



Pond Siting Report Update

Prepared for: Florida Department
of Transportation – District 5

CR 46A Realignment from
SR 46 to North of Arundel Way
Lake County, Florida

FPID No. 238275-8-32-02

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Pond Siting Report Update

Realignment of CR 46A from SR 46 to North of Arundel Way

Executive Summary

CDM Smith Inc. (CDM Smith) has been contracted by the Florida Department of Transportation (FDOT) District 5 (D5) to prepare a Pond Siting Report Update for the County Road (CR) 46A Realignment from North of Arundel Way to State Road (SR) 46 (FPN 238275-8-32-02) in Lake County, Florida. Previous drainage studies for this alignment include the following:

- *Pond Siting Report for the Wekiva Parkway (SR 429)/SR 46 Realignment PD&E Study (FPN 238275-1-22-01 & 240200-1-22-01)* dated July 2010 and prepared under the Project Development & Environment (PD&E) design phase.
- *Drainage Design Report: Section 5 – CR 46 and CR 46A (FPN 431081-2-32-01)* dated May 10, 2012 and prepared under the Line & Grade design phase.

The purpose of this pond siting update task is to identify and evaluate alternative stormwater pond sites for the updated preferred roadway alignment. The process for identifying the alternative pond sites included the following steps:

- Identify a minimum of three alternative pond sites per basin.
- Maximize the use of remnant right-of-way parcels.
- Consider hydraulic, environmental and cost parameters.
- Consider input from property owners. The predominant property owner is Mr. Scott Taylor with whom we met on two occasions to discuss his preferences for pond locations on his property. The minutes of the meeting with Mr. Taylor are included in **Appendix L**.

The project includes the ultimate 4-laning of CR 46A from North of Arundel Way to SR 46 for a distance of approximately 2.5 miles where it will tie into the proposed Wekiva Parkway Section 4B alignment at the west side of the proposed SR 46 / SR 429 interchange. The Wekiva Parkway Section 4B project includes a proposed wet detention pond (Pond 4B-5) which is planned to accept the runoff from approximately 1,500 feet of this project at the eastern end of CR 46A.

For purposes of estimating the proposed pond sizes a rural four-lane typical section for CR 46A is used throughout the project alignment. A rural two-lane typical section has also been used for SR 46 from the begin construction location at Hojin Court to the SR 46 / CR 46A intersection. Additionally, the alternative stormwater ponds have been sized to accommodate the runoff from the proposed Wekiva Trail, a 12-foot wide paved mixed-used path along SR 46 and from the SR 46 / CR 46A intersection to the southern project terminus. The proposed typical sections are included in **Appendix B**.

The following is a summary of the proposed stormwater basins and preferred pond alternatives:

- Basin 5-1 is located at the south end of the project and extends from the begin construction location on SR 46 to the eastern terminus at the beginning of the Wekiva Parkway Section 4B project. Basin 5-1 extends north along CR 46A to about 200 feet northwest of the SR 46 / CR 46A intersection. Basin 5-1 is a closed basin which discharges to Mount Plymouth Lake. The preferred alternative has been identified as Pond 5-1B. Basin 5-1 includes significant floodplain impacts which will be compensated by grading down a portion of old SR 46 in addition to the proposed floodplain compensation pond FPC 5-1.
- Basin 5-2 extends northward from the northern boundary of Basin 5-1 at approximately 200 feet northwest of the SR 46 / CR 46A intersection to approximately 500 feet south of the intersection of CR 46A with the old CR 46A. Basin 5-2 is a closed basin which discharges to the Bear Pond floodplain. The preferred pond alternative is Pond 5-2B which is located west of the proposed roadway alignment and south of the Bear Pond floodplain. The proposed pond is designed to compensate for the impacts to the Bear Pond floodplain and provides a 50-foot strip between the proposed pond right-of-way and the parcel line to the west (at Red Tail Subdivision) to allow for future driveway access between the adjacent private parcels to the north and south.
- Basin 5-3 extends northward from the north boundary of Basin 5-2 to the begin project location on old CR 46. Basin 5-3 is an open basin which ultimately discharges to Seminole Creek to the northeast. The proposed outfall for Basin 5-3 is located on the north side of old CR 46A approximately 1,000 feet east of the proposed CR 46A alignment. The project alignment does not currently discharge through this area to Seminole Creek; therefore, the proposed ponds are designed to retain the 25-year / 24-hour volume. The preferred pond alternative for Basin 5-3 is Pond 5-3A which includes two equalized ponds (Ponds 5-3A-1 and 5-3A-2) located on a remnant parcel between proposed CR 46A and old CR 46A.

