POND SITING REPORT

Florida Department of Transportation

District Five

SR 535 PD&E Study

Limits of Project: From US 192 to North of SR 536/World Center Drive

Orange and Osceola Counties, Florida

Financial Management Number: 437174-2

ETDM Number: 14325

Date: August 2024

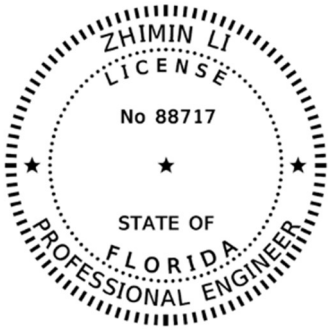
The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated May 26, 2022 and executed by the Federal Highway Administration and FDOT.

PROFESSIONAL ENGINEERING CERTIFICATE

I hereby certify that I am a registered professional engineer in the State of Florida practicing with BCC Engineering LLC, a corporation, authorized to operate as an engineering business by the State of Florida, and that I have reviewed or approved the evaluation, findings, opinions, conclusions, or technical advice hereby reported for:

Project:	SR 535 PD&E from US 192 to North of SR 536/World Center Drive
FM Number:	437174-2
Location:	Osceola and Orange County, Florida
Client:	FDOT District Five

This PD&E Pond Siting Report includes a summary of data collection efforts and engineering analysis for this SR 535 project. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of transportation engineering and planning as applied through professional judgment and experience.



Name:	Zhimin Li, P.E.
P.E. Number	88717
Date	August 5, 2024

This item has been electronically signed and sealed by Zhimin Li, P.E. on August 5, 2024 using a digital signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Executive Summary

SR 535 is a four-lane divided minor arterial facility located within unincorporated Osceola and Orange Counties in Central Florida. SR 535 is known as Vineland Road in Osceola County and Kissimmee-Vineland Road in Orange County. The project limits extend approximately 2.35 miles from the US 192 intersection in Osceola County to just north of the SR 536 intersection in Orange County. The purpose of the project is to accommodate future projected traffic demand and improve safety. The need for the project is based on addressing future transportation demand and safety concerns.

The project is within the jurisdiction of MetroPlan Orlando. The MetroPlan Orlando 2045 Cost Feasible Plan (CFP) includes widening of SR 535 from US 192 in Osceola County to SR 536 in Orange County in years 2031 to 2035 (construction). The SR 535 improvements are funded for design in the Florida Department of Transportation (FDOT) 2024-2029 Five-Year Work Program and MetroPlan Orlando 2023-2028 Transportation Improvement Program (TIP). This project was screened in the Efficient Transportation Decision Making (ETDM) system as ETDM #14325.

'No-Build' and Construction ('Build') Alternatives were evaluated during the study. The build alternative consists of widening SR 535 from four to six lanes. The study evaluated a range of typical section and intersection alternatives including inside widening and outside widening of the existing roadway. The build alternative analysis included the evaluation of open and closed stormwater drainage conveyance systems together with the evaluation of pond site locations. The study also evaluated Transportation System Management and Operations (TSMO) and multimodal improvements.

The Preferred Alternative consists of inside widening from four to six lanes with a shared use path along both sides and intersection improvements. The Preferred Alternative has a design speed of 45-miles per hour (mph) and consists of full reconstruction with the additional lanes constructed towards the median. The typical section consists of three (3) 11-foot travel lanes in each direction separated by a 32-foot to 47-foot median with a 14-foot shared use path on the west side and a 12-foot shared use path on the east side of the roadway. The Preferred Alternative will be constructed within the existing right-of-way width of 200-feet to 224-feet. Swales with ditch bottom inlets in conjunction with flume inlets at the curb line will be provided for drainage conveyance.

The Preferred Alternative will also implement intersection improvements including the following innovative intersection concepts.

- Polynesian Isle Boulevard Partial Median U-Turn (PMUT): Implementation of the PMUT involves the removal of northbound and southbound direct left turn movements from SR 535 to Polynesian Isle Boulevard and the addition of signalized U-turns at the existing median openings located just north and south of the intersection along SR 535 to accommodate vehicles wishing to travel east or west on Polynesian Isle Boulevard.
- International Drive Partial Displaced Left Turn (PDLT). Implementation of the PDLT involves the removal of direct eastbound and westbound left turns from Internation Drive at SR 535 with the displaced left turns installed on both legs International Drive. The

northbound and southbound left turn movements for SR 535 continue to take place at the main intersection.

- SR 536 (World Center Drive) Partial Displaced Left Turn (PDLT). Implementation of the PDLT involves the removal and replacement of direct northbound and southbound left turns from SR 535 at SR 536 with the displaced left turns installed on both legs of SR 535. The eastbound and westbound left turn movements for the SR 536/World Center Drive continue to take place at the main intersection.

This Pond Siting Report (PSR) has been prepared to identify stormwater management requirements and evaluate potential sites for stormwater management facilities to meet applicable water quality treatment and attenuation requirements. This analysis is preliminary and is used as an engineering tool to identify potential pond sites utilizing an "alternatives" methodology. The pond site locations are screened using preliminary information based upon many assumptions and judgments. The calculations presented in this report are preliminary and help in estimating the preliminary size of the stormwater ponds for each basin. The pond sizes, the limits of the basins associated with each pond alternative shown on the figures, tables, and included in the documentation are subject to change throughout the preliminary engineering and project design phases. The vertical datum for this analysis is the North American Vertical Datum of 1988 (NAVD 88), and datum conversions for data used in the analysis is referenced in this report.

Where feasible, stormwater management facilities have been recommended within existing FDOT or County right-of-way. Where the siting of a stormwater management facility will require additional right-of-way, a pond site evaluation matrix has been prepared to document and compare alternative sites with respect to numerous factors influencing site selection including: right-of-way requirements, easement requirements, costs for a given pond site, floodplain impacts, contamination and hazardous materials, potential utility impacts, threatened endangered & significant species, cultural resources, wetland impacts, construction and maintenance considerations, and impacts to other relevant features.

There are 4 basins in the existing and proposed condition (Basins 1-4), and all basins drain to permitted stormwater systems in the existing condition. Basins 1-3 collect runoff from state roads, including SR 530 (US 192), SR 535 and SR 536, while Basin 4 collects runoff from International Drive, an Orange County roadway. The preferred alternative for each basin is provided in **Table ES-1** and anticipated right of way needs (excluding public right-of-way used for the alternatives) associated with the preferred alternatives are provided in **Table ES-2**. Existing stormwater ponds within Basins 1 and 4 have sufficient capacity to provide the required water quality treatment and attenuation in the ponds currently serving these basins, so no additional right-of-way is required based on the calculations contained herein.

Table ES-1: Preferred Pond Alternatives

Basin	Preferred Alternative	Ponds	Type	Remarks
1	1A	Exist. Pond 1-1	Wet	Exist. pond sufficient. Reduced drainage area (30.94 ac to 29.16 ac) from exist. to proposed conditions. Increased freeboard in exist. pond.
2	2A	Exist. Pond 2-1 and Pond 2-2	Wet	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 2-1 outfall to Shingle Creek.
3	3A	Exist. Pond 3-1 and Pond 3-2	Wet	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 3-1 and Pond 3-2 outfalls to Shingle Creek.
4	4A	Exist. Pond 4-1	Wet	Exist. pond sufficient. Reduced drainage area (8.70 ac to 7.63 ac) from exist. to proposed conditions. Increased freeboard in exist. pond.

Table ES-2: Right-of-Way Needs for Preferred Alternatives

Basin	Preferred Alternative	Ponds	Estimated R/W Req'd.	Remarks
1	1A	Exist. Pond 1-1	0.0	Pond within exist. R/W
2	2A	Exist. Pond 2-1 and Pond 2-2	3.0	Exist. Pond 2-1 within exist. R/W. Estimated R/W needs for Pond 2-2 provided (excluding public R/W used for pond).
3	3A	Exist. Pond 3-1 and Pond 3-2	3.5	Exist. Pond 3-1 within exist. R/W. Estimated R/W needs for Pond 3-2 provided (excluding public R/W used for pond).
4	4A	Exist. Pond 4-1	0.0	Pond within exist. R/W

A summary of the preferred alternatives is provided below:

- Basin 1: Alternative 1A is the preferred alternative for Basin 1. Alternative 1A consists of an existing wet detention pond (identified as Exist. Pond 1-1) within FDOT right-of-way to provide the required water quality treatment and attenuation volumes.

- Basin 2: Alternative 2A is the preferred alternative for Basin 2. Alternative 2A consists of 2 ponds, one existing wet detention pond within existing FDOT right-of-way (identified as Exist. Pond 2-1) interconnected with a second wet detention pond (identified as Pond 2-

2) to provide the required water quality treatment and attenuation volumes. Since there is insufficient area within the existing FDOT right-of-way to provide a stormwater management alternative to meet water quality treatment and attenuation requirements, Pond Alternative 2A will require acquisition of right-of-way.

- Basin 3: Alternative 3A is the preferred alternative for Basin 3. Alternative 3A consists of 2 ponds, one existing wet detention pond within existing FDOT right-of-way (identified as Exist. Pond 3-1) interconnected with a second wet detention pond (identified as Pond 3-2) to provide the required water quality treatment and attenuation volumes. Since there is insufficient area within the existing FDOT right-of-way to provide a stormwater management alternative to meet water quality treatment and attenuation requirements, Pond Alternative 3A will require acquisition of right-of-way.

