from the L-31N levee. Herbiciding and vegetative die-off evident in some areas along highway.

Score	Notes
1.50	FISH AND WILDLIFE UTILIZATION: Dip-netting produced some aquatic invertebrates, <i>Gambusia</i> . Dense cattail provides some cover and nesting habitat.
N/A	OVERSTORY/SHRUB CANOPY:
0.25	VEGETATIVE GROUND COVER: Dense cattail.
1.75	Upland/Wetland Buffer: < 30'; <10% <i>Schinus</i> .
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; highway to north impedes sheetflow.
2.0	<p>Water Quality Treatment and Inputs: $LU + PT/2 = WQ \text{ Score}$</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0</p> <p style="text-align: center;">Pretreatment (PT): 50% Highway = 1.0</p>

**WETLAND EVALUATION SUMMARY
WETLAND RAPID ASSESSMENT PROCEDURE**

Wetland Number: 5-ENP **UTM:** 549707; 2849308 **Summary Score:** 0.54

Project: Modified Water Deliveries to Everglades National Park, Tamiami Trail Modifications

Date of Site Visit: December 19, 2000

Assessment Team Members: Tre' Wharton (Corps); Ken Rutchey (SFWMD); Tim Towles (FWC); David Ferrell (FWS); David Jones (ENP); Kathy Fanning (DERM).

Wetland Classification: E/SB: Fringe of exotic and shrub vegetation along south side of highway.

Site Description: This wetland polygon represents the exotic-dominated fringe of vegetation along the entire south side of the highway extending approximately 30' into the wetlands.

Score	Notes
1.5	FISH AND WILDLIFE UTILIZATION: Some small passerines (warblers) noted in shrubs. Provides cover/perching habitat. Screens highway from marsh. Wildlife skeletal remains noted (turtles, birds). (Wildlife utilization affected by proximity of US 41: wildlife mortality and movement).
1.5	OVERSTORY/SHRUB CANOPY: Dominated, in some areas, by Brazilian pepper, some scattered <i>Ficus</i> , scattered bays. Some areas of fringe contain < 10% Brazilian pepper.
N/A	VEGETATIVE GROUND COVER:
1.0	Upland/Wetland Buffer: < 30'; > 50% <i>Schinus</i> (Minimal buffer zone).
2.0	Field Indicators of Wetland Hydrology: Adequate hydrology present; highway to north impedes sheetflow.
2.0	<p>Water Quality Treatment and Inputs: LU + PT/2 = WQ Score</p> <p style="text-align: center;">Land Use (LU): 50% Open space = 3.0 Pretreatment (PT): 50% Highway = 1.0</p> <p>(Run-off from US 41 enters the wetland with minimal treatment).</p>

Appendix G. Statewide wildlife mortality totals for Florida state parks

DISTRICT ONE						
Park	Miles Surveyed	Mammals	Herps	Birds	Total	Notable Species
Big Lagoon	5	7	5	0	12	
Blackwater River	0.7	25	11	0	36	E.Diamondback
Camp Helen	1.0	5	0	0	5	Grey Fox
Dead Lakes	0.5	0	0	0	0	
Deer Lake	1.5	6	1	0	7	
Falling Waters	1.0	0	2	1	3	
Econfina River	7.0	3	1	0	4	
Florida Caverns	3.0	14	7	0	21	White-tailed Deer
Grayton Beach	6.0	10	6	3	19	
Henderson Beach	6.0	1	9	3	13	
Lake Jackson Mounds	0.3	0	0	0	0	
Letchworth Mounds	0.5	0	0	0	0	
Maclay Gardens	2.2	0	2	0	2	
Natural Bridge	0.1	0	0	0	0	
Ochlockonee River	3.0	3	18	4	25	
Perdido Key	1.0	0	0	0	0	
Ponce DeLeon Springs	0.2	0	0	0	0	
River Bluff	0.5	0	0	0	0	
Rocky Bayou	4.0	8	11	1	20	
St. Andrews	3.0	0	0	0	0	
St. George	8.0	0	0	0	0	
St. Joseph Peninsula	5.3	8	62	8	78	E. Diamondback
Tallahassee-St. Marks Trail	16.0	0	0	0	0	
Three Rivers	10.0	4	0	0	4	
Topsail Hill	4.0	0	3	0	3	
Torreya	1.0	1	5	0	6	
Wakulla Springs	9.0	25	6	0	31	
District 1 Total	99.8	120	149	20	289	

