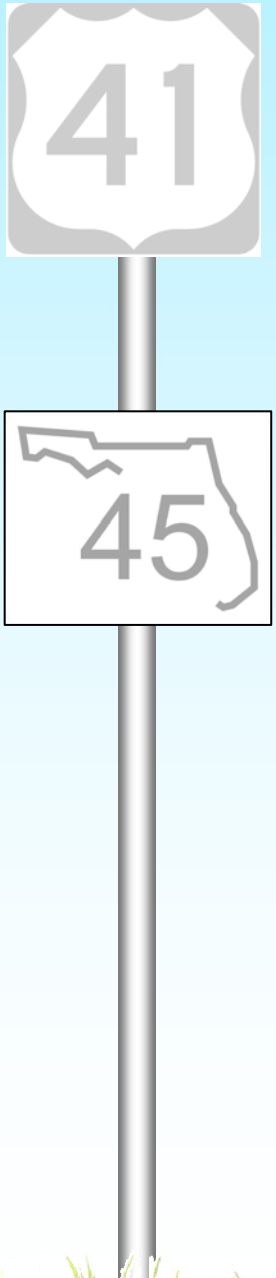
US 41 (SR 45)

Project Development and Environment (PD&E) Study

From 12th Street to Kracker Avenue

Final Pond Sizing Analysis Memorandum



WPI Segment No: 421140 8; ETDM # 9511
Hillsborough County

Prepared for the
Florida Department of Transportation
District Seven

September 2009

US 41 (SR 45)

Project Development and Environment (PD&E) Study

From 12th Street to Kracker Avenue

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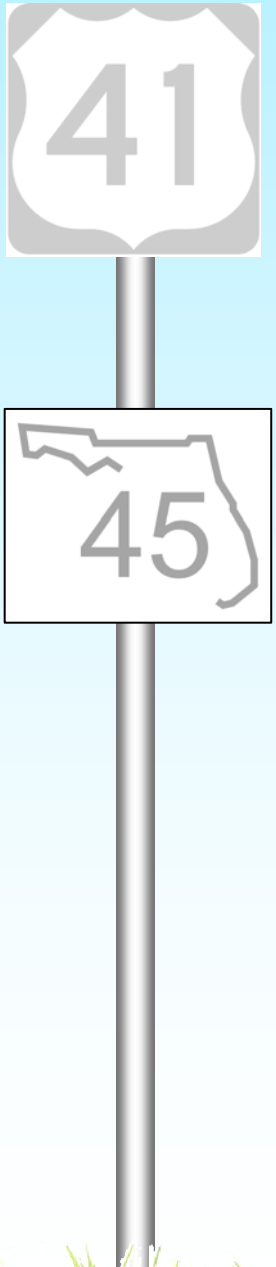

WPI Segment No: 421140 8; ETDM # 9511
Hillsborough County

Prepared for the
Florida Department of Transportation
District Seven

Prepared by
American Consulting Engineers of Florida, LLC

September 2009

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Section 1 – EXECUTIVE SUMMARY

The Florida Department of Transportation (FDOT) conducted a Project Development and Environment (PD&E) Study to evaluate alternative improvements for US 41/SR 45 from 12th Street North to Kracker Avenue in southern Hillsborough County (**Figure 2-1)**. The total project length is approximately 6.2 miles. Study objectives included the following: determine proposed typical sections and develop preliminary conceptual design plans for proposed improvements, while minimizing impacts to the environment; consider agency and public comments; and ensure project compliance with all applicable federal and state laws. Improvement alternatives were identified which will improve safety and meet future transportation demand.

In accordance with the FDOT's PD&E Manual, a Pond Sizing Analysis Memorandum was prepared for this PD&E Study. The information presented in this document is subject to change until the final Phase of the project. This Pond Sizing Analysis Memorandum is preliminary and used as an engineering tool to identify potential stormwater management and floodplain compensation site requirements to serve the conceptual improvements. The calculations presented in this report are preliminary and help in estimating the preliminary size of the pond site facilities for each basin. The size requirements are preliminary based upon many assumptions and judgments. Conceptual calculations are attached in **Appendix A**.

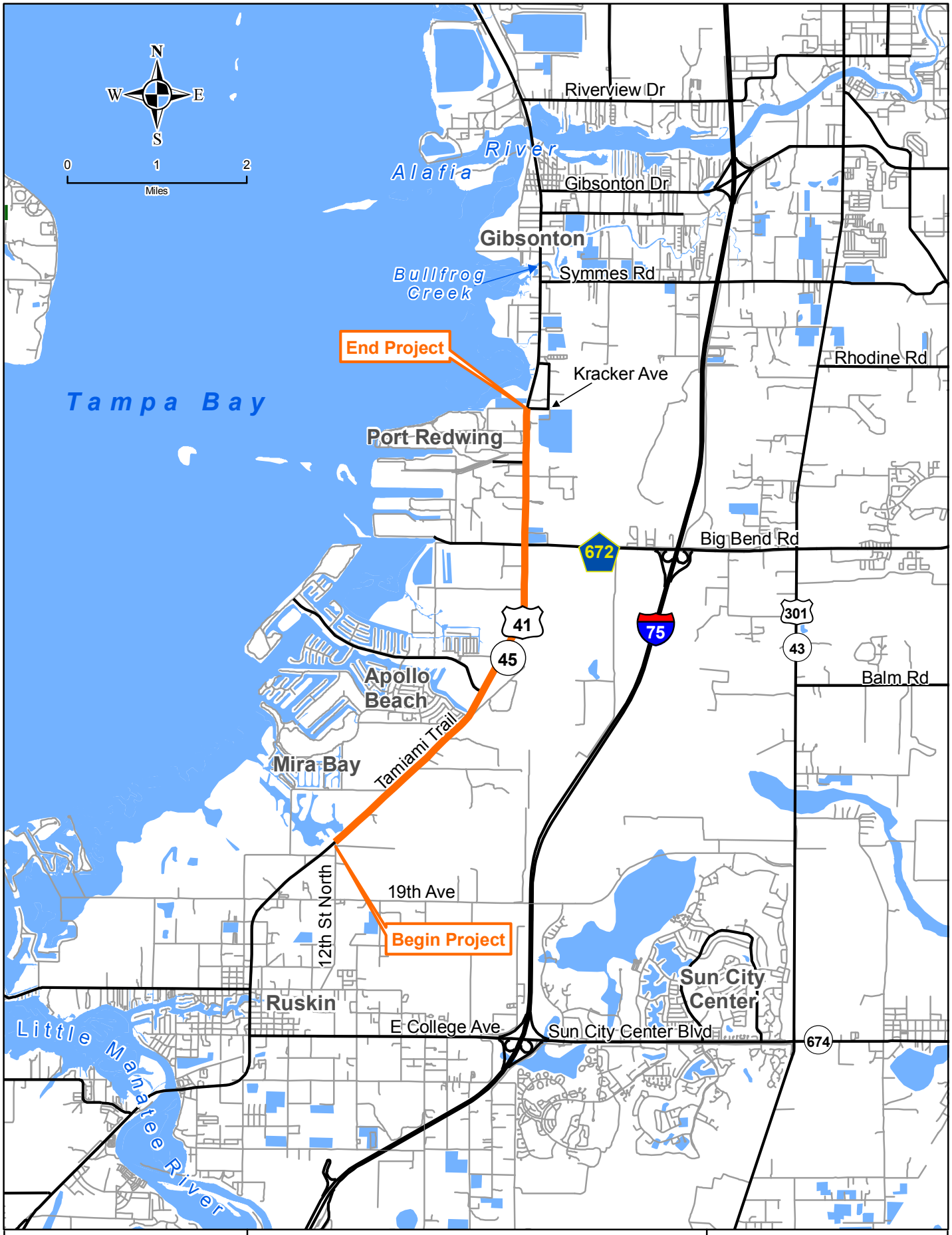
The stormwater management facilities are estimated based on the difference between the existing condition and the conceptual improvements estimated runoff volumes (non-routing method). Water quality requirements are also estimated based on both standard water quality and TMDL requirements. Facilities can be combined, where possible, to reduce the number of pond sites and realize efficiencies in maintenance and access areas. The results are summarized in **Table 3-1**.

Floodplain compensation site requirements are identified separately and are estimated based on the area of encroachment, estimated volume of encroachment, and estimated depth of compensation per area of compensation site. These are summarized in **Table 3-2**.

Section 2 – INTRODUCTION

2.1 Project Description

The Florida Department of Transportation (FDOT) conducted a Project Development and Environment (PD&E) Study to evaluate alternative improvements to US 41 (SR 45). This project involves a 6.2 mile segment of US 41 from 12th Street extending north to Kracker Avenue in Hillsborough County (**Figure 2-1**). The highway is to be improved from an existing, four-lane rural facility to an urban and suburban six-lane divided facility. There are no bridge structures located within this segment of US 41; however, bridge culvert widening or replacement is anticipated over Wildcat Creek and Newmans Branch. The proposed improvements will include construction of stormwater management facilities and various intersection improvements, in addition to bicycle and pedestrian facilities. The study area is located in Township 31, Range 19, and Sections 2, 3, 10, 11, 14, 15, 22, 27, 28, 32 and 33.