- Basin 4: Alternative 4A is the preferred alternative for Basin 4. Alternative 4A consists of an existing wet detention pond (identified as Exist. Pond 4-1) within existing right-of-way and easement to provide the required water quality treatment and attenuation volumes.

Project improvements will impact the 100-year floodplain as a result of longitudinal and transverse impacts. Five floodplain compensation (FPC) sites have been developed as part of this analysis. All FPC sites analyzed will provide the requisite storage to offset floodplain impacts. As part of this analysis a comparison matrix was developed to determine which location would be the preferred alternative. Based on this analysis, FPC Site 1 is the recommended alternative. Please reference the Location Hydraulics Report for additional information on floodplain impacts and compensation for the preferred alternative improvements.

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1.0 Introduction

In November 2017, the Florida Department of Transportation (FDOT) District Five (D-5) completed a Corridor Planning Study (CPS) to evaluate State Road 535 (SR 535) from US 192 in Osceola County to I-4 in Orange County. The purpose of the CPS was to identify specific problem areas along the corridor and evaluate multimodal alternatives that will be carried forward into future phases of project development in order to optimize the operations of the existing facility. Improvements identified as a result of the CPS included widening from four to six lanes, TSMO and multimodal improvements, and intersection improvements (including innovative intersection designs).

This Pond Siting Report (PSR) was prepared as a component of the PD&E Study in accordance with the Florida Department of Transportation (FDOT) PD&E Manual (July 1, 2023). This report will preliminarily analyze the appropriate location and size of stormwater ponds to account for the increase of stormwater runoff due to the proposed roadway improvements.

The purpose of this pond siting report is to:

- Size ponds to provide the required water quality treatment and runoff attenuation
- Evaluate alternatives for stormwater management ponds
- Identify stormwater pond alternative locations
- Analyze impacts to adjacent properties
- Analyze impacts to wetlands and other environmental resources
- Identify opportunities for joint use locations
- Identify right-of-way needs
- Recommend preferred pond sites

Evaluation of floodplain impacts and alternative floodplain compensation (FPC) site analysis is provided in the Location Hydraulics Report (LHR) under separate cover.

The horizontal datum for the project is Florida State Plane (NAD 1983), East Zone. The vertical datum for the project is the North American Vertical Datum of 1988 (NAVD 88), and the elevation difference between NAVD 88 and NGVD 29 is -0.90 feet (i.e., the NAVD 88 elevation is 0.90 feet lower than the corresponding NGVD 29 elevation).

1.1 Project Description

FDOT D-5 is conducting a Project Development and Environment (PD&E) Study to evaluate the widening of SR 535 from four to six lanes from US 192 in Osceola County to just north of World Center Drive (SR 536) in Orange County, approximately 2.35 miles as shown in **Figure 1-1**. SR 535 is known as Vineland Road in Osceola County and Kissimmee-Vineland Road in Orange County.

Within the study limits, SR 535 is a four-lane divided minor arterial facility that runs generally in a north south direction with an existing posted speed that varies from 45 to 50 mph. Bicycle and pedestrian facilities are provided intermittently throughout the study

area. There are three bridges over SR 535 within the study limits. Two of the existing bridges serve eastbound and westbound SR 417 and one of the existing bridges serves both eastbound and westbound Osceola Parkway. The existing drainage system collects roadway runoff in ditches and conveys the roadway runoff to treatment ponds via roadside ditches. The proposed improvements include widening SR 535 from four to six lanes, constructing signal improvements, providing drainage treatment and providing shared use paths along both sides of the roadway. The existing bridges will not be modified. The typical section for the preferred alternative is provided in **Figure 1-2.**

Figure 1-1: Project Location

1.2 Purpose & Need

The purpose of the project is to accommodate future projected traffic demand and improve safety.

1.2.1 Transportation Demand

In the existing condition, the section of SR 535 from US 192 to Kyngs Heath Road operates at a Level of Service (LOS) D with an Annual Average Daily Traffic (AADT) of 28,300; the section from Kyngs Heath Road to Poinciana Boulevard operates at

LOS D with an AADT of 26,900; the section from Poinciana Boulevard to Polynesian Isle Boulevard operates at LOS D with an AADT of 46,800; the section from Polynesian Isle Boulevard to World Center Drive operates at LOS D with an AADT of 44,300.

Based on the approved Orange County and Osceola County Comprehensive Plan's future land-uses that are included in the Central Florida Regional Planning Model (CFRPM) version 7.0, in the future year (2045) No-Build condition, the section of SR 535 from US 192 and Kyngs Heath Road is projected to operate at LOS F with an AADT of 42,000; the section from Kyngs Heath Road to Poinciana Boulevard is projected to operate at LOS E with an AADT of 40,000; the section from Poinciana Boulevard to Polynesian Isle Boulevard is projected to operate at LOS F with an AADT of 69,000; the section from Polynesian Isle Boulevard to World Center Drive is projected to operate at LOS F with an AADT of 66,000.

1.2.2 Safety

A total of 981 crashes were reported on SR 535 from US 192 to Lake Bryan Beach Boulevard in the five-year period from 2014 through 2018. Of those reported crashes, 463 (47%) resulted in injury and four (4) resulted in a fatality. The most frequent crash type was rear end with 605 (62%) total crashes, indicating congestion. Sideswipe crashes were the second highest with 106 (11%), followed by left-turn with 93 (9%) total crashes. Of the 981 crashes, 602 (61%) crashes occurred during daylight conditions. The crash rates along this segment of SR 535 exceed the FDOT statewide averages for similar facilities.

1.3 Project Status

The project is within the jurisdiction of MetroPlan Orlando. The MetroPlan Orlando 2045 Cost Feasible Plan (CFP) includes widening of SR 535 from US 192 in Osceola County to SR 536 in Orange County in years 2031 to 2035 (construction). The SR 535 improvements are funded for design in the Florida Department of Transportation (FDOT) 2024-2029 Five-Year Work Program and MetroPlan Orlando 2024-2029 Five-Year Work Program and MetroPlan Orlando 2023-2028 Transportation Improvement Program (TIP). This project was screened in the Efficient Transportation Decision Making (ETDM) system as ETDM #14325.

1.4 Commitments

FDOT has made a series of commitments and recommendations during this PD&E Study. The following sections summarize the commitments and recommendations that will be adhered to during the future transportation phases.

- The most recent version of the USFWS Standard Protection Measures for the Eastern Indigo Snake will be utilized during construction.

- FDOT will require contractors to remove garbage daily from the construction site or use bear proof containers for securing of food and other debris from the project work area to prevent these items from becoming an attractant for the Florida black bear (Ursus americanus floridanus). Any interaction with nuisance bears will be reported to the FWC Wildlife Alert hotline 888-404-FWCC (3922).

1.5 Alternatives Analysis Summary

The following alternatives were evaluated during the study:

- 'No-Build' Alternative
- Construction ('Build') Alternative
  The build alternative consists of widening SR 535 from four to six lanes. The study evaluated a range of typical section and intersection alternatives including inside widening and outside widening of the existing roadway. The build alternative analysis included the evaluation of open and closed stormwater drainage conveyance systems together with the evaluation of pond site locations. The study also evaluated Transportation System Management and Operations (TSMO) and multimodal improvements.

1.6 Description of Preferred Alternative

The Preferred Alternative consists of inside widening from four to six lanes with a shared use path along both sides and intersection improvements. The preferred alternative is shown on **Figure 1-2**.

The Preferred Alternative has a design speed of 45-miles per hour (mph) and consists of full reconstruction with the additional lanes constructed towards the median. The typical section consists of three (3) 11-foot travel lanes in each direction separated by a 32-foot to 47-foot median with a 14-foot shared use path on the west side and a 12-foot shared use path on the east side of the roadway. The Preferred Alternative will be constructed within the existing right-of-way width of 200-feet to 224-feet. Swales with ditch bottom inlets in conjunction with flume inlets at the curb line will be provided for drainage conveyance. Stormwater attenuation and floodplain compensation will be provided.

Figure 1-2: Preferred Typical Section

SR 535 roadway improvements would not require extending or reconstructing the existing bridges over SR 535 (one (1) bridge carries Osceola Parkway traffic over SR 535 and two (2) bridges carry SR 417) as all improvements will fit under the existing structures (see **Figure 1-3** and **Figure 1-4**).