Appendix G. cont.

DISTRICT TWO						
Park	Miles Surveyed	Mammals	Herps	Birds	Total	Notable Species
Amelia Island	1.1	2	0	0	2	
Big Talbot	6.3	96	3	26	125	Long-billed Dowitcher, Gopher Tortoise, Great Horned Owl
Cedar Key Scrub	10.0	18	4	1	23	Peninsula Ribbon Snake, Striped Skunk
Devil's Millhopper	0.6	17	1	0	18	Gopher Tortoise
Ft. Clinch	6.2	7	6	0	13	Coachwhip (3), Gopher Tortoise
Ft. George	4.4	3	1	0	4	
Ichetucknee Springs	10.5	142	177	14	333	American Kestrel, Gopher Tortoise (3), Gopher Frog
Little Talbot	5.2	40	8	10	58	Common Loons (2), Coachwhip (2), Gopher Tortoise(2)
M. K. Rawlings	0.2	4	1	0	5	
Paynes Prairie	53.0	11	45	2	58	E. Diamondback, (2), Gopher Tortoise (2)
Peacock Springs	3.5	7	0	0	7	
Rainbow Springs	1.3	2	0	0	2	Striped Skunk
San Felasco Hammock	11.7	158	16	16	190	Gray Fox, Red-shouldered Hawk, Gopher Tortoise
District 2 Total	106.5	507	262	69	838	

Appendix G. cont.

DISTRICT THREE						
Park	Miles Surveyed	Mammals	Herps	Birds	Total	Notable Species
Anastasia	5.5	5	2	1	8	
Blue Spring	2.0	16	12	2	30	
Bulow Creek	6.7	41	2	1	44	Gopher Tortoise, White-tailed Deer (8)
Bulow Plantation Ruin	1.3	4	1	0	5	
Catfish Creek	1.6	1	1	0	2	Coyote
DeLeon Springs	4.0	11	4	3	18	Bobcat
Faver-Dykes	2.0	8	3	1	12	
Flagler Beach	0.5	6	3	1	10	
Guana River	10.1	132	14	47	193	E. Diamondback (2), Gopher Tortoise, Cat (4)
Kissimmee Prairie	20.0	0	7	0	7	
Lake Griffin	2.0	1	0	1	2	
Lake Kissimmee	5.6	10	4	5	19	E. Diamondback
Lake Louisa	2.8	0	0	0	0	
Lower Wekiva River	0.6	7	3	0	10	FL Pine Snake, Gopher Tortoise (2)
North Peninsula	2.5	16	4	4	24	E. Diamondback, Spotted Skunk, Gopher Tortoise
Ravine Gardens	1.0	16	0	0	16	
Rock Springs Run	4.6	42	41	12	95	E. Diamondback, Gopher Tortoise (8), South-eastern Kestrel
Sebastian Inlet	3.0	56	11	46	113	Royal Tern, Gopher Tortoise (5), River Otter
Silver River	1.2	0	1	0	1	Two months surveyed
Tomoka	6.1	46	12	1	59	E. Diamondback, Gopher Tortoise (2)
Tosohatchee	13.2				0	No report
Washington Oaks	2.7	7	6	2	15	Gopher Tortoise
Wekiwa Springs	6.6	4	3	0	7	E. Diamondback, Gopher Tortoise
District 3 Total	105.6	429	134	127	690	

Appendix G. cont.