US 41 (SR 45) PD&E Study

from 12th Street to Kracker Avenue
Hillsborough County, FL
WPI Segment No. 421140-8

Project Location Map

Source: FGDL

Figure 2-1

Purpose and Need

The purpose of the proposed project is to provide a higher capacity and safer facility to better meet future transportation demand in this rapidly developing area of Hillsborough County. US 41 runs parallel to and west of I-75. US 41 is a major north-south urban principal arterial that connects numerous communities along the west coast of Florida, including Ruskin, Apollo Beach and Gibsonton. This anticipated traffic growth and existing high levels of congestion create a need to analyze the corridor for necessary improvements to ensure this facility does not continue to deteriorate resulting in unacceptable levels of service. The PD&E Study also included the consideration of a No-Build Alternative.

US 41 is functionally classified as an "urban principal arterial – other". While US 41 is not on the Strategic Intermodal System (SIS), a short (0.92 miles) segment of US 41 between Pembroke Road and Big Bend Road (CR 672) is part of a SIS connector, which connects the Port of Tampa to I-75, both of which are SIS facilities. The Strategic Intermodal System (SIS) is a statewide network of highways, railways, waterways and transportation hubs that handle the bulk of Florida's passenger and freight traffic. This project is included in the Hillsborough County Metropolitan Planning Organization's (MPO) Year 2025 Long-Range Transportation Plan (LRTP) as an unfunded need. The West Central Florida MPO Chair's Coordinating Committee (CCC) has classified US 41 as a "regional road" and as an "unfunded need" on the "regionally significant road network" in west central Florida. This corridor is also designated as an emergency evacuation route.

A longer segment of US 41 was evaluated in the Programming Screen of the Efficient Transportation Decision Making (ETDM) process (project #5180) in 2008, for a larger area along US 41 from 19th Avenue NE to Gibsonton Drive. This process established the Class of Action as a State Environmental Impact Report (SEIR).

2.2 Purpose of Report

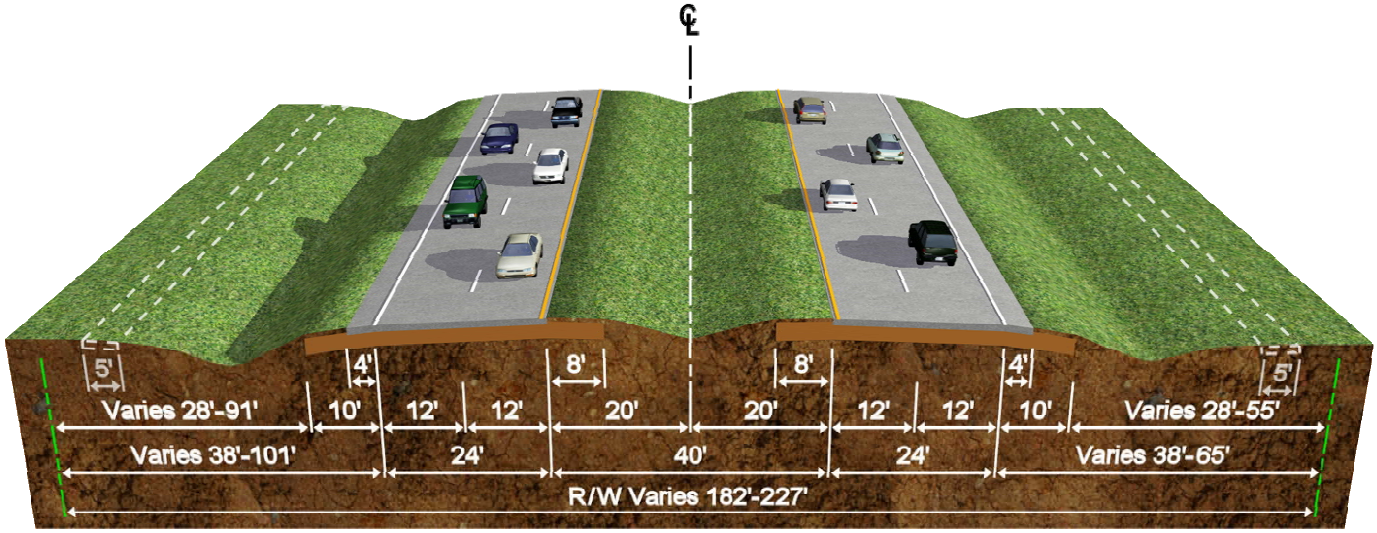
The purpose of this Pond Sizing Analysis Memorandum is preliminary and used as an engineering tool to identify potential stormwater management and floodplain compensation site requirements to serve the conceptual improvements. The calculations presented in this report are preliminary and help in estimating the preliminary size of the pond site facilities for each basin. The size requirements are preliminary based upon many assumptions and judgments. Conceptual calculations are attached in **Appendix A**.

2.3 Existing Facility and Proposed Improvements

US 41 currently has a 4-lane divided rural typical section (**Figure 2-2**). The existing roadway has 11.5 to 12.0 ft travel lanes, 4-ft paved inside and outside shoulders, and a 40-ft grassed median. The posted speed limit is 55 miles per hour (mph) except for a short segment on either side of Big Bend Road, which is posted at 45 mph. The existing right-of-way typically varies from 182 ft to 227 ft.

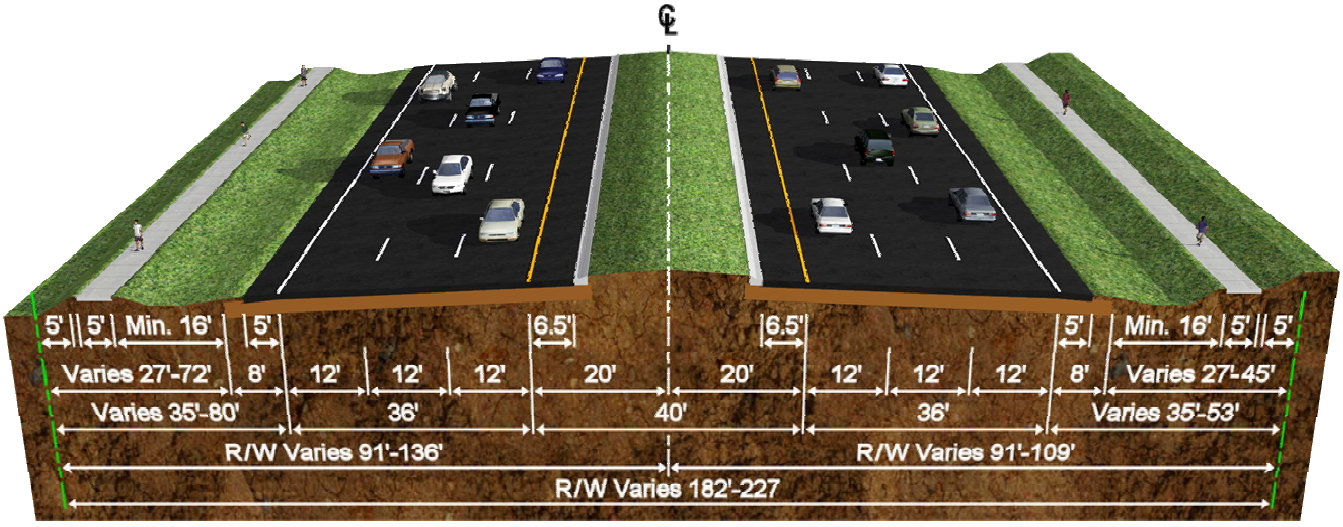
Expected improvements include widening to six lanes as well as intersection improvements and construction of stormwater management facilities and bicycle and pedestrian facilities. In addition to six basic lanes, auxiliary lanes are also proposed in the vicinity of Apollo Beach Boulevard and Big Bend Road (CR 672). Preliminary recommended roadway typical sections are shown in **Figure 2-2**. A "No-Build" Alternative will also be considered. The proposed project is not funded in FDOT's current 5-year work program.

US 41 Existing Typical Section



(Existing 5-ft sidewalks are intermittent)

US 41 Proposed Suburban Typical Section

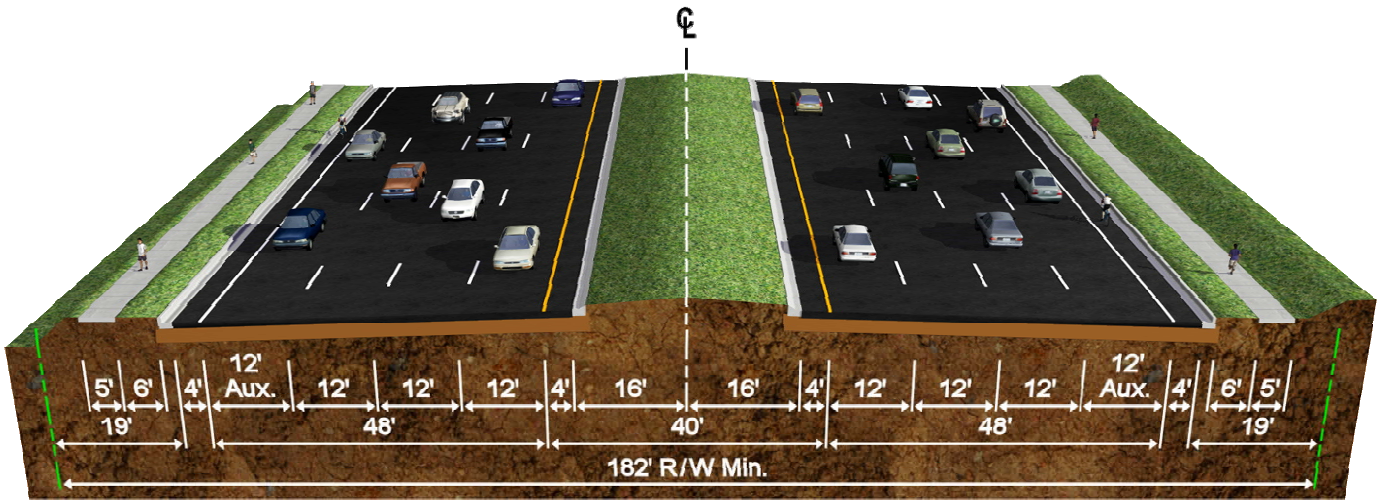


6-Lane Suburban

Design Speed = 50 MPH

Rev. 7/30/09

US 41 (SR 45) PD&E Study From 12th Street to Kracker Avenue Hillsborough County, Florida WPI Segment No. 421140-8	**US 41 Existing and Proposed Build Alternative Typical Sections**	**Figure 2-2** **Sheet 1 of 2**