Figure 1-3: Osceola Parkway over SR 535

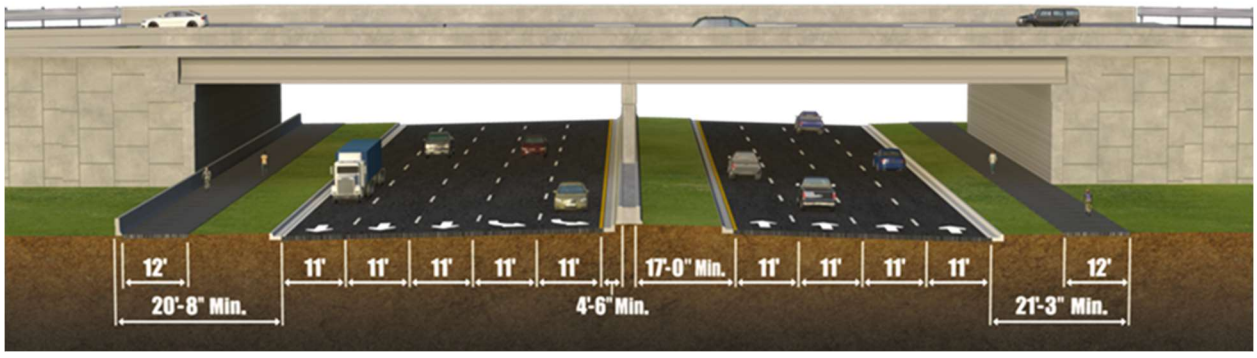
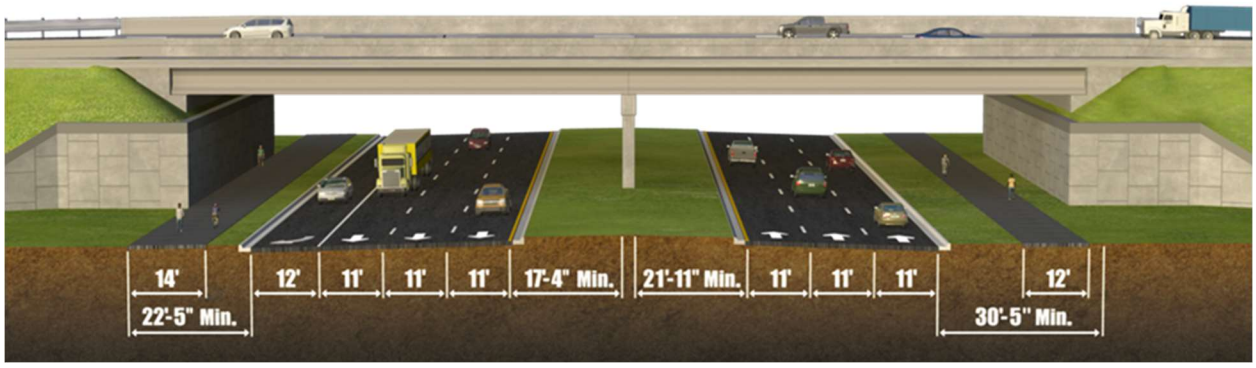


Figure 1-4: SR 417 over SR 535



1.6.1 Intersection Improvements

The Preferred Alternative will also implement intersection improvements including the following innovative intersection concepts.

- Polynesian Isle Boulevard Partial Median U-Turn (PMUT): Implementation of the PMUT involves the removal of northbound and southbound direct left turn movements from SR 535 to Polynesian Isle Boulevard and the addition of signalized U-turns at the existing median openings located just north and south of the intersection along SR 535 to accommodate vehicles wishing to travel east or west on Polynesian Isle Boulevard.
- International Drive Partial Displaced Left Turn (PDLT). Implementation of the PDLT involves the removal of direct eastbound and westbound left turns from International Drive at SR 535 with the displaced left turns installed on both legs International Drive. The northbound and southbound left turn movements for SR 535 continue to take place at the main intersection.
- SR 536 (World Center Drive) Partial Displaced Left Turn (PDLT). Implementation of the PDLT involves the removal and replacement of direct northbound and southbound left turns from SR 535 at SR 536 with the displaced left turns installed on both legs of SR 535. The eastbound and westbound left turn movements for the SR 536/World Center Drive continue to take place at the main intersection.

1.6.2 Drainage

There are 4 basins in the existing and proposed condition, and all basins drain to permitted stormwater systems in the existing condition (see **Table 1-1**). Where feasible, stormwater management facilities have been recommended within existing FDOT or County right-of-way (R/W). Below is a summary of the preferred pond alternatives (see **Figure 1-5**).

- Basin 1: Alternative 1A is the Preferred Alternative for Basin 1. Alternative 1A consists of an existing wet detention pond (identified as Exist. Pond 1-1) within FDOT R/W to provide the required water quality treatment and attenuation volumes.
- Basin 2: Alternative 2A is the Preferred Alternative for Basin 2. Alternative 2A consists of 2 ponds, one existing wet detention pond within existing FDOT R/W (identified as Exist. Pond 2-1) interconnected with a second wet detention pond (identified as Pond 2-2) to provide the required water quality treatment and attenuation volumes. Since there is insufficient area within the existing FDOT R/W to provide a stormwater management alternative to meet water quality treatment and attenuation requirements, Pond Alternative 2A will require acquisition of R/W.

- Basin 3: Alternative 3A is the Preferred Alternative for Basin 3. Alternative 3A consists of 2 ponds, one existing wet detention pond within existing FDOT R/W (identified as Exist. Pond 3-1) interconnected with a second wet detention pond (identified as Pond 3-2) to provide the required water quality treatment and attenuation volumes. Since there is insufficient area within the existing FDOT R/W to provide a stormwater management alternative to meet water quality treatment and attenuation requirements, Pond Alternative 3A will require acquisition of R/W.
- Basin 4: Alternative 4A is the Preferred Alternative for Basin 4. Alternative 4A consists of an existing wet detention pond (identified as Exist. Pond 4-1) within existing R/W and easement to provide the required water quality treatment and attenuation volumes.

Table 1-1: Preferred Pond Alternatives

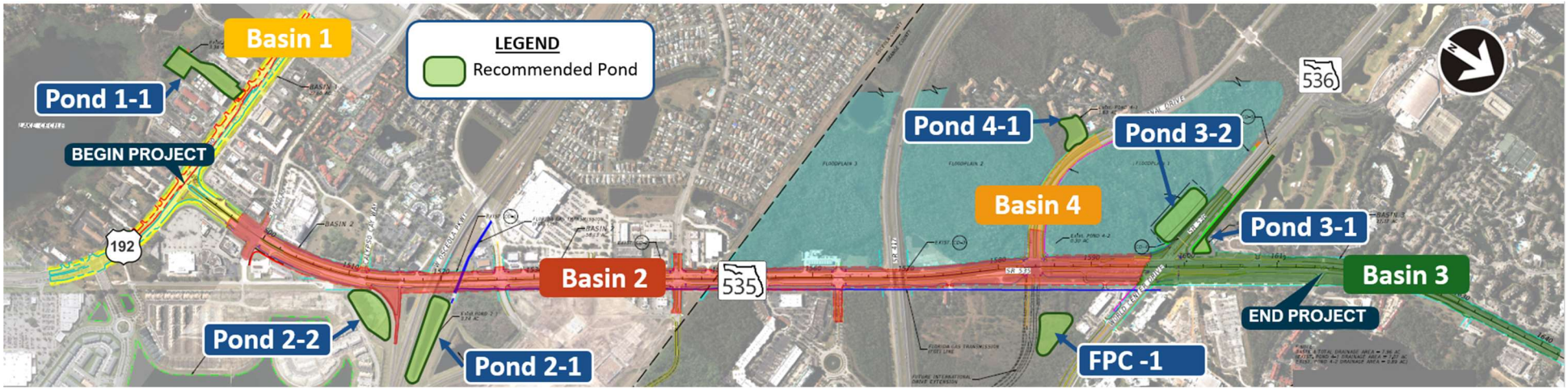
Basin	Preferred Alternative	Ponds	Type	R/W Req'd.	Remarks
1	1A	Exist. Pond 1-1	Wet	0.0	Exist. pond sufficient. Reduced drainage area (30.94 ac to 29.16 ac) from exist. to proposed conditions. Increased freeboard in exist. pond. Pond within exist. R/W
2	2A	Exist. Pond 2-1 and Pond 2-2	Wet	3.0	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 2-1 outfall to Shingle Creek. Exist. Pond 2-1 within exist. R/W. Estimated R/W needs for Pond 2-2 provided (excluding public R/W used for pond).
3	3A	Exist. Pond 3-1 and Pond 3-2	Wet	3.5	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 3-1 and Pond 3-2 outfalls to Shingle Creek. Exist. Pond 3-1 within exist. R/W. Estimated R/W needs for Pond 3-2 provided (excluding public R/W used for pond).
4	4A	Exist. Pond 4-1	Wet	0.0	Exist. pond sufficient. Reduced drainage area (8.70 ac to 7.63 ac) from exist. to proposed conditions. Increased freeboard in exist. pond. Pond within exist. R/W

An analysis of floodplain impacts and floodplain compensation (FPC) alternatives was performed. Project improvements will impact the 100-year floodplain as a result of longitudinal impacts and transverse impacts. The preferred FPC alternative and anticipated right of way needs associated with the preferred alternative are provided in **Table 1-2**.

Table 1-2: Preferred FPC Site

Name	Floodplain Impacts (ac-ft)	Floodplain compensation Volume Provided (ac-ft)	Estimated Pond R/W Req'd. (including access) (ac)
FPC-1	8.89	14.45	4.3

Figure 1-5: Preferred Alternative Ponds



1.6.3 Right of Way and Construction Cost

SR 535 has an existing right-of-way of 224 feet which is ample right-of-way to accommodate the Preferred Alternative. Some right-of-way impacts will be required to accommodate intersection improvements at the International Drive and World Center Drive (SR 536) intersections and for offsite ponds. Approximately 11.5 acres of right-of-way impacts (excluding public R/W required) are anticipated as a result of the preferred alternative. Approximately 0.7 acres are associated with improvements at the SR 535/International Drive and SR 535/World Center Drive (SR 536) intersections. Additionally, approximately 10.8 acres are associated with the required stormwater and floodplain compensation ponds (excluding public R/W required). A total of 8 parcels are anticipated to be impacted from the preferred alternative. See **Table 1-3** for cost estimate.