DISTRICT FOUR						
Park	Miles Surveyed	Mammals	Herps	Birds	Total	Notable Species
Alafia River	5.0	38	0	5	43	Bobcat, Barn Owl, Great-horned Owl, White-tailed Deer
Collier-Seminole	9.0	6	4	1	11	Bobcat, Corn Snake
Dade Battlefield	0.7	0	1	0	1	Hognose Snake
Delnor-Wiggins Pass	1.5	1	0	0	1	Raccoon
Fakahatchee Strand	11.5	25	80	11	116	Everglades Mink, Barred Owl, American Alligators
Fort Cooper	3.6	0	0	0	0	
Highlands Hammock	7.1	25	18	2	45	Eastern Indigo Snake, Red-headed Woodpecker
Hillsborough River	4.0	7	5	0	12	Sherman's Fox Squirrel, 7-ft American Alligator
Honeymoon Island	6.0	6	10	2	18	Gopher Tortoise, E. Diamondback
Koreshan	2.0	0	2	0	2	Corn Snake, Southern Ringneck Snake
Lake Manatee	4.0	63	11	1	75	Eastern Spotted Skunk, Gopher Tortoises, Bobcat, Gray Fox
Little Manatee River	2.0	2	2	0	4	Gopher Tortoise, American Alligator
Lovers Key	5.0	51	4	2	57	Ospreys, Raccoon (40)
Myakka River	12.0	125	20	20	165	River Otter, Barred Owl (6), Bobcat, Great Blue Herons
Oscar Scherer	2.0	10	7	2	19	Bobcat
Paynes Creek	1.3	10	3	0	13	Scarlet Kingsnake
District 4 Total	76.7	369	167	46	582	

Appendix G. cont.

DISTRICT FIVE						
Park	Miles Surveyed	Mammals	Herps	Birds	Total	Notable Species
Avalon	1.1	14	1	0	15	
Bahia Honda	3.5	6	4	8	18	Indigo Snake, Northern Gannet
Cape Florida	4.3	7	6	0	13	
Curry Hammocks	1.3	26	5	18	49	
Ft. Pierce Inlet	1.5	3	1	0	4	
Hugh Taylor Birch	2.5	3	3	1	7	
MacArthur Beach	2.3	32	0	3	35	
John Pennekamp	1.4	5	0	3	8	
Lloyd Beach	2.5	14	2	4	20	
Jonathan Dickinson	6.5	66	57	7	130	Yellow-billed Cuckoo, Sandhill Crane, Gopher Tortoise (4)
Key Largo Hammocks	10.5	146	28	69	243	American Crocodile, Hispid Cotton Rat, Rose-ate Spoonbill
Lignumvitae Key	1.0	21	0	3	24	
Long Key	3.6	32	3	12	47	Long-billed Dowitcher (2), White-crowned Pigeon
Oleta River	5.3	17	5	2	24	
Savannas	4.0	0	0	0	0	
District 5 Total	51.3	392	115	130	637	

Appendix G. cont.