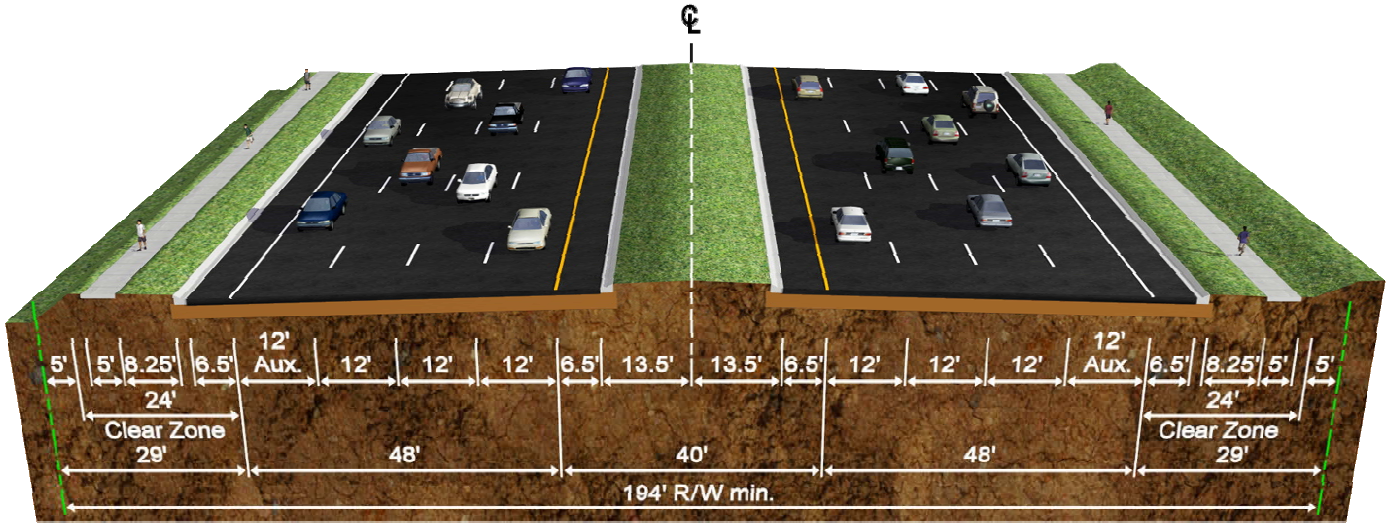


6-Lane Urban with Auxiliary Lanes*

Design Speed = 45 MPH

*This typical section applies to two segments:

1. From Flamingo Drive to approximately 1000 ft north of Apollo Beach Blvd
2. Approximately 1000 ft south of Big Bend Road to Big Bend Road



6-Lane High-Speed Urban with Auxiliary Lanes**

Design Speed = 50 MPH

**This typical section applies to US 41 from Big Bend Road to Pembroke Road, which is part of a Strategic Intermodal System (SIS) connector route which connects the Port of Tampa to I-75.

Rev. 2/27/09

US 41 (SR 45) PD&E Study From 12th Street to Kracker Avenue Hillsborough County, Florida WPI Segment No. 421140-8	**US 41 Proposed Build Alternative Typical Sections**	**Figure 2-2** **Sheet 2 of 2**

Section 3.0 – POND SIZING ANALYSIS

The information presented in this document is subject to change until the final Phase of the project. This Pond Sizing Analysis Memorandum is preliminary and used as an engineering tool to identify potential stormwater management and floodplain compensation site requirements to serve the conceptual improvements. The calculations presented in this report are preliminary and help in estimating the preliminary size of the pond site facilities for each basin. The size requirements are preliminary based upon many assumptions and judgments. Conceptual calculations are attached in **Appendix A**.

The stormwater management facilities are estimated based on the difference between the existing condition and the conceptual improvements estimated runoff volumes (non-routing method). Water quality requirements are also estimated based on both standard water quality and TMDL requirements. Facilities can be combined, where possible, to reduce the number of pond sites and realize efficiencies in maintenance and access areas. The results are summarized in **Table 3-1**.

Floodplain compensation site requirements are identified separately and are estimated based on the area of encroachment, estimated volume of encroachment, and estimated depth of compensation per area of compensation site. These are summarized in **Table 3-2**.

Table 3-1: Stormwater Management Facility Summary

Project Basin/Pond No.	Project Basin Boundaries	Wet Detention Area (ac)	Dry Retention Area (ac)	SWF Total Area (ac)
1A	Sta 162+50 to Sta 173+72	1.34	0.45	1.79
1	Sta 173+72 to Sta 188+85	1.73	0.54	2.27
2	Sta 188+85 to Sta 229+90	4.70	1.45	6.15
3	Sta 229+90 to Sta 253+02	2.65	0.82	3.47
4	Sta 253+02 to Sta 275+35	2.56	0.79	3.35
5	Sta 275+35 to Sta 321+94	5.34	1.65	6.99
6	Sta 321+94 to Sta 340+35	2.11	0.65	2.76
7	Sta 340+35 to Sta 375+35	4.01	1.25	5.26
8	Sta 375+35 to Sta 391+52	1.85	0.57	2.42
9	Sta 391+52 to Sta 402+35	1.24	0.38	1.62
10	Sta 402+35 to Sta 412+17	1.13	0.35	1.48
11	Sta 412+17 to Sta 439+95	3.18	0.98	4.16
12	Sta 439+95 to Sta 444+46	0.52	0.16	0.68
13	Sta 444+46 to Sta 458+35 (west of centerline)	0.80	0.25	1.05
14	Sta 444+46 to Sta 471+44 (east of centerline)	1.55	0.48	2.03
15	Sta 458+35 to Sta 471+44 (west of centerline)	0.75	0.23	0.98

Table 3-2: Floodplain Encroachment and Compensation Summary

Project Basin/FPC site No.	Project Basin Boundaries	Zone AE 1% annual chance flood EL (ft –NAVD 88) ①	Estimated Floodplain Encroachment Area (ac)	Estimated Floodplain Compensation (FPC) site Volume (ac-ft) ②
1A	Sta 162+50 to Sta 173+72	9.0	4.63	4.63
1	Sta 173+72 to Sta 188+85	9.0	6.32	6.32
2	Sta 188+85 to Sta 229+90	9.0	17.15	17.15
3	Sta 229+90 to Sta 253+02	9.0	6.99	6.99
4	Sta 253+02 to Sta 275+35	9.0	1.80	1.80
5	Sta 275+35 to Sta 321+94	9.0	2.43	2.43
6	Sta 321+94 to Sta 340+35	9.0	0.83	0.83
7	Sta 340+35 to Sta 375+35	10.0	0.04	0.04
8	Sta 375+35 to Sta 391+52	10.0	1.61	1.61
9	Sta 391+52 to Sta 402+35	10.0	3.09	3.09
10	Sta 402+35 to Sta 412+17	10.0	4.10	4.10
11	Sta 412+17 to Sta 439+95	10.0-11.0	11.61	11.61
12	Sta 439+95 to Sta 444+46	10.0-11.0	1.88	1.88
13	Sta 444+46 to Sta 458+35 (west of centerline)	10.0-11.0	2.90	2.90
14	Sta 444+46 to Sta 471+44 (east of centerline)	10.0-11.0	5.64	5.64
15	Sta 458+35 to Sta 471+44 (west of centerline)	10.0-11.0	2.73	2.73

① *The estimated 100-year floodplain elevations are taken from the Revised Preliminary FIRMs for Hillsborough County, panel numbers 0656H, 0493H, 0494H, 0492H and 0484H. It is anticipated that the Revised Preliminary FIRMs will supersede the Current Effective FIRMs on August 28, 2008.*

② *An estimated fill depth of 1-ft was used to determine the estimated FPC site volume*

Appendix A

Drainage Maps

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200
Feet

American
Consulting Engineers of Florida, LLC
18250 North US Highway 41
Lutz, Florida 33549
Phone: (813) 496-7400 Fax: (813) 496-7401
Certificate of Authorization No. 9302
Jeffrey S. Novotny, P.E. No. 51083

US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 1

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REGIONAL SUB BASIN - WOLF BRANCH CUTOFF CANAL

GOLF AND SEA BOULEVARD

NORTH

0 50 200
Feet

MANNS HARBOUR DRIVE

MIRABAY BOULEVARD

BARBOR BAY

Zone AE
(EL 9 FT NAVD 88)

PROJECT BASIN 2 OUTFALL
CROSS DRAIN 2
8' x 4' CBC

MATCH LINE 182+61.00

185 190 195 200 205 210

41

MATCH LINE 210+61.00

HARBOUR ISLES

SPANISH SHELL WAY

HD SOUTH SHORE

THE MARKETPLACE AT APOLLO BEACH

HAMMOCK VIEW LANE

ZONE AE
(EL 9 FT NAVD 88)