Table 1-3: Cost Estimate

	Cost
Construction	$76.5M
R/W	$38.1M
Utility Relocation	$7.0M
Sub Total	$121.6M
Design (15%)	$11.5M
CEI (10%)	$7.7M
Total Estimated Project Cost	$140.8M

2.0 Data Collection

In order to locate the existing stormwater facilities, determine existing drainage patterns within the limits of the corridor, potential site availability, and design criteria and requirements, the following sources were used:

- FDOT Drainage Manual, 2024
- FDOT Drainage Design Guide, 2024
- SFWMD Environmental Resource Permit Applicant's Handbook, Volumes I (2020) and II (2016)
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, Panel Nos. 12095C0605F,12097C0055G, 12095C0585F
- Osceola and Orange County Property Appraiser Websites
- SFWMD Environmental Resource Permit (ERP) Research
- USDA Natural Resources Conservation Service (NRCS) Web Soil Survey
- NOAA LiDAR Data
- FDOT Aerial Maps
- USGS Topographic Map Quadrangles
- FDOT Straight Line Diagrams
- Geotechnical Investigations

3.0 Design Criteria

The design of the stormwater management facilities for the project is governed by the rules set forth by the South Florida Water Management District (SFWMD), FDOT, Orange and Osceola Counties. Water quality treatment and attenuation requirements will comply with the guidelines as defined in Chapter 62-330.010 of the Florida Administration Code (F.A.C.), the SFWMD Environmental Resource Permit Applicant's Handbooks, and the FDOT Drainage Manual as well as the pre-application meeting held with SFWMD on 11/16/22. SFWMD pre-application meeting minutes can be found in **Appendix I**.

3.1 Water Quality Treatment Criteria

SR 535 within the project limits is located within the Shingle Creek basin (WBID 3169A) and Lake Okeechobee Basin Management Action Plan (BMAP) and does not directly discharge to an Outstanding Water (OFW). It should be noted that north of SR 417, SR 535 is located on the divide between WBID 3169A and WBID 3169B (Reedy Creek Basin), and the historical discharge from SR 535 is to WBID 3169A based on a review of permit documentation. Retention, detention, or both retention and detention in the overall system, including swales, lakes, canals, greenways, etc., shall be provided for one of the three following criteria or equivalent combinations thereof: (SFWMD Applicant's Handbook, Vol. II, Sec. 4.2.1)

- Wet detention volume shall be provided for the first inch of runoff from the developed project, or the total runoff of 2.5 inches times the impervious area, whichever is greater.
- Dry detention volume shall be provided equal to 75 percent of the above amounts computed for wet detention.
- Retention volume shall be provided equal to 50 percent of the above amounts computed for wet detention.
- Impervious areas subject to non-vehicular traffic (e.g., sidewalk and shared use paths) do not require water quality treatment and can be separated out from the calculation of impervious area. For the purposes of the pond siting analysis in the PD&E, the shared use paths have been included in the calculation of impervious area to provide a conservative estimate of water quality volume required. It is recommended that the impervious area acreage be refined during the final design phase of the project to provide a more accurate estimate of required water quality treatment volume.
- Based on the pre-application meeting with SFWMD, an additional 50% of water quality treatment volume should be provided wherever feasible due to the fact that the project is located within the Lake Okeechobee BMAP. If not feasible, SFWMD will require a description of the site constraints or reasons that the additional treatment volume cannot be provided.
- Net improvement for nutrient loading requirements: the project lies within the Shingle Creek Basin, which is impaired for nutrients (macrophytes). SFWMD

stated that nutrient loading calculations are not required for discharges to Shingle Creek due to this type of nutrient impairment, but that net improvement for total phosphorus (TP) is required because the project lies within the Lake Okeechobee BMAP. SFWMD pre-application meeting minutes can be found in **Appendix I**.

3.2 Water Quantity (Attenuation) Criteria

3.2.1 SFWMD Criteria

For open basins, the post-development peak rate of discharge must not exceed the pre- developed peak rate of discharge for the 25-year/72-hour event. For closed basins, the post-development peak discharge volume must not exceed the pre-development peak discharge rate and volume during the 100-year, 72-hour storm. (SFWMD Applicant's Handbook, Vol. II, Sec. 3.2 and 3.3).

3.2.2 FDOT Criteria

The design of stormwater management systems for Department projects will comply with the water quality, rate, and quantity requirements of Section 334.044(15), Florida Statues (F.S.), Chapter 14-86, Florida Administrative Code (F.A.C.), Rules of the Department of Transportation, only in basins closed during storms up to and including the 100-year storm event, or areas subject to historical flooding.

3.2.3 Osceola County and Orange County Criteria

Based on a review of permit documentation, one existing pond evaluated in this report utilizes the Osceola County 10-year/72-hour and 100-year/72-hour event. Several existing ponds evaluated in this report utilize the Orange County 25-year/24-hour event. Please see the pond calculations for the design storm utilized to determine required attenuation volumes.

3.3 Anticipated Permits

A summary of the anticipated permits required is provided below:

- An Individual Environmental Resource Permit (ERP) will be required from the SFWMD. SFWMD indicated that a new ERP would be issued for the proposed project improvements that references the previous permits in the pre-application meeting.
- A Water Use Permit for dewatering may be required from the SFWMD.
- A NPDES permit will be required from the Florida Department of Environmental Protection (FDEP), as the project will result in 1 acre or more of disturbed area.
- A 404 permit may be required from the FDEP. This will be determined during the design phase of this project.

4.0 Environmental Look Around

Discussion of potential regional stormwater alternatives was discussed as part of the Community Advisory Group (CAG) meetings held with representatives from Osceola and Orange Counties. The following regional alternatives were evaluated as part of the Environmental Look Around (ELA) process:

- Expansion of the existing stormwater pond in the SR 535/Osceola Parkway interchange infield area: Osceola County representatives stated that the infield area was being reserved to accommodate future improvements to Osceola Parkway, so this alternative was dropped from further consideration.

- Discharge to the existing rapid infiltration basins (RIBs) owned and operated by Orange County Utilities: Orange County representatives stated that there is no additional capacity in the RIBs located east of SR 535 and south of SR 536 due to ongoing development in the area, so this alternative was dropped from further consideration.

The following potential joint-use stormwater opportunities were also evaluated as noted below:

- Potential joint-use stormwater facility or floodplain compensation site at the future extension of International Drive east of SR 535: While this option may be a viable option to consider during final design, the International Drive extension and associated improvements has not developed far enough at the current time to identify potential joint-use opportunities. There are proposed stormwater pond and floodplain compensation site alternatives located adjacent to the future International Drive extension, so opportunities may exist during final design for a joint-use facility.

- Potential joint-use stormwater facility within the Storey Lake development: the Storey Lake development has an existing stormwater management system located east of SR 535 and south of Osceola Parkway. This alternative was included in this analysis as a stormwater alternative for Basin 2.

5.0 Existing Conditions

5.1 Topography

The topography along the project corridor generally slopes from north to south, with elevations ranging from 101 feet NAVD at the SR 535/SR 536 intersection to 87 feet NAVD at the SR 535/SR 530 intersection. Based on a review of existing plans, the longitudinal grade of SR 535 ranges from approximately 0.28% - 0.30% between US 192 and Kyngs Heath Rd (State Project No. (SPN) 92090-3543), from approximately 0.10% - 0.26% (from SPN 92506-3602) and approximately 0.03% in the vicinity of the SR 535/SR 536 intersection (SPN 75560-3610). Excerpts from these plans are provided in **Appendix J**.

5.2 Soils and Geotechnical Investigations

Based on the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey, soils in the area are predominantly fine sands with a groundwater depth of approximately 1 foot below the ground surface. The soils encountered along the project limits are mostly hydrologic soil group (HSG) A/D and B/D soils. For dual classification soils, the first letter represents the drained condition and the second letter represents the undrained condition. A summary of the soil types found in the vicinity of the project are provided in **Appendix H**.

The hydrologic soil groups are defined as follows:

- Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
- Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained, or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
- Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
- Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Please see **Appendix H** for NRCS Soil Survey information as well as preliminary geotechnical investigation at potential pond and floodplain compensation site locations.

5.3 Contamination Screening

A total of 19 sites of potential contamination risk were identified along the project corridor in the Draft Contamination Screening Evaluation (CSER) Report for this PD&E Study. The 19 sites included 2 high-risk sites, 8 medium-risk sites and 9 low-risk sites. Please see the excerpt from the Draft CSER in **Appendix F** for further information.

5.4 Environmental Characteristics

5.4.1 Land Use Data

The project corridor is a mixture of residential, commercial, upland and wetland forest and wetlands. The widening of SR 535 does not alter the existing or future land uses in the area. Please see the Land Use Maps in **Appendix A**.

5.4.2 Cultural Features

Cultural features preserve and enhance the cultural nature of a community and include parks, schools, churches and other religious institutions. Also included are historic sites, archaeologically significant sites and resources, and potential historic districts. Based on a review of the project corridor, there are no sites within the Area of Probable Effect (APE) eligible for the National Register of Historic Places (NRHP) and no archeological sites within the APE. Please see the excerpt from the Cultural Resources Assessment Survey (CRAS) in **Appendix E** for further information.