Statewide Totals

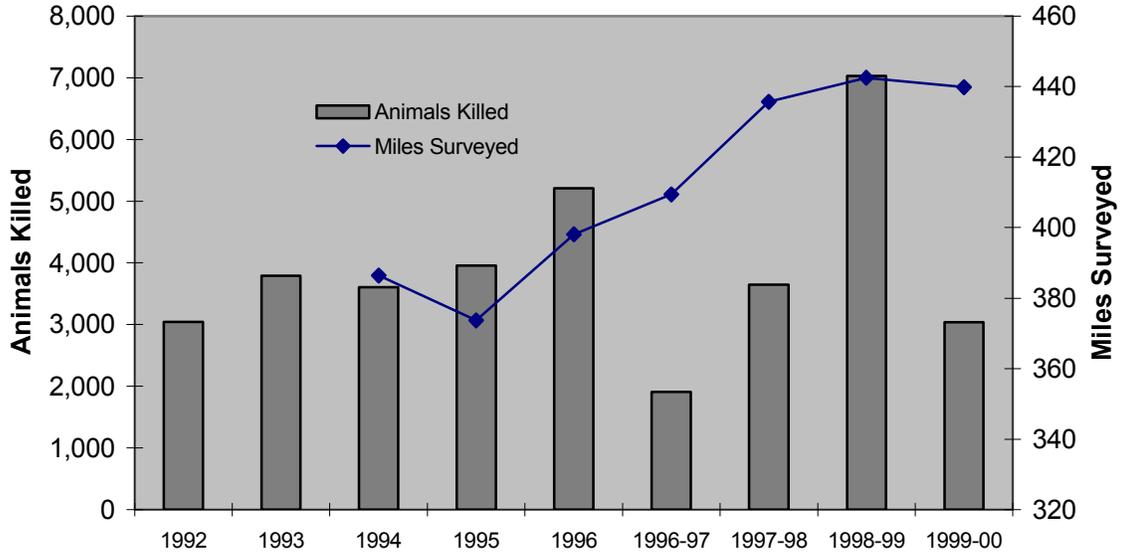
	# of Miles	Mammals	Herps	Birds	Total
District 1 Total	99.8	120	149	20	289
District 2 Total	106.5	507	262	69	838
District 3 Total	105.6	429	134	127	690
District 4 Total	76.7	369	167	46	582
District 5 Total	51.3	392	115	130	637
Statewide Totals	439.8	1,817	827	392	3,036

Nine-Year Summary

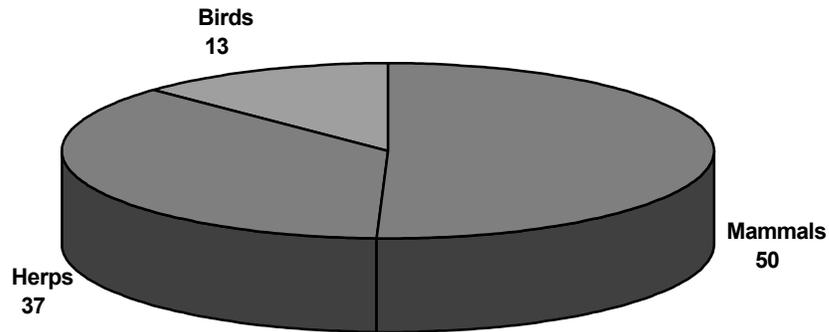
	Miles	Mammals	Herps	Birds	Total
1992	N/A	1,754	935	355	3,044
1993	N/A	2,184	1,068	539	3,791
1994	386.4	1,829	1,361	414	3,604
1995	373.7	2,254	1,062	640	3,956
1996	398.1	2,263	2,300	647	5,210
1996-97	409.4	1,173	474	265	1,912
1997-98	435.7	2,299	802	536	3,647
1998-99	442.5	2,225	4,110	694	7,029
1999-2000	439.8	1,817	827	392	3,036
TOTAL		17,798	12,939	4,482	35,229

Data for 1992-96 based on calendar year. 1996-97 data reflect the 6-month period of January to June during which FPS switched to fiscal year accounting. Subsequent data are based on a July to June fiscal year.

Appendix G. cont.



Data for 1992-96 based on calendar year. 1996-97 data reflect the 6-month period of January to June during which FPS switched to fiscal year accounting. Subsequent data are based on a July to June fiscal year.



Among the animals killed on State park roads are 13 species tracked by the Florida Natural Areas Inventory: gopher frog, fox squirrel, Southeastern kestrel, gopher tortoise, indigo snake, pine snake, eastern diamondback rattlesnake, royal tern, Everglades mink, American crocodile, white-crowned pigeon, and roseate spoonbill.