PROJECT BASIN - 1

PROJECT BASIN - 2

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 2

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REGIONAL SUB BASIN - WOLF BRANCH CUTOFF CANAL

0 50 200
Feet

NORTH

LEISEY ROAD

MYSTIC FALLS DRIVE

Zone AE
(EL 9 FT NAVD 88)

PROJECT BASIN 3 OUTFALL
CROSS DRAIN 3
10' x 5' CBC

MATCH LINE 210+61.00

215 220 15" RCP 225 230 235

41

MATCH LINE 238+61.00

Zone AE
(EL 9 FT NAVD 88)

PROJECT BASIN - 2

PROJECT BASIN - 3

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 3

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LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 4

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REGIONAL SUB BASIN DIVIDE

APOLLO BEACH CANAL

GOLF COURSE DRAIN

FROND WAY

FAUNA LANE

FRANCIS DRIVE

Zone AE
(EL 9 FT NAVD 88)

PLAZA L C FORTUNE

FORTUNE PLACE

MILLER MAC ROAD

Zone X

REX HALL LANE

FLAMINGO DRIVE

PROJECT BASIN 5 OUTFALL
CROSS DRAIN 5
54" RCP

BOYZ - N - BURGERS

NORTH

0 50 200
Feet

MATCH LINE 266+62.00

270

275

280

41

285

290

MATCH LINE 294+52.00

RUSKIN VEGETABLE CORP

6-LANE URBAM WITH
AUXILIARY LANES

REGIONAL SUB
BASIN DIVIDE

PROJECT BASIN - 4

PROJECT BASIN - 5

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
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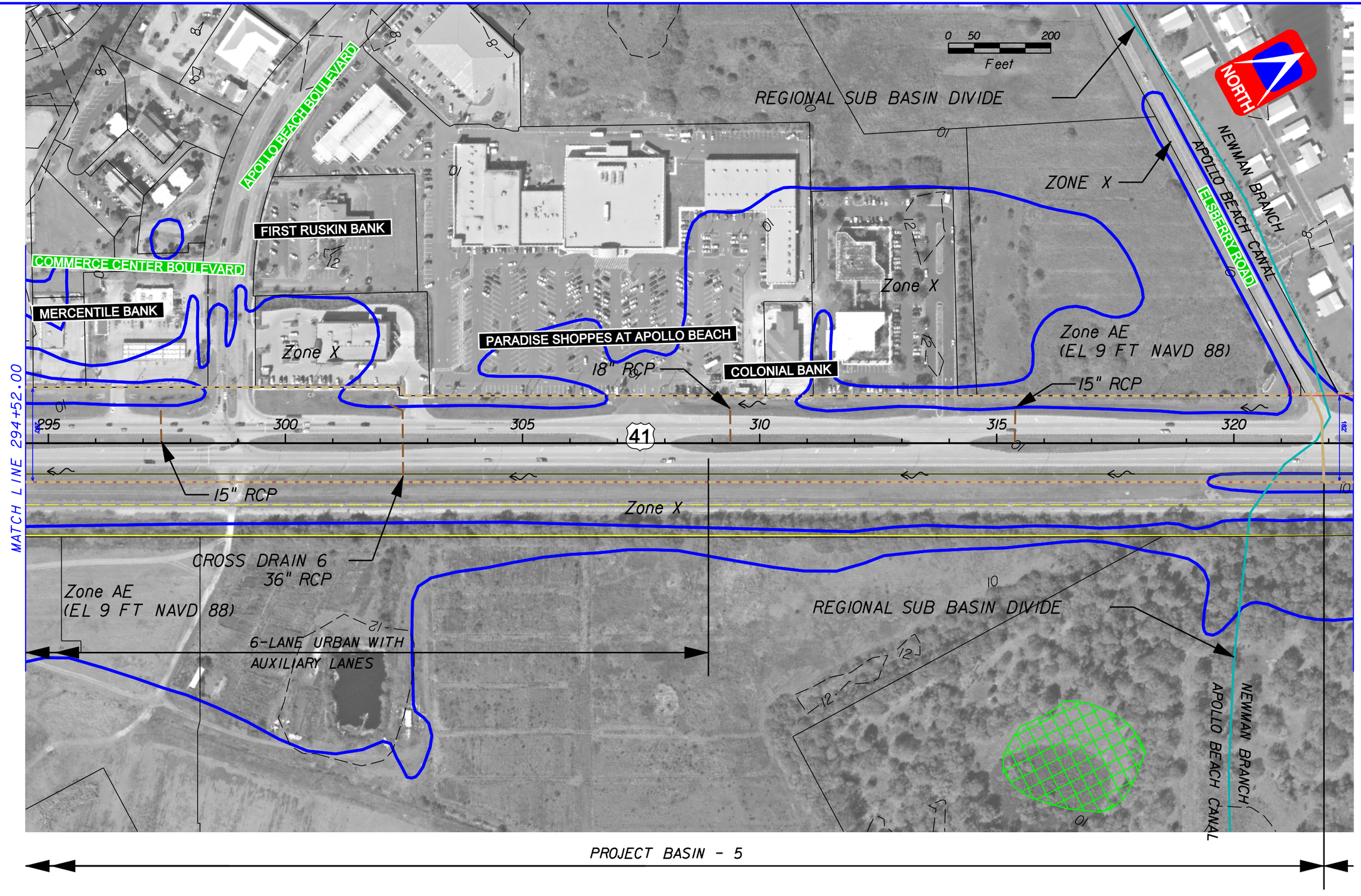

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
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- POTENTIAL POND SITE

0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

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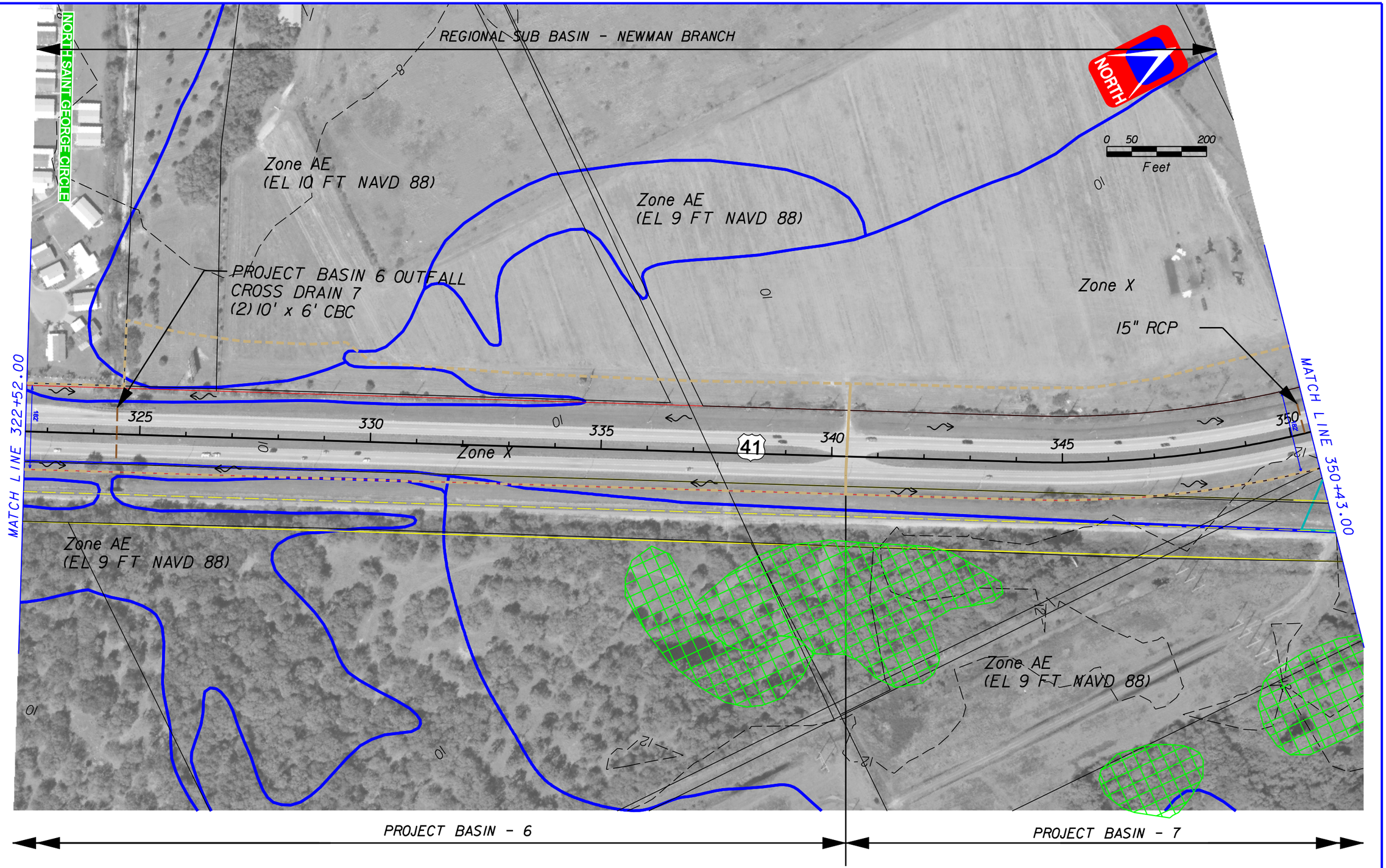

LEGEND

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0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 7