5.4.3 Natural and Biological Features

The proposed project has potential to involve several State and/or Federally listed protected wildlife species. The project corridor was evaluated for the presence of potentially occurring species. These species and their anticipated involvement are identified in the Natural Resources Evaluation Report (NRE). The preferred alternative has “no effect”, “no effect anticipated”, “not likely to affect”, or “no adverse effect anticipated” on listed or protected species.

The potential presence of wetlands and other surface waters (OSW) were identified on the west side of SR 535 in Orange County through a desktop review of the FDOT Environmental Screening Tool (EST). In addition, Orange County and SFWMD conservation easements have also been identified in this area.

Please see the excerpt from the NRE in **Appendix G** for further information.

5.5 Cross Drains

Five cross drains have been identified under SR 535 and SR 536 within the project limits. A summary of the cross drain locations is provided in **Table 5-1**.

Table 5-1: Cross Drain Summary

Cross Drain	Road	Station	Location (Milepost)	Basin	Cross Drain Size and Type
CD-1	SR 535	1521+30	0.600	2	2-30” RCP
CD-2	SR 535	1544+00	1.037	2	2-24” RCP
CD-3	SR 535	1570+00	0.382	2 (offsite)	1-24” RCP
CD-4	SR 536	1599+00 LT	1.694	3	1-3’x8’ CBC
CD-5	SR 536	1609+50 LT	1.920	3	1-36” RCP

5.6 Existing Drainage Conditions

SR 535 is a 4-lane roadway through the project limits, comprised of a divided urban section from US 192 to Kyngs Heath Rd, and a divided rural section from Kyngs Heath Rd to north of SR 536. Four basins have been identified in the existing condition based on existing drainage divides and drainage features. All basins are classified as open basins which discharge to Shingle Creek.

The SR 535 corridor within Osceola County is highly developed, while the land use along SR535 within Orange County is currently less developed. Undeveloped areas west of SR 535 in Orange County consist primarily of wetlands, as well as Orange County and SFWMD conservation easements. There is a Florida Gas Transmission (FGT) line located on the east side of SR 535 between the Osceola Parkway interchange and the SR 535/SR 536 intersection.

All roadways within the project limits (SR 535, SR 536 and International Drive) as well as adjacent developments have permitted stormwater treatment systems. A list of the relevant Environmental Resource Permits within the project corridor is provided in **Table 5-2** and relevant permit excerpts have been included in **Appendix J**. Based on a review of the existing plans, offsite runoff is generally separated from the on-site runoff with the exception of SR 530 (US 192) in Basin 1.

Table 5-2: Relevant Environmental Resource Permits

Application No.	Permit No.	Date Issued	Description
X000008640	85-00118-S	10/10/85	SR 535 Widening from US 192 to Orange County line
901113-1	48-00592-S	11/3/90	SR 535 from South of SR 536 to I-4
930909-1	49-00653-S	4/14/94	Osceola Parkway
971113-1	49-00883-P	3/12/98	SR 530 (US 192) from Bonnet Creek to SR 535
970147-8	48-00866-S	11/12/98	Greene Property Phase II (International Drive)
150611-22	49-00908-P	8/3/15	Orchid Bay/Storey Lake
160208-15	49-00908-P	3/11/16	Orchid Bay (Storey Lake)
160428-7	49-00908-P	6/7/16	Storey Lake Blvd Phases 2 & 3

5.7 Existing Drainage Basins

A summary of the existing project basins and limits are provided in **Table 5-3**.

Table 5-3: Summary of Existing Project Basins

Basin	Road	From	To	Outfall	Basin Area* (ac)
1	SR 535	1490+00	1499+31	Exist. Pond 1-1	27.60
2	SR 535	1499+31	1595+75	Exist. Pond 2-1	56.13
3	SR 535	1595+75	1642+20	Exist. Pond 3-1 & Exist. Pond 3-2	27.17
4	International Dr	West of SR 535	End Construction	Exist. Pond 4-1 & Exist. Pond 4-2	7.96

* Basin areas exclude section of basins which cover existing ponds

5.7.1 Basin 1

Basin 1 is located on SR 535 between SR 530 (US 192) and Kyngs Heath Rd, as well as a portion of SR 530 to the east and west of the SR 535 intersection. The existing roadway and stormwater system within Basin 1 was constructed as part of SPN 92090-3543. Runoff from the roadway along SR 535 is drained by closed storm drain systems which convey runoff to an existing wet detention pond (identified as Pond WRA-4 in SPN 92090-3543) located on the south side of SR 530 and west of SR 535. The wet detention pond receives runoff from on-site area along SR 530 and SR 535, as well as offsite areas, and discharges east to Lake Cecile and to Shingle Creek.

The pond is permitted by SFWMD as part of Permit No. 49-00883-P. Based on a review of the permit documents, the SFWMD 25yr-72hr design high water (DHW) elevation within the existing pond is above the inside berm elevation. See **Appendix J** for existing plans and calculations for the existing stormwater system.

5.7.2 Basin 2

Basin 2 is located on SR 535 between Kyngs Heath Rd and SR 536. The existing roadway and stormwater system within Basin 2 was constructed as part of SPN 75560-3609 and 75560-3610. Runoff from the roadway along SR 535 is drained by roadside ditches, side drains and cross drains to convey runoff to an existing wet detention pond (identified as Pond E in Osceola Parkway plans by Osceola County [Job No. 93503]). The existing wet detention pond is located on the east side of SR 535 within the Osceola Parkway interchange infield area, and is bounded by Osceola Parkway on the south side and a FGT line on the north side. The wet detention pond receives runoff from on-site area along SR 535, and discharges east along Osceola Parkway to unnamed wetlands associated with Shingle Creek.

The pond was originally constructed as a linear ditch as part of SPN 75560-3609 and later modified by Osceola County to a wet detention pond as part of the Osceola Parkway construction. The current pond is permitted by SFWMD as part of Permit No. 49-00653-S. See **Appendix J** for existing plans and calculations for the existing stormwater system.

5.7.3 Basin 3

Basin 3 is located on SR 535 between SR 536 and the northern project limits, and includes the SR 535/SR 536 intersection and a portion of SR 536. The existing roadway and stormwater system within Basin 3 was constructed as part of SPN 75560-3610. Runoff from the roadway along SR 535 and SR 536 is drained by roadside ditches, side drains and cross drains to convey runoff to existing ponds located on both sides of SR 536 west of SR 535. The existing stormwater system consists of a wet detention pond in the northwest quadrant of the SR 535/SR 536 intersection interconnected with a dry detention pond in the southwest quadrant of the SR 535/SR 536 intersection (neither pond had specific pond names in SPN 75560-3610). The

wet detention pond receives runoff from on-site area along SR 535 and SR 536, and the dry detention pond receives runoff from SR 536. There are multiple outfalls from both the wet and dry detention ponds, but the primary discharge to towards SR 535 and to Shingle Creek.

The ponds are permitted by SFWMD as part of Permit No. 48-00592-S. See **Appendix J** for existing plans and calculations for the existing stormwater system.

5.7.4 Basin 4

Basin 4 is located on International Drive west of SR 535. This section of International Drive and the associated stormwater system within Basin 4 was constructed as part of developer improvements for the Greene property. Runoff from the roadway along International Drive is drained by closed storm drain systems which convey runoff to an existing wet detention pond (identified as Pond 5 in the permit plans for Application No. 990604-8) located on the south side of International Drive and west of SR 535, and a dry detention pond (identified as Pond 6 in the permit plans for Application No. 990604-8) in the northwest quadrant of the SR 535/International Drive intersection. The ponds receives runoff from on-site area along International Drive, and discharge to unnamed wetlands that drain to Shingle Creek.

Based on a review of the permit documents, the Orange County 25yr-24hr design high water (DHW) elevation within the existing pond is above the inside berm elevation. The pond is permitted by SFWMD as part of Permit No. 48-00866-S. See **Appendix J** for existing plans and calculations for the existing stormwater system.

6.0 Proposed Conditions

In general, basin limits and discharge points in the proposed condition will remain the same as the existing condition except where noted in the proposed basin descriptions. Existing stormwater ponds have been evaluated, and proposed stormwater ponds have been sized to provide the required water quality treatment, attenuation and nutrient load reduction set forth by the SFWMD and FDOT.

6.1 Proposed Drainage Typical Section

The preferred typical section for SR 535 is a 6-lane divided urban roadway with shared use paths on both sides of the roadway. A combination of closed storm drain system and shallow roadside ditches located between the proposed curb and gutter and shared use paths are proposed on both sides of the roadway as shown in **Figure 6-1**.

Figure 6-1: Preferred Typical Section

The primary purpose of the shallow ditches is not conveyance, as the proposed ditch footprints do not have adequate capacity to convey runoff to the proposed stormwater ponds and outfalls. The width available for the shallow ditches is generally limited by right-of-way and utility constraints. Flume inlets or curb openings will convey runoff from the roadway to the shallow ditches, and a storm drain system composed of DBIs and pipe will convey runoff to the outfall.

The shallow ditches will assist in meeting stormwater criteria, and also may assist with the phasing of the drainage system construction as noted below.

- Net improvement for nutrient loading for total phosphorus is required due to the project's location within the Lake Okeechobee BMAP. Given that the conversion from a rural typical section in the existing condition to an urban typical section in the proposed condition, there is a significant increase in the directly connected imperious area (DCIA). This increase in DCIA also results in higher nutrient loads in the proposed condition. Utilizing a proposed drainage system with flume inlets and

shallow roadside ditches where feasible will convert the proposed roadway impervious area to non-DCIA, thereby significantly reducing the nutrient load in the proposed condition prior to stormwater treatment.