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REGIONAL SUB BASIN DIVIDE

NEWMAN BRANCH
BIG BEND BAYOU

Zone X

PROJECT BASIN 7 OUTFALL
CROSS DRAIN 9
8' x 5' CBC

CROSS DRAIN 8
36" RCP

Zone AE
(EL 10 FT NAVD 88)

15" RCP

NORTH

0 50 200
Feet

MATCH LINE 350+43.00

355 360 365 370 375

41

MATCH LINE 378+37.00

REGIONAL SUB BASIN DIVIDE

BIG BEND BAYOU
NEWMAN BRANCH

PACIFIC TOMATO GROWERS

Zone AE
(EL 9 FT NAVD 88)

Zone X

PROJECT BASIN - 7 (WEST OF CENTERLINE)

PROJECT BASIN - 8
(WEST OF CENTERLINE)

PROJECT BASIN - 7 (EAST OF CENTERLINE)

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
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0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 8

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REGIONAL SUB BASIN - BIG BEND BAYOU

NORTH

0 50 200
Feet

Zone AE
(EL 10 FT NAVD 88)

PROJECT BASIN 8 OUTFALL
CROSS DRAIN 10
10' x 4' CBC

ALLEGHANY COUNTY 672

BIG BEND ROAD

PROJECT BASIN 9 OUTFALL
CROSS DRAIN 11
34" x 53" ERCP

18" RCP

MATCH LINE 378+37.00

380 385 390 41 395 400 405

MATCH LINE 406+37.00

Zone X

6-LANE URBAN WITH
AUXILIARY LANES

Zone X

Zone X

Zone AE
(EL 10
NAVD 88)

6-LANE HIGH-SPEED URBAN
WITH AUXILIARY LANES

Zone X

Zone AE
(EL 10 FT
NAVD 88)

PROJECT BASIN - 8 (EAST OF CENTERLINE)

PROJECT BASIN - 8 (WEST OF CENTERLINE)

PROJECT BASIN - 9

PROJECT BASIN - 10

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
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0 50 200
Feet

American
Consulting Engineers of Florida, LLC
18250 North US Highway 41
Lutz, Florida 33549
Phone: (813) 496-7400 Fax: (813) 496-7401
Certificate of Authorization No. 9302
Jeffrey S. Novotny, P.E. No. 51083

US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 9

USER: 5ryanm 1/27/2009 f:\project\507904\421140822201\roadway\PLANRDII.dgn

REGIONAL SUB BASIN - BIG BEND BAYOU

TAMPA ELECTRIC CO

NORTH

0 50 200

Feet

Zone AE
(EL 10 FT NAVD 88)

PROJECT BASIN 11 OUTFALL

PROJECT BASIN 10 OUTFALL
CROSS DRAIN 12
36" RCP

15" RCP

CROSS DRAIN 13
36" RCP

Zone AE
(EL 11 FT NAVD 88)

MATCH LINE 406+37.00

MATCH LINE 434+37.00

410 415 420 41 425 430

6-LANE HIGH-SPEED URBAN
WITH AUXILIARY LANES

POWELL ROAD

Zone AE
(EL 10 FT NAVD 88)

PROJECT BASIN - 10

PROJECT BASIN - 11

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200

Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 10

USER: 5ryanm 1/27/2009 f:\project\507904\421140822201\roadway\PLANRD12.dgn

NORTH

0 50 200
Feet

REGIONAL SUB BASIN DIVIDE

Zone AE
(EL 11 FT NAVD 88)

Zone AE
(EL 10 FT NAVD 88)

PEMBROKE ROAD

ADAMSVILLE ROAD

BIG BEND BAYOU

DIRECT RUNOFF TO BAY

PROJECT BASIN 13 OUTFALL
15" RCP

PROJECT BASIN 12 OUTFALL
CROSS DRAIN 14
(2) 10' x 4' CBC

15" RCP

15" RCP

MATCH LINE 434+37.00

MATCH LINE 462+37.00

435 440 445 450 41 455 460

Zone AE
(EL 10 FT NAVD 88)

BIG BEND BAYOU
KITCHEN BRANCH

REGIONAL SUB
BASIN DIVIDE

6-LANE HIGH-SPEED URBAN
WITH AUXILIARY LANES

PROJECT BASIN - 13 (WEST OF CENTERLINE)

PROJECT BASIN - 15
(WEST OF CENTERLINE)

PROJECT BASIN - 11

PROJECT BASIN - 12

PROJECT BASIN - 14 (EAST OF CENTERLINE)

LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200
Feet

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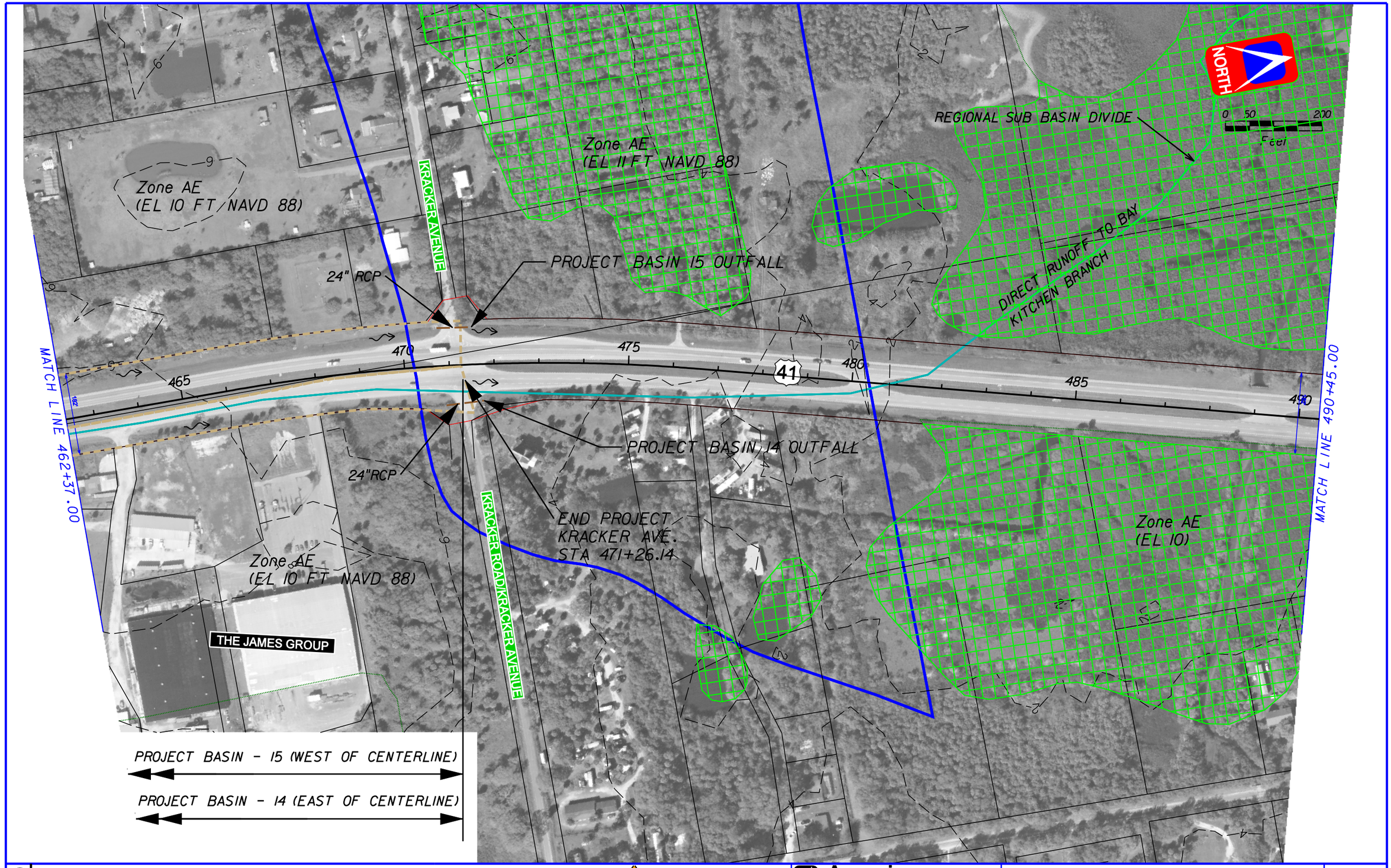
US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 11

USER: 5ryanm 1/27/2009 f:\project\507904\421408220\roadway\PLANRDI3.dgn



LEGEND

- PUBLIC MANAGED LANDS
- PROPOSED ROADWAY
- FEMA 100 YEAR FLOOD PLAIN
- WETLAND OR OTHER SURFACE WATERS BOUNDARY (NWI GIS)
- DRAINAGE BASIN DIVIDE
- EXISTING & PROPOSED ROW
- PROPERTY LINES (HILLSBOROUGH COUNTY GIS)
- RCP CULVERT
- RUNOFF FLOW DIRECTION
- POTENTIALLY CONTAMINATED SITE
- POTENTIAL POND SITE

0 50 200
Feet

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US 41 (SR 45) PD&E STUDY
DRAINAGE MAP

FPID 421140-8-22-01

SHEET NO. 12

USER: 5ryanm 1/27/2009 f:\project\507904\421140822\01\roadway\PLANRD14.dgn

Appendix B

Drainage Calculations

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Project Basin 1A

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Begin Station $Sta1 := 16250ft$ End Station $Sta2 := 17372ft$

$Length := Sta2 - Sta1$ $Length = 1122\,ft$ $Row\_width := 182ft$

$Additional\_Area := 0.38acre$ $Additional\_Area = 0.38 \cdot acre$

$Row\_area := Length \cdot Row\_width + Additional\_Area$ $Row\_area = 5.07 \cdot acre$