- The preferred widening for SR 535 is to widen to the inside (towards the median). Construction of storm drain systems outside of the existing roadway footprint may facilitate the Maintenance of Traffic (MOT) plan developed during the design phase.

6.2 Proposed Pond Sizing Methodology

The pond sizing analysis assumes that all ponds will be designed using wet detention pond design criteria due to the soil conditions and groundwater table elevations along the SR 535 corridor. The report focuses on the preliminary estimate of required pond volumes necessary for each roadway drainage basin. As all project basins currently drain to permitted stormwater facilities, the existing ponds have been evaluated to determine whether the pond size is sufficient to provide the required water quality treatment and attenuation, or if additional pond volume is required (either through expansion of the existing stormwater pond or by adding a potential stormwater pond to the basin). All existing stormwater ponds serving the project basins are utilized in the proposed condition.

The following parameters were considered in the sizing and location of the potential pond sites:

- Hydrologic and hydraulic factors such as existing ground elevations, soil types, estimated seasonal high groundwater table (SHGWT), stormwater conveyance feasibility, allowable hydraulic grade line (HGL);
- Potential impacts to environmental resources, including wetlands, conservation easements, threatened or endangered species;
- Floodplain impacts;
- Major utility conflict potential;
- Parcel descriptions and land usage;
- Impacts to cultural resources; and
- Impacts to contamination sites

6.3 Proposed Drainage Basins and Stormwater Pond Alternatives

A summary of the project basins and limits are provided in **Table 6-1**.

Table 6-1: Summary of Proposed Project Basins

Basin	Road	From	To	Outfall	Basin Area* (ac)
1	SR 535	1490+00	1496+07	Exist. Pond 1-1	25.82
2	SR 535	1496+07	1595+75	Exist. Pond 2-1 and prop. pond	58.98
3	SR 535	1595+75	1642+20	Exist. Pond 3-1 & prop. pond	27.17
4	International Dr	West of SR 535	End Construction	Exist. Pond 4-1	6.00

* Basin areas exclude section of basins which cover pond sites which vary depending on the alternative.

6.3.1 Basin 1

Basin 1 is located on SR 535 from SR 530 (US 192) to south of Kyngs Heath Rd, as well as a portion of SR 530 to the east and west of the SR 535 intersection. The proposed Basin 1 drainage area has been reduced from the existing condition by shifting the SR 535/Kyngs Heath Rd intersection into Basin 2 as shown in the Basin Maps. One pond alternative (Exist. Pond 1-1) is provided for Basin 1 as the alternative is located within existing FDOT Right-of-way.

Alternative 1A (Exist. Pond 1-1)

Exist. Pond 1-1 is the existing wet detention pond located on the south side of SR 530 and west of SR 535 constructed as part of SPN 92090-3543 and permitted by SFWMD under Permit No. 49-00883-P. As noted in **Section 5.7.1** of this report, the SFWMD 25yr-72hr design high water (DHW) elevation within Exist. Pond 1-1 is above the inside berm elevation in the existing condition. As only minor roadway improvements are proposed within Basin 1, a reduction in basin area will result in lowering the DHW elevation below the inside edge of berm while meeting water quality treatment and attenuation requirements. Note that site constraints do not allow an additional 50% water quality treatment for Basin 1. See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

6.3.2 Basin 2

Basin 2 is located on SR 535 from south of the Kyngs Heath Rd to south of the SR 535/SR 536 intersection. The proposed Basin 2 drainage area has been increased from the existing condition by shifting the SR 535/Kyngs Heath Rd intersection into Basin 2 and adding area from International Drive from existing Basin 4. Three pond alternatives are provided for Basin 2. Each alternative combines the existing wet detention pond (Exist. Pond 2-1) with a proposed offsite pond to provide the water quality treatment and attenuation requirements.

Alternative 2A (Exist. Pond 2-1 & Pond 2-2)

Alternative 2A is composed of 2 interconnected wet detention ponds, Exist. Pond 2-1 and Pond 2-2. Exist. Pond 2-1 is the existing wet detention pond originally constructed as a linear ditch as part of SPN 75560-3609 and later modified by Osceola County to a wet detention pond as part of the Osceola Parkway construction. The pond is located within the Osceola Parkway interchange infield area and cannot be expanded due to site constraints (Osceola Parkway is located south of the pond and a FGT line is located north of the pond). Pond 2-2 is a proposed offsite wet detention pond that will impact one parcel owned by Shingle Creek Community Development District (CDD) (the owner has been identified from the Osceola County Property Appraiser website). The pond and interconnection with Exist. Pond 2-1 will also impact the Osceola Parkway right-of-way owned by Osceola County. The pond site is an existing borrow pit constructed as part of the Storey Lake development on the south side of Osceola Parkway east of SR 535 under SFWMD Application No. 150611-24/Permit No. 49-00908-P. The borrow pit is hydraulically connected to the Storey Lake stormwater system, but does not provide any water quality treatment or attenuation for the development. Please see excerpts from SFWMD Application No. 150611-24/Permit No. 49-00908-P in **Appendix J**.

Pond 2-2 will be interconnected with Exist. Pond 2-1 via a pipe under Osceola Parkway. The pond system will discharge east along Osceola Parkway via the existing pond outfall system for Exist. Pond 2-1, and outfall east of Storey Lake Blvd to unnamed wetlands associated with Shingle Creek. With the interconnected ponds located to the north and south of the Osceola Parkway bridge, Alternative 2A should facilitate construction of the proposed SR 535 storm drain system by eliminating the need to construct the proposed storm drain system trunk line under the bridge in order to convey runoff to a pond.

See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

Alternative 2B (Exist. Pond 2-1 & Pond 2-3)

Alternative 2B is composed of 2 interconnected wet detention ponds, Exist. Pond 2-1 and Pond 2-3. Exist. Pond 2-1 is described in Alternative 2A. Pond 2-3 is a proposed offsite wet detention pond that will impact 3 parcels – a developed commercial site owned by 7-Eleven Inc., a developed commercial site owned by Osceola Enterprises of Kissimmee,

and an undeveloped commercial site owned by GH Land Trust (owners have been identified from the Osceola County Property Appraiser website). The pond and interconnection with Exist. Pond 2-1 will also impact Old Vineland Rd north of Kyngs Heath Rd (which is currently a dead-end street that only serves the properties impacted by Pond 2-3) and Osceola Parkway Right-of-way owned by Osceola County.

Pond 2-3 will be interconnected with Exist. Pond 2-1 via pipes along the east side of SR 535 and under Osceola Parkway. The pond system will discharge east along Osceola Parkway via the existing pond outfall system for Exist. Pond 2-1, and outfall east of Storey Lake Blvd to unnamed wetlands associated with Shingle Creek. With the interconnected ponds located to the north and south of the Osceola Parkway bridge, Alternative 2B should facilitate construction of the proposed SR 535 storm drain system by eliminating the need to construct the proposed storm drain system trunk line under the bridge in order to convey runoff to a pond.

See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

Alternative 2C (Exist. Pond 2-1 & Pond 2-4)

Alternative 2C is composed of 7 wet detention ponds, Exist. Pond 2-1 and Pond 2-4. Exist. Pond 2-1 is described in Alternative 2A. Pond 2-4 refers to the existing permitted stormwater management system for the Storey Creek development, which is comprised of 6 interconnected ponds with an outfall to wetlands associated with Shingle Creek on the east side of the development. These 6 interconnected ponds are owned by the Shingle Creek CDD and Osceola County (owners have been identified from the Osceola County Property Appraiser website). This alternative would serve as a joint-use facility.

Runoff from SR 535 is not currently conveyed to Pond 2-4, so any required water quality treatment and attenuation volume will have to be added to the current permitted pond volumes. Analysis of the Pond 2-4 system is based on information from SFWMD Application No. 150611-24/Permit No. 49-00908-P. The hydraulic analysis documentation available on the SFWMD ePermitting website for the Storey Lake development is incomplete, but does provide enough data to provide reasonable assurance that Alternative 2C is a viable option.

A summary of the analysis for Alternative 2C is provided below:

- It is anticipated that the existing pond outfalls will remain. Exist. Pond 2-1 will continue to discharge east along Osceola Parkway via the existing pond outfall system and outfall east of Storey Lake Blvd. to unnamed wetlands associated with Shingle Creek. The Pond 2-4 system will continue to discharge via multiple control structures to unnamed wetlands associated with Shingle Creek south of the Exist. Pond 2-1 outfall.
- It is assumed that a portion of the required water quality treatment and attenuation volume in Basin 2 can be provided in Exist. Pond 2-1, with the remaining volume provided within the Pond 2-4 system.