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 1.59 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 3.48 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 3.67 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 1.39 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 2.09 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

Minimum Elevations:

Roads $Elev_{pvmt} := 8 \cdot ft$

Pervious Areas: $Elev_{prv} := 5 \cdot ft$

Water table data based on soil data and topographic information, approximate only $Depth := 1ft$

Wet Season Water Table: $SHW := Elev_{prv} - Depth$ $SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area}$$ $CN_e = 85.6$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area}$$ $CN_p = 93.05$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.68\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.2\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 4.31\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.26\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 3.07\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.75\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.15\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 4.71\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.16\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 3.45\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.40\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.38\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.42 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 1.00 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 1.34 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 1.34 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 85.64$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.266 - \frac{(.266 - .182)}{(90 - 85)} \cdot (90 - CN_e)$ $CA_e = 0.19$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 4.19\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 8.48 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 1.14 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 93.05$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 17.90\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 36.21 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 4.86 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 76.6 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 76.6 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 4.42 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond $\quad Input := QA_p \quad Input = 17.90\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input} \quad Rt = 90.15 \cdot day$

Proposed Removal Efficiency

$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \quad PRN = 41.7 \cdot \%$ NG

$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \quad PRP = 73.1 \cdot \%$ NG

Required additional TMDL treatment

$Eff1 := 59.83\%$

$Eff2_N := PRN \quad Eff2_P := PRP$

$NRe = 76.59 \cdot \% \quad PRe = 76.59 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N \quad Train_N = 76.59 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P \quad Train_P = 89.21 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$Eff1_{depth} := 1.00in - \frac{1.00in - 0.75in}{65.6\% - 55.7\%} \cdot (65.6\% - Eff1) \quad Eff1_{depth} = 0.85 \cdot in$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth} \quad Dry_{vol} = 0.36 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft \quad Weir_{dry} := Elev_{pvmt} - 2ft$

$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \quad Area_{dry} = 0.45 \cdot acre$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry} \quad SWMF = 1.79 \cdot acre$

Project Basin 1

Begin Station $Sta1 := 17372ft$ End Station $Sta2 := 18885ft$

$Length := Sta2 - Sta1$ $Length = 1513\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 6.32 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 2.14 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 4.18 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 4.95 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 1.37 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 2.81 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 5.4\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 3.85\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 5.94\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 4.37\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.54\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.51\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.53 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 1.35 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 1.73 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 1.73 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 5.44\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 11.00 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 1.48 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 22.33\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 45.17 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 6.06 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 5.72 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond $\quad Input := QA_p \quad Input = 22.33\,ft\cdot\frac{acre}{yr}$

$Rt := \frac{Pool}{Input} \quad Rt = 93.58\cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75\cdot\frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)}\cdot\frac{1}{100} \qquad PRN = 41.8\cdot\% \quad NG$$

$$PRP := \frac{1}{100}\cdot\left[40.13 + 6.372\cdot\ln\left(\frac{Rt}{day}\right) + 0.213\cdot\left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4\cdot\% \quad NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$ $\quad Eff2_N := PRN \quad Eff2_P := PRP$

$NRe = 75.66\cdot\% \quad PRe = 75.66\cdot\%$

Treatment train efficiency $\quad Train_N := Eff1 + (1 - Eff1)Eff2_N \quad Train_N = 75.67\cdot\%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P \quad Train_P = 88.90\cdot\%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1)\cdot\frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81\cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area\cdot Eff1_{depth} \quad Dry_{vol} = 0.43\cdot acre\cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft \quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}}\cdot 1.25 \qquad Area_{dry} = 0.54\cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry} \quad SWMF = 2.27\cdot acre$

Project Basin 2

Begin Station $Sta1 := 18885ft$ End Station $Sta2 := 22990ft$

$Length := Sta2 - Sta1$ $Length = 4105\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 17.15 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 5.81 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 11.35 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 13.44 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 3.71 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 7.63 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 14.66\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 10.46\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 16.12\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 11.85\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 1.46\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 1.39\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 1.43 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 3.65 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 4.70 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 4.70 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 14.75\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading	$NA_e := TNhwy \cdot QA_e$	$NA_e = 29.83 \cdot \frac{kg}{yr}$
Posphorus loading	$PA_e := TPhwy \cdot QA_e$	$PA_e = 4.00 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 60.58\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading	$NA_p := TNhwy \cdot QA_p$	$NA_p = 122.55 \cdot \frac{kg}{yr}$
Phosphorus loading	$PA_p := TPhwy \cdot QA_p$	$PA_p = 16.44 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 15.52 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 60.58\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 1.16 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 1.45 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 6.16 \cdot acre$

Project Basin 3

Begin Station $Sta1 := 22990ft$ End Station $Sta2 := 25302ft$

$Length := Sta2 - Sta1$ $Length = 2312\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 9.66 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
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Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 3.27 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 6.39 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 7.57 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 2.09 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 4.30 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 8.26\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 5.89\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 9.08\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 6.67\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.82\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.78\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.80 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 2.06 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 2.65 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 2.65 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 8.31\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 16.80 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 2.25 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 34.12\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 69.02 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 9.26 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 8.74 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 34.12\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%$$ NG

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%$$ NG

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.65 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.82 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 3.47 \cdot acre$

Project Basin 4

Begin Station $Sta1 := 25302ft$ End Station $Sta2 := 27535ft$

$Length := Sta2 - Sta1$ $Length = 2233\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 9.33 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 3.16 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 6.17 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 7.31 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 2.02 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 4.15 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 7.98\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 5.69\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 8.77\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 6.44\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.79\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.76\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.78 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 1.99 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 2.56 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 2.56 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 8.02\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 16.23 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 2.18 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 32.95\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 66.66 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 8.94 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 8.44 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond $\quad Input := QA_p \quad Input = 32.95\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input} \quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%$$ NG

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%$$ NG

Required additional TMDL treatment

$Eff1 := 58.2\%$ $\quad Eff2_N := PRN \quad Eff2_P := PRP$

$NRe = 75.66 \cdot \% \quad PRe = 75.66 \cdot \%$

Treatment train efficiency $\quad Train_N := Eff1 + (1 - Eff1)Eff2_N \quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P \quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth} \quad Dry_{vol} = 0.63 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft \quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.79 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry} \quad SWMF = 3.35 \cdot acre$

Project Basin 5

Begin Station $Sta1 := 27535ft$ End Station $Sta2 := 32194ft$

$Length := Sta2 - Sta1$ $Length = 4659\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 19.47 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 6.59 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 12.88 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 15.25 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 4.21 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 8.66 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 16.64\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 11.87\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 18.3\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 13.45\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 1.66\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 1.58\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 1.62 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 4.14 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 5.34 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 5.34 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 16.74\ ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 33.86 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 4.54 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 68.75\ ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 139.08 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 18.66 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\ ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 17.62 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond $\quad Input := QA_p \quad Input = 68.75\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input} \quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$ $\quad Eff2_N := PRN \quad Eff2_P := PRP$

$NRe = 75.66 \cdot \% \quad PRe = 75.66 \cdot \%$

Treatment train efficiency $\quad Train_N := Eff1 + (1 - Eff1)Eff2_N \quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P \quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth} \quad Dry_{vol} = 1.32 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft \quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 1.65 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry} \quad SWMF = 6.99 \cdot acre$

Project Basin 6

Begin Station $Sta1 := 32194ft$ End Station $Sta2 := 34035ft$

$Length := Sta2 - Sta1$ $Length = 1841\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 7.69 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 2.60 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 5.09 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 6.03 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 1.67 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 3.42 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area}$$ $CN_e = 86.1$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area}$$ $CN_p = 94.1$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 6.58\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 4.69\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 7.23\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 5.31\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.65\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.62\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.64 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 1.64 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 2.11 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 2.11 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 6.61\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 13.38 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 1.79 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 27.17\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 54.96 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 7.37 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 6.96 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond $\quad Input := QA_p \quad Input = 27.17\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input} \quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%$$ NG

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%$$ NG

Required additional TMDL treatment

$Eff1 := 58.2\%$ $\quad Eff2_N := PRN \quad Eff2_P := PRP$

$NRe = 75.66 \cdot \% \quad PRe = 75.66 \cdot \%$

Treatment train efficiency $\quad Train_N := Eff1 + (1 - Eff1)Eff2_N \quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P \quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth} \quad Dry_{vol} = 0.52 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft \quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.65 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry} \quad SWMF = 2.76 \cdot acre$

Project Basin 7

Begin Station $Sta1 := 34035ft$ End Station $Sta2 := 37535ft$

$Length := Sta2 - Sta1$ $Length = 3500\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 14.62 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 4.95 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 9.67 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 11.46 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 3.17 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 6.51 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area}$$ $CN_e = 86.1$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area}$$ $CN_p = 94.1$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 12.5\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 8.91\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 13.75\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 10.1\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 1.25\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 1.19\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 1.22 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 3.11 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 4.01 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 4.01 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 12.57\ ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading	$NA_e := TNhwy \cdot QA_e$	$NA_e = 25.44 \cdot \frac{kg}{yr}$
Posphorus loading	$PA_e := TPhwy \cdot QA_e$	$PA_e = 3.41 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 51.65\ ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading	$NA_p := TNhwy \cdot QA_p$	$NA_p = 104.49 \cdot \frac{kg}{yr}$
Phosphorus loading	$PA_p := TPhwy \cdot QA_p$	$PA_p = 14.02 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\ ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 13.23 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond $\quad Input := QA_p \quad Input = 51.65\,ft\cdot\frac{acre}{yr}$