- Based on a preliminary volumetric analysis using the 2 large ponds within the Pond 2-4 system, there is sufficient excess treatment volume in the Pond 2-4 system (32.91 ac-ft from SFWMD Application #150611-22) to accommodate the total water quality treatment volume for the Basin 2 improvements. If it is not feasible to utilize the excess permitted treatment volume provided in the Pond 2-4 system, then the top of treatment volume stage would increase by approximately 0.15 feet.
- Similarly, the increase in attenuation volume requirements in the Pond 2-4 system due to the SR 535 improvements in Basin 2 would increase the DHW stage by approximately 0.06 feet.
- The total stage increase in the Pond 2-4 system if receiving runoff from Basin 2 is approximately 0.21 feet.
- These minor increases in pond stage could be handled through modification of the existing control structures for Exist. Pond 2-1 and the Pond-2-4 system.
- Runoff from SR 535 could be routed to the Pond 2-4 system though the existing borrow pit in the southeast quadrant of the SR 535/Osceola Parkway interchange (e.g., the location of Pond 2-2).
- In order to utilize the Pond 2-4 system as a joint-use facility, FDOT would require easement over the interconnected pond system. Based on information from the Osceola County Property Appraiser website, the total area of the 6 interconnected ponds in the Storey Lake development is approximately 99.2 ac.

Please see **Appendix J** for excerpts from SFWMD Application Nos. 150611-22, 160208-15 and 160248-7/Permit No. 49-00908-P. See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

6.3.3 Basin 3

Basin 3 is located on SR 535 from south of the SR 535/SR 536 intersection to north of the SR 535/SR 536 intersection, as well as SR 536 to the west of the SR 535/SR 536 intersection. Three pond alternatives are provided for Basin 3. Each alternative combines the existing wet detention pond (Exist. Pond 3-1) in the northwest quadrant of the SR 535/SR 536 intersection with a proposed offsite pond to provide the water quality treatment and attenuation requirements. The existing dry detention pond (Exist. Pond 3-2) in the southwest quadrant of the SR 535/SR 536 intersection is impacted by the proposed roadway improvements and cannot be used in the proposed condition.

Alternative 3A (Exist. Pond 3-1 & Pond 3-2)

Alternative 3A is composed of 2 interconnected wet detention ponds, Exist. Pond 3-1 and Pond 3-2. Exist. Pond 3-1 is the existing wet detention pond in the northwest quadrant of the SR 535/SR 536 intersection constructed as a linear ditch as part of SPN 75560-3610. Pond 3-2 is a proposed offsite wet detention pond in the southwest quadrant of the SR 535/SR 536 intersection (adjacent to Exist. Pond 3-2). Pond 3-2 will impact one parcel owned by WGW Partners LLC (the owner's name has been identified from the Orange

County Property Appraiser website). The Pond 3-2 site is undeveloped and is located adjacent to an existing SFWMD and Orange County conservation easement.

Pond 3-2 will be interconnected with Exist. Pond 3-1 via a pipe under SR 536. It is anticipated that multiple outfalls may be used for Exist. Pond 3-1 and Pond 3-2 (similar to the existing condition) to reduce the storage volume required. The number of outfalls and attenuation requirements for each outfall will be determined in final design, but the primary discharge will be towards SR 535 and to Shingle Creek.

See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

Alternative 3B (Exist. Pond 3-1 & Pond 3-3)

Alternative 3B is composed of 2 interconnected wet detention ponds, Exist. Pond 3-1 and Pond 3-3. Exist. Pond 3-1 is described in Alternative 3A. Pond 3-3 is a proposed offsite wet detention pond located in the southeast quadrant of the SR 535/SR 536 intersection that will impact 3 parcels – a developed commercial site owned by Red Rosen LLC, a developed commercial site owned by J&G Investment Group VC 1 LLC, and an undeveloped commercial site owned by Orange County Properties Limited LLC (owners have been identified from the Osceola County Property Appraiser website).

Due to the location of Pond 3-3 relative to Basin 3 and Exist. Pond 3-1, it is anticipated that the ponds will be interconnected in series with Exist. Pond 3-1 draining to Pond 3-3. It is anticipated that multiple outfalls may be used for Exist. Pond 3-1 and Pond 3-3 (similar to the existing condition) to reduce the storage volume required. The number of outfalls and attenuation requirements for each outfall will be determined in final design, but the primary discharge will be towards SR 535 and to Shingle Creek.

See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

Alternative 3C (Exist. Pond 3-1 & Pond 3-4)

Alternative 3C is composed of 2 interconnected wet detention ponds, Exist. Pond 3-1 and Pond 3-4. Exist. Pond 3-1 is described in Alternative 3A. Pond 3-4 is a proposed offsite wet detention pond located east of SR 535 and south of SR 536, and adjacent to the Internation Drive extension. Pond 3-4 will impact one parcel owned by Gissy Holdings I-Drive Property LLC (the owner's name has been identified from the Orange County Property Appraiser website).

Due to the location of Pond 3-4 relative to Basin 3 and Exist. Pond 3-1, it is anticipated that the ponds will be interconnected in series with Exist. Pond 3-1 draining to Pond 3-4. It is anticipated that multiple outfalls may be used for Exist. Pond 3-1 and Pond 3-4 (similar to the existing condition) to reduce the storage volume required. The number of outfalls and attenuation requirements for each outfall will be determined in final design, but the primary discharge will be towards SR 535 and to Shingle Creek.

See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

6.3.4 Basin 4

Basin 4 is located on International Drive west of SR 535. The proposed Basin 4 drainage area has been reduced from the existing condition by shifting a portion of the existing basin on International Drive to Basin 2. One pond alternative (Exist. Pond 4-1) is provided for Basin 4 as no improvements to the permitted stormwater system are proposed. The existing dry detention pond (Exist. Pond 4-2) in the northwest quadrant of the SR 535/International Drive intersection is impacted by the proposed roadway improvements and cannot be used in the proposed condition.

Alternative 4A (Exist. Pond 4-1)

Exist. Pond 4-1 is the existing wet detention pond located on the south side of International Drive and west of SR 535 constructed as part of the Greene Property Phase II improvements and permitted by SFWMD under Permit No. 48-00866-S. As noted in **Section 5.7.4** of this report, the Orange County 25yr-24hr design high water (DHW) elevation within Exist. Pond 4-1 is above the inside berm elevation in the existing condition. There is a slight increase in the impervious area within Basin 4, but a reduction in total basin area. The reduction in basin area will result in lowering the DHW elevation below the inside edge of berm while meeting water quality treatment and attenuation requirements. Note that site constraints do not allow an additional 50% water quality treatment for Basin 4. See **Appendix B** for Pond Alternative Exhibits and **Appendix C** for pond sizing calculations.

6.4 Preferred Pond Sites

The preferred alternative for each basin is provided in **Table 6-2** and anticipated right-of-way needs (excluding public right-of-way used for the alternatives) associated with the preferred alternatives are provided in **Table 6-3**. Existing stormwater ponds within Basins 1 and 4 have sufficient capacity to provide the required water quality treatment and attenuation in the ponds currently serving these basins, so no additional right-of-way is required based on the calculations contained herein.

Pond evaluation matrices for each basin are provided in **Appendix D**. A summary of the pond site recommendations is provided below:

- Exist. Pond 1-1 is sufficient for Basin 1

- Alternative 2A (Exist. Pond 2-1 and Pond 2-2) is the preferred alternative for Basin 2. Alternative 2A has the lowest estimated total cost, and is in the most hydraulically favorable location.

- Alternative 3A (Exist. Pond 3-1 and Pond 3-2) is the preferred alternative for Basin 3. The evaluation of the preferred alternative for Basin 3 also includes an evaluation of the floodplain compensation (FPC) site needs within Basin 3 (see the Location Hydraulics Report under separate cover for additional details).

  Therefore, the estimated total cost of the stormwater alternatives in conjunction with FPC site alternatives (assuming only 1 site per parcel is selected) was performed. Alternative 3A involves the expansion of an existing pond, and maintains the existing drainage patterns with less impact to the SR 535/SR 536 intersection. Alternative 3C requires more significant impact to the existing drainage systems at the SR 535/SR 536 intersection which may result in additional impacts to utilities and maintenance of traffic operations for the travelling public.

- Exist. Pond 4-1 is sufficient for Basin 4

Table 6-2: Preferred Pond Sites

Basin	Preferred Alternative	Ponds	Type	Remarks
1	1A	Exist. Pond 1-1	Wet	Exist. pond sufficient. Reduced drainage area (27.60 ac to 25.82 ac) from exist. to proposed conditions. Increased freeboard in exist. pond.
2	2A	Exist. Pond 2-1 and Pond 2-2	Wet	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 2-1 outfall to Shingle Creek.
3	3A	Exist. Pond 3-1 and Pond 3-2	Wet	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 3-1 and Pond 3-2 outfalls to Shingle Creek.
4	4A	Exist. Pond 4-1	Wet	Exist. pond sufficient. Reduced drainage area (7.96 ac to 6.00 ac) from exist. to proposed conditions and Exist Pond 4-2 removed. Increased freeboard in exist. pond.

Table 6-3: Right-of-Way Needs for Preferred Alternatives

Basin	Preferred Alternative	Ponds	Estimated R/W Req'd.	Remarks
1	1A	Exist. Pond 1-1	0.0	Pond within exist. R/W
2	2A	Exist. Pond 2-1 and Pond 2-2	3.0	Exist. Pond 2-1 within exist. R/W. Estimated R/W needs for Pond 2-2 provided (excluding public R/W used for pond).
3	3A	Exist. Pond 3-1 and Pond 3-2	3.5	Exist. Pond 3-1 within exist. R/W. Estimated R/W needs for Pond 3-2 provided (excluding public R/W used for pond).
4	4A	Exist. Pond 4-1	0.0	Pond within exist. R/W

6.5 Nutrient Loading Analysis

The project lies within the Shingle Creek basin, which is impaired for nutrients (macrophytes). It should be noted that north of SR 417, SR 535 is located on the divide between WBID 3169A and WBID 3169B (Reedy Creek Basin) and that WBID 3169B is not impaired for nutrients. SFWMD stated that nutrient loading calculations are not required for discharges to Shingle Creek due to this type of nutrient impairment, but that net improvement for total phosphorus (TP) is required because the project lies within the Lake Okeechobee BMAP. Impervious areas subject to non-vehicular traffic (e.g., sidewalk and shared use paths) do not require water quality treatment and can be separated out from the calculation of impervious area. For the purposes of the pond siting analysis in the PD&E, the shared use paths have been

included in the calculation of impervious area to provide a conservative estimate of water quality volume required. It is recommended that the impervious area acreage be refined during the design phase of the project to provide a more accurate estimate of water quality treatment volume requirements.

Based on the SFWMD pre-application meeting, dry detention facilities (existing or proposed) do not receive any credit for providing nutrient load reduction. As all basins discharge to Shingle Creek, net improvement for TP is analyzed on a project-wide basis. Nutrient load calculations using BMPTrains can be found in **Appendix C**. A summary of the net improvement calculations for the preferred pond sites is included in **Table 6-4**.

Table 6-4: Nutrient Loading Summary

Basin	Existing TP Loading (kg/yr)	Proposed TP Loading (kg/yr)	Difference in TP Loading (kg/yr)
1	3.41	3.13	-0.28
2	2.45	2.49	0.04
3	1.91	1.57	-0.34
4	1.58	1.02	-0.56
Total	9.35	8.21	-1.14

7.0 Floodplains and Floodways

The Federal Emergency Management Agency (FEMA) has developed Flood Insurance Rate Maps (FIRMs) for the study area. The relevant FIRM panel numbers are 12095C0605F for Orange County, Florida dated September 25, 2009, and 12097C0055G for Osceola County, Florida dated June 18, 2013. Based on the information contained within the FIRMs, there is a 100-year floodplain located directly south of SR 535 between Station 1550+00 and Station 1600+00. The floodplain through this area is bisected by International Drive and SR 417 creating three distinct sections. All three locations have been identified as Zone A on the FIRMs. There are no floodways located within the limits of the project. The floodplain limits in the vicinity of project improvements have been identified in the Pond Alternatives Exhibits provided in **Appendix B**. The FEMA FIRMs have also been provided in **Appendix A**.

Since all three locations of floodplain have been identified as Zone A, no base flood elevations (BFE) were provided on the FIRMs. In order to extrapolate a value for the BFEs to utilize in the floodplain impact calculations, the floodplain shapes were superimposed on contours generated from LiDAR data. The BFEs associated with each impact location have been identified in **Table 7-1** along with the floodplain impacts within each section.

Table 7-1: Base Flood Elevations and Floodplain Impacts

Floodplain Reference*	Station Range	Base Flood Elevation	Floodplain Impacts (ac-ft)
1	1582+00 to 1600+00	95	4.82
2	1569+00 to 1582+00	91	1.78
3	1550+00 to 1569+00	89.5	2.29
Total			**8.89**

*reference numbers as noted on the calculations and exhibits

Project improvements will result in longitudinal and transverse impacts to the 100-year floodplain. Longitudinal impacts are anticipated from encroaching into the floodplain areas due to the proposed roadway improvements, as well as from a stormwater pond berm. SR 535 does not bisect the floodplain but is instead on the upstream fringe of the mapped floodplain. Transverse impacts are anticipated from the extension or replacement of the existing cross drains. During the design phase, opportunities to reduce these impacts by optimizing the grading for ditches and proposed side slopes will be investigated. In addition to the impacts that result from the road widening, the Pond 3-2 maintenance berm will also encroach into the 100-year floodplain.

Since the three impact locations are within close proximity of each other, it was determined that the impacts from the three locations could be combined for developing compensation options. Equivalent storage was checked to ensure impacts at the lower elevations could be

accommodated at each floodplain compensation site. Five floodplain compensation (FPC) sites have been developed and are included as part of the analysis. Since land adjacent to the floodplain in the vicinity of the project is limited, four of the five FPC sites will be hydraulically connected to the floodplain utilizing storm drain piping. Pond liners have been assumed at FPC sites 1, 2, and 3 in order to provide compensation at equivalent elevations for those impacts at the lower end of the spectrum. Once more detailed information is obtained during the design phase it is anticipated that additional storage can be provided within the right-of-way at these lower elevations and the need for liners will be either be reduced or eliminated. The location of the five FPC sites are shown on the Pond Alternative Exhibits in **Appendix B** and the compensation provided at each location is summarized in **Table 7-2** below. Detailed calculations for each floodplain compensation site are provided in the **Location Hydraulics Report** under separate cover.

Table 7-2: Floodplain Compensation Alternatives

FPC Site	Station	Side	Floodplain Compensation Provided (ac-ft)
1	1586+00	Rt	14.45
2	1581+00	Rt	19.74
3	1575+00	Rt	19.74
4	1572+00	Lt	10.08
5	1566+00	Rt	12.75

All FPC site alternatives analyzed will provide the required storage to offset floodplain impacts. Based on this analysis, FPC Site 1 is the preferred alternative. The evaluation matrix which outlines all of the variables included in the analysis is provided in the **Location Hydraulics Report**.

8.0 Results

The analysis presented in this report identified potential stormwater pond sites based on recent aerials and other preliminary data. Once the potential pond sites were narrowed down to three alternatives, a more detailed analysis was conducted utilizing the following parameters: right-of-way requirements, easement requirements, costs for a given pond site, floodplain impacts, contamination and hazardous materials, potential utility impacts, threatened endangered & significant species, cultural resources, wetland impacts, construction and maintenance considerations, and impacts to other relevant features as noted in the pond site evaluation matrix provided in **Appendix D**. In conjunction with this analysis, a Contamination Screening Evaluation Report, Natural Resource Evaluation, and a Cultural Resource Assessment Survey were prepared and are provided under separate cover with this submittal. The preferred alternative for each basin is provided in **Table 8-1** and anticipated right of way needs (excluding public right-of-way used for the alternatives) associated with the preferred alternatives are provided in **Table 8-2**.

Table 8-1: Preferred Pond Alternatives

Basin	Preferred Alternative	Ponds	Type	Remarks
1	1A	Exist. Pond 1-1	Wet	Exist. pond sufficient. Reduced drainage area (27.60 ac to 25.82 ac) from exist. to proposed conditions. Increased freeboard in exist. pond.
2	2A	Exist. Pond 2-1 and Pond 2-2	Wet	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 2-1 outfall to Shingle Creek.
3	3A	Exist. Pond 3-1 and Pond 3-2	Wet	Interconnected ponds to provide required water quality treatment and attenuation. Utilize Exist. Pond 3-1 and Pond 3-2 outfalls to Shingle Creek.
4	4A	Exist. Pond 4-1	Wet	Exist. pond sufficient. Reduced drainage area (7.96 ac to 6.00 ac) from exist. to proposed conditions and Exist Pond 4-2 removed. Increased freeboard in exist. pond.

Table 8-2: Right-of-Way Needs for Preferred Alternatives

Basin	Preferred Alternative	Ponds	Estimated R/W Req'd.	Remarks
1	1A	Exist. Pond 1-1	0.0	Pond within exist. R/W
2	2A	Exist. Pond 2-1 and Pond 2-2	3.0	Exist. Pond 2-1 within exist. R/W. Estimated R/W needs for Pond 2-2 provided (excluding public R/W used for pond).
3	3A	Exist. Pond 3-1 and Pond 3-2	3.5	Exist. Pond 3-1 within exist. R/W. Estimated R/W needs for Pond 3-2 provided (excluding public R/W used for pond).
4	4A	Exist. Pond 4-1	0.0	Pond within exist. R/W

An analysis of floodplain impacts and FPC alternatives has been performed, and the evaluation matrix which outlines all of the variables included in the analysis is provided in the **Location Hydraulics Report**. Project improvements will impact the 100-year floodplain as a result of longitudinal impacts and transverse impacts. Impacts to the floodplain were conservatively estimated based on the existing profile and the potential impacts of the road widening within the project limits. During the design phase, opportunities to reduce these impacts by optimizing the grading for ditches and proposed side slopes should be investigated. The preferred FPC alternative and anticipated right of way needs associated with the preferred alternative are provided in **Table 8-3**.

Table 8-3: Preferred FPC Site

Name	Floodplain Impacts (ac-ft)	Floodplain Compensation Volume Prov'd. (ac-ft)	Estimated Pond R/W Req'd. (Including Access) (ac)
FPC 1	8.89	14.45	4.3

9.0 Conclusions

Potential ponds have been sized and located along the project limits for this PD&E study. The analysis estimates right-of-way needs using a volumetric analysis, which accounts for water quality treatment and water quantity for runoff attenuation. Please note that the estimated right-of-way areas for the ponds were based on pond sizes determined from preliminary data, calculations, reasonable engineering judgment, and assumptions. It should be noted that the information contained herein is preliminary and will need to be refined once this project enters the design phase. Pond sizes and configurations may change during final design as more detailed information on SHWT, wetland normal pool elevation, final roadway profile design, aesthetic requirements, etc. become available.