$Rt := \frac{Pool}{Input} \quad Rt = 93.58\cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75\cdot\frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)}\cdot\frac{1}{100} \qquad PRN = 41.8\cdot\% \quad NG$$

$$PRP := \frac{1}{100}\cdot\left[40.13 + 6.372\cdot\ln\left(\frac{Rt}{day}\right) + 0.213\cdot\left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4\cdot\% \quad NG$$

Required additional TMDL treatment

$Eff1 := 58.4\%$ $\quad Eff2_N := PRN \quad Eff2_P := PRP$

$NRe = 75.66\cdot\% \quad PRe = 75.66\cdot\%$

Treatment train efficiency $\quad Train_N := Eff1 + (1 - Eff1)Eff2_N \quad Train_N = 75.79\cdot\%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P \quad Train_P = 88.95\cdot\%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1)\cdot\frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.82\cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area\cdot Eff1_{depth} \quad Dry_{vol} = 1.00\cdot acre\cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft \quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}}\cdot 1.25 \qquad Area_{dry} = 1.25\cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry} \quad SWMF = 5.26\cdot acre$

Project Basin 8

Begin Station $Sta1 := 37535ft$ End Station $Sta2 := 39152ft$

$Length := Sta2 - Sta1$ $Length = 1617\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 6.76 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc. $Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 2.29 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 4.47 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 5.29 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 1.46 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 3.01 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area}$$ $CN_e = 86.1$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area}$$ $CN_p = 94.1$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 5.78\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 4.12\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 6.35\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 4.67\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.58\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.55\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.56 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 1.44 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 1.85 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 1.85 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 5.81\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading	$NA_e := TNhwy \cdot QA_e$	$NA_e = 11.75 \cdot \frac{kg}{yr}$
Posphorus loading	$PA_e := TPhwy \cdot QA_e$	$PA_e = 1.58 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 23.86\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading	$NA_p := TNhwy \cdot QA_p$	$NA_p = 48.27 \cdot \frac{kg}{yr}$
Phosphorus loading	$PA_p := TPhwy \cdot QA_p$	$PA_p = 6.48 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 6.11 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 23.86\,ft\cdot\frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58\cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75\cdot\frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)}\cdot\frac{1}{100} \qquad PRN = 41.8\cdot\%\quad NG$$

$$PRP := \frac{1}{100}\cdot\left[40.13 + 6.372\cdot\ln\left(\frac{Rt}{day}\right) + 0.213\cdot\left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4\cdot\%\quad NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66\cdot\%$ $\quad PRe = 75.66\cdot\%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67\cdot\%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90\cdot\%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1)\cdot\frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81\cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area\cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.46\cdot acre\cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}}\cdot 1.25 \qquad Area_{dry} = 0.57\cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 2.42\cdot acre$

Project Basin 9

Begin Station $Sta1 := 39152ft$ End Station $Sta2 := 40235ft$

$Length := Sta2 - Sta1$ $Length = 1083\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 4.52 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc.

$Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 1.53 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 2.99 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 3.55 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 0.98 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 2.01 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 3.87\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 2.76\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 4.25\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 3.13\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.39\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.37\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.38 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 0.96 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 1.24 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 1.24 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 3.89\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 7.87 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 1.06 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 15.98\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 32.33 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 4.34 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 4.09 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 15.98\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.31 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.38 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 1.62 \cdot acre$

Project Basin 10

Begin Station $Sta1 := 40235ft$ End Station $Sta2 := 41217ft$

$Length := Sta2 - Sta1$ $Length = 982\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 4.10 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc.

$Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 1.39 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 2.71 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 3.21 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 0.89 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 1.83 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$

Water table data based on soil data and topographic information, approximate only

$Depth := 1ft$

Wet Season Water Table: $SHW := Elev_{prv} - Depth$ $SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area}$$ $CN_e = 86.1$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area}$$ $CN_p = 94.1$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm e $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 3.51\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 2.5\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 3.86\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 2.83\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.35\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.33\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.34 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 0.87 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 1.13 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 1.13 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 3.53\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 7.14 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 0.96 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 14.49\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 29.32 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 3.93 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 3.71 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $Input = 14.49\,ft\cdot\frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $Rt = 93.58\cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75\cdot\frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)}\cdot\frac{1}{100} \qquad PRN = 41.8\cdot\%\quad NG$$

$$PRP := \frac{1}{100}\cdot\left[40.13 + 6.372\cdot\ln\left(\frac{Rt}{day}\right) + 0.213\cdot\left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4\cdot\%\quad NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $Eff2_P := PRP$

$NRe = 75.66\cdot\%$ $PRe = 75.66\cdot\%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $Train_N = 75.67\cdot\%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $Train_P = 88.90\cdot\%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1)\cdot\frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81\cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area\cdot Eff1_{depth}$ $Dry_{vol} = 0.28\cdot acre\cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}}\cdot 1.25 \qquad Area_{dry} = 0.35\cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $SWMF = 1.47\cdot acre$

Project Basin 11

Begin Station $Sta1 := 41217ft$ End Station $Sta2 := 43995ft$

$Length := Sta2 - Sta1$ $Length = 2778\,ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 11.61 \cdot acre$

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc.

$Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 3.93 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 7.68 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 9.09 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 2.51 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 5.17 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm e $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 9.92\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 7.08\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 10.91\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 8.02\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.99\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.94\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.97 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 2.47 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 3.18 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 3.18 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 9.98\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 20.19 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 2.71 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 41.00\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 82.93 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 11.12 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 10.50 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 41.00\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.79 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.98 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 4.17 \cdot acre$

Project Basin 12

Begin Station $Sta1 := 43995ft$ End Station $Sta2 := 44446ft$

$Length := Sta2 - Sta1$ $Length = 451\ ft$ $Row\_width := 182ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 1.88 \cdot acre$

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc.

$Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 56ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 0.64 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 1.25 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 124ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 1.48 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 0.41 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 0.84 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\ ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 1.61\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 1.15\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 1.77\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 1.3\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.16\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.15\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.16 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 0.40 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 0.52 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 0.52 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 1.62\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 3.28 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 0.44 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 6.66\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 13.46 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 1.81 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 1.71 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 6.66\,ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.13 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.16 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 0.68 \cdot acre$

Project Basin 13

Begin Station $Sta1 := 44446ft$ End Station $Sta2 := 45835ft$

$Length := Sta2 - Sta1$ $Length = 1389\,ft$ $Row\_width := 91ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 2.90 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc.

$Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 28ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 0.98 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 1.92 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 62ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 2.27 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 0.63 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 1.29 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area} \qquad CN_e = 86.1$$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area} \qquad CN_p = 94.1$$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm event $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 2.48\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 1.77\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 2.73\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 2\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.25\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.24\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.24 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 0.62 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 0.80 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 0.80 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 2.50\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 5.05 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 0.68 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 10.25\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 20.73 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 2.78 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 2.63 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 10.25\,ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.20 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.25 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 1.04 \cdot acre$

Project Basin 14

Begin Station $Sta1 := 44446ft$ End Station $Sta2 := 47144ft$

$Length := Sta2 - Sta1$ $Length = 2698\,ft$ $Row\_width := 91ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 5.64 \cdot acre$

American Consulting Engineers of Florida, LLC

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc.

$Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 28ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 1.91 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 3.73 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 62ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 4.42 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 1.22 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 2.51 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$

Water table data based on soil data and topographic information, approximate only

$Depth := 1ft$

Wet Season Water Table: $SHW := Elev_{prv} - Depth$ $SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area}$$ $CN_e = 86.1$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area}$$ $CN_p = 94.1$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm e $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 4.82\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 3.44\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 5.3\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 3.89\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.48\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.46\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.47 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 1.20 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 1.55 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 1.55 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 4.85\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 9.80 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 1.32 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 19.91\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 40.27 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 5.40 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool

SWFWMD requirement is 35% littoral zone at 2 ft depth

Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 5.10 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 19.91\ ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.38 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.48 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 2.02 \cdot acre$

Project Basin 15

Begin Station $Sta1 := 45835ft$ End Station $Sta2 := 47144ft$

$Length := Sta2 - Sta1$ $Length = 1309\,ft$ $Row\_width := 91ft$

$Row\_area := Length \cdot Row\_width$ $Row\_area = 2.73 \cdot acre$

Project: **US 41 (SR 45) PD&E**
FPID No. 421140-8-22-01
Hillsborough County
Project No.: **5079041**

Land use break down

Increase impervious areas by percentage for intersections, etc.

$Exist\_inc := 10\%$ $Prop\_inc := 15\%$

Existing areas

$Exist\_imp := Length \cdot 28ft \cdot (1 + Exist\_inc)$ $Exist\_imp = 0.93 \cdot acre$

$Exist\_per := Row\_area - Exist\_imp$ $Exist\_per = 1.81 \cdot acre$

Proposed areas

$Prop\_imp := Length \cdot 62ft \cdot (1 + Prop\_inc)$ $Prop\_imp = 2.14 \cdot acre$

$Prop\_per := Row\_area - Prop\_imp$ $Prop\_per = 0.59 \cdot acre$

$Additional\_imp := Prop\_imp - Exist\_imp$ $Additional\_imp = 1.22 \cdot acre$

Elevation data from SWFWMD topographic information (adjusted to NAVD 88), approximate only

	Minimum Elevations:	**Maximum Elevations:**
Roads	$Elev_{pvmt} := 8 \cdot ft$	$Elev_{pvmt2} := 9 \cdot ft$
Pervious Areas:	$Elev_{prv} := 5 \cdot ft$	$Elev_{prv2} := 9 \cdot ft$
Water table data based on soil data and topographic information, approximate only		$Depth := 1ft$
Wet Season Water Table:	$SHW := Elev_{prv} - Depth$	$SHW = 4.00\,ft$

SCS Curve Numbers:

Soil types within basin limits:

$CN_{BD} := 80$

$CN_{pavt} := 98$

Existing curve number calculation

$$CN_e := \frac{Exist\_imp \cdot CN_{pavt} + Exist\_per \cdot CN_{BD}}{Row\_area}$$ $CN_e = 86.1$

Proposed curve number calculation

$$CN_p := \frac{Prop\_imp \cdot CN_{pavt} + Prop\_per \cdot CN_{BD}}{Row\_area}$$ $CN_p = 94.1$

14-86 Design rainfall depth (non-routing method) is the 100 yr 24 hr storm e $P_{100yr} := 12in$

SWFWMD design rainfall depth is the 25 yr 24 hr storm event $P_{25yr} := 9in$

Existing runoff volume calculation

Soil Storage $S_e := \left(\frac{1000}{CN_e} - 10\right)\cdot in$ $S_e = 1.62\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{e100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_e\right)}$ $Q_{e100} = 10.26\cdot in$

Runoff Volume (100-Year,Vf) $V_{e100} := Q_{e100}\cdot Row\_area$ $V_{e100} = 2.34\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{e25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_e\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_e\right)}$ $Q_{e25} = 7.32\cdot in$

Runoff Volume (25-Year,Vf) $V_{e25} := Q_{e25}\cdot Row\_area$ $V_{e25} = 1.67\cdot acre\cdot ft$

Proposed runoff volume calculation

Soil Storage $S_p := \left(\frac{1000}{CN_p} - 10\right)\cdot in$ $S_p = 0.63\cdot in$

100 year 24 hour runoff volume

Runoff in Inches (100-Year, Qf) $Q_{p100} := \frac{\left[P_{100yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{100yr} + \left(0.8\cdot S_p\right)}$ $Q_{p100} = 11.28\cdot in$

Runoff Volume (100-Year,Vf) $V_{p100} := Q_{p100}\cdot Row\_area$ $V_{p100} = 2.57\cdot acre\cdot ft$

25 year 24 hour runoff volume

Runoff in Inches (25-Year, Qf) $Q_{p25} := \frac{\left[P_{25yr} - \left(0.2\cdot S_p\right)\right]^2}{P_{25yr} + \left(0.8\cdot S_p\right)}$ $Q_{p25} = 8.29\cdot in$

Runoff Volume (25-Year,Vf) $V_{p25} := Q_{p25}\cdot Row\_area$ $V_{p25} = 1.89\cdot acre\cdot ft$

Required attentuation storage volume calculation

$Att_{req100} := V_{p100} - V_{e100}$ $Att_{req100} = 0.23\cdot acre\cdot ft$

$Att_{req25} := V_{p25} - V_{e25}$ $Att_{req25} = 0.22\cdot acre\cdot ft$

Water Quality Volume Calculations

Required Treatment Volume depth $TV_{depth} := 1in$

Required Treatment Volume for system, (Vwq) $Vwq := TV_{depth} \cdot Row\_area$ $Vwq = 0.23 \cdot acre \cdot ft$

Preliminary Pond Sizing

Preliminary pond size is based on greater of difference in 100yr 24 hr runoff volume and stacked water quality volume and 25 year runoff difference

The maximum weir elevation is set at 2.5 ft below the minimum roadway elevaiton, the area of the required pond is based on the volume available between the SHW and the weir invert after the depth of rainfall on the pond

$Weir_{inv} := Elev_{pvmt} - 2.5ft$ $Weir_{inv} = 5.50\ ft$

$Depth_{available} := Weir_{inv} - SHW$ $Depth_{available} = 1.50\ ft$

Pond surface area for 100 year required attenuation

$$Pond_{area100} := \frac{Att_{req100}}{Depth_{available} - P_{100yr}} \cdot 1.25 \qquad Pond_{area100} = 0.58 \cdot acre$$

Pond surface area for 25 year required attenuation

$$Pond_{area25} := \frac{Att_{req25} + Vwq}{\left(Depth_{available} - P_{25yr}\right)} \cdot 1.25 \qquad Pond_{area25} = 0.75 \cdot acre$$

$$Pond_{area} := \begin{cases} val \leftarrow Pond_{area100} \\ Pond_{area25} \text{ if } val < Pond_{area25} \\ val \text{ otherwise} \end{cases}$$

$Pond_{area} = 0.75 \cdot acre$

Nutrient loading analysis

Annual Precipitation Depth $AP := 51.50 \frac{in}{yr}$

Annual Mass Loading for Highway Areas

$TNhwy := 1.64 \cdot \frac{mg}{l}$ $TPhwy := 0.220 \cdot \frac{mg}{l}$

Annual C values

Meteorological Zone 4

curve number calculations, calculates a curve number for a general non-DCIA land use for determination of an annual runoff coefficient from DEP table in stormwater quality applicant's handbook, appendix C zone 4, will differ from CN used in ICPR routing

Existing loading calculation

Existing roadway DCIA = 0% $CN_e = 86.09$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_e := 0.182 - \frac{(.182 - .266)}{(85 - 90)} \cdot (85 - CN_e)$ $CA_e = 0.20$

Existing annual runoff $QA_e := CA_e \cdot AP \cdot Row\_area$ $QA_e = 2.35\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_e := TNhwy \cdot QA_e$ $NA_e = 4.76 \cdot \frac{kg}{yr}$

Posphorus loading $PA_e := TPhwy \cdot QA_e$ $PA_e = 0.64 \cdot \frac{kg}{yr}$

Proposed loading calculation

Proposed roadway DCIA = 100% $CN_p = 94.10$

From Appendix C, FDEP Stormwater Quality Handbook

Annual curve number $CA_p := 0.823$

Existing annual runoff $QA_p := CA_p \cdot AP \cdot Row\_area$ $QA_p = 9.66\,ft \cdot \frac{acre}{yr}$

Existing annual loading

Nitrogen loading $NA_p := TNhwy \cdot QA_p$ $NA_p = 19.54 \cdot \frac{kg}{yr}$

Phosphorus loading $PA_p := TPhwy \cdot QA_p$ $PA_p = 2.62 \cdot \frac{kg}{yr}$

Required removal efficiency calculations

Required N removal efficiency $NRe := 1 - \frac{NA_e}{NA_p}$ $NRe = 75.7 \cdot \%$

Required P removal efficiency $PRe := 1 - \frac{PA_e}{PA_p}$ $PRe = 75.7 \cdot \%$

Esimated wet pond properties (based on previous sizing calcualtions)

Wet pond permanent pool properties
SWFWMD requirement is 35% littoral zone at 2 ft depth
Permanent pool depth is 65% of pond area

$Pool_{depth} := 4ft$

$Ave\_depth := Pool_{depth} \cdot 65\% + 2ft \cdot 35\%$ $Ave\_depth = 3.30\,ft$

$Pool := Pond_{area} \cdot Ave\_depth$ $Pool = 2.47 \cdot acre \cdot ft$

Proposed Residence Time

Annual input to pond

$Input := QA_p$ $\quad Input = 9.66\,ft \cdot \frac{acre}{yr}$

$Rt := \frac{Pool}{Input}$ $\quad Rt = 93.58 \cdot day$

Proposed Removal Efficiency

$$PRN := \frac{43.75 \cdot \frac{Rt}{day}}{\left(4.38 + \frac{Rt}{day}\right)} \cdot \frac{1}{100} \qquad PRN = 41.8 \cdot \%\ \ NG$$

$$PRP := \frac{1}{100} \cdot \left[40.13 + 6.372 \cdot \ln\left(\frac{Rt}{day}\right) + 0.213 \cdot \left(\ln\left(\frac{Rt}{day}\right)\right)^2\right] \qquad PRP = 73.4 \cdot \%\ \ NG$$

Required additional TMDL treatment

$Eff1 := 58.2\%$

$Eff2_N := PRN$ $\quad Eff2_P := PRP$

$NRe = 75.66 \cdot \%$ $\quad PRe = 75.66 \cdot \%$

Treatment train efficiency

$Train_N := Eff1 + (1 - Eff1)Eff2_N$ $\quad Train_N = 75.67 \cdot \%$

$Train_P := Eff1 + (1 - Eff1)Eff2_P$ $\quad Train_P = 88.90 \cdot \%$

From FDEP Stormwater Quality handbood, appendix D

$$Eff1_{depth} := 0.75in - (55.7\% - Eff1) \cdot \frac{(0.75in - 1.0in)}{(55.7\% - 65.6\%)} \qquad Eff1_{depth} = 0.81 \cdot in$$

Required dry retention volume

$Dry_{vol} := Row\_area \cdot Eff1_{depth}$ $\quad Dry_{vol} = 0.19 \cdot acre \cdot ft$

Required dry retention pond area

$Bottom_{dry} := SHW + 1ft$ $\quad Weir_{dry} := Elev_{pvmt} - 2ft$

$$Area_{dry} := \frac{Dry_{vol}}{Weir_{dry} - Bottom_{dry}} \cdot 1.25 \qquad Area_{dry} = 0.23 \cdot acre$$

Total estimated stormwater management facility area requirements

$SWMF := Pond_{area} + Area_{dry}$ $\quad SWMF = 0.98 \cdot acre$