The Pond Alternatives Evaluation Matrix is included on the following page. The pre- and post-development drainage maps are included in **Appendix C** and the pond calculations are included in **Appendices E, F and G**.

Pond Alternatives Evaluation Matrix
Realignment of CR 46A from SR 46 to North of Arundel Way
FPN 238275-8-32-02

Basin	Pond Site ID	Pond Site Location	Parcel Code	Required Pond Size ^A (acres)	Required Total Parcel Size ^B (acres)	FEMA Flood Zone (YES/NO)	Utility Conflicts (Y/N)	Habitat Impacts (Level)	Wetland Impacts (Y/N)	Archaeological Impacts	Historic Site Impacts	Social Impacts	Current Land Use Zoning	Future Land Use Zoning	Total Cost ^{C, D} (\$M)	Comments
1	5-1A	Sta. 373+00, RT (BL SR 46)		5.81	7.88	YES	---	LOW	NO	---	---	---	---	---	\$1.91	This site not preferred by the owner.
	5-1B	Sta. 252+00, RT (BL CR 46A)		4.28	4.36	NO	---	HIGH	NO	---	---	---	---	---	\$1.28	Preferred
	5-1C	Sta. 394+00, LT (BL SR 46)		5.23	6.07	NO	---	MEDIUM	NO	---	---	---	---	---	\$1.11	This site not preferred by the owner.
2	5-2A	Sta. 216+00, LT (BL CR 46A)		6.90	11.77	NO	---	MEDIUM	NO	---	---	---	---	---	\$2.65	
	5-2B	Sta. 216+00, LT (BL CR 46A)		6.99	11.71	NO	---	MEDIUM	NO	---	---	---	---	---	\$2.75	Preferred
	5-2C	Sta. 216+00, LT (BL CR 46A), Sta. 201+00, LT (BL CR 46A)		7.47	12.59	NO	---	MEDIUM	NO	---	---	---	---	---	\$2.67	This alt. not preferred by the owner.
	5-2D	Sta. 216+00, LT (BL CR 46A), Sta. 201+00, LT (BL CR 46A)		7.37	12.30	NO	---	MEDIUM	NO	---	---	---	---	---	\$2.70	This alt. not preferred by the owner.
3	5-3A	Sta. 185+00, RT (BL CR 46A)		5.90	0.00	NO	---	MEDIUM	NO	---	---	---	---	---	\$0.78	Preferred
	5-3B	Sta.198+00, LT (BL CR 46A) Sta. 201+00, LT (BL CR 46A)		5.27	1.56	NO	---	LOW	NO	---	---	---	---	---	N/A	Available area not large enough for hydraulic purposes.
	5-3C	Sta. 100+00 (BL Old CR 46A)		3.15	3.61	NO	---	LOW	NO	---	---	---	---	---	\$0.79	

Notes:

A) Required pond size is measured at the outside top of berm.

B) Includes additional R/W required for ponds only. Does not include remnant roadway parcels that are utilized for ponds.

C) Total cost includes wetland impacts, species impacts, R/W costs and construction

D) The cost evaluation for the stormwater management facility alternatives in this report includes stormwater management facility construction costs, costs associated with wetland impacts, and parcel acquisition costs. The stormwater management facility construction costs include cost of installed drainage structures, drainage pipes and outfalls, clearing and grubbing, earthwork excavation and grading, berm construction, erosion protection, fencing, access accommodations and sodding. The associated parcel acquisition costs for each alternative evaluated include the estimated cost of land and any impacted improvements, administrative costs and legal fees.

Pond Siting Report Update

Realignment of CR 46A from SR 46 to North of Arundel Way

1.0 Introduction

CDM Smith has been contracted by FDOT D5 to prepare a Pond Siting Report Update for the CR 46A Realignment from North of Arundel Way to SR 46 (FPN 238275-8-32-02). The project is located near the City of Mt. Plymouth in Sections 21, 27, 28, 29 and 37; Township 19 South; Range 28 East in Lake County, Florida.

The purpose of this pond siting update task is to evaluate alternative stormwater pond sites for the updated roadway alignment. Three alternative pond sites were evaluated for Basins 5-1 and 5-3 and four alternative pond sites were evaluated for Basin 5-2. A preferred pond site alternative for each basin has been identified based on our evaluation of the criteria shown on the Pond Alternatives Evaluation Matrix (see Executive Summary) and is documented within the following sections of the report.

2.0 Project Description

The proposed CR 46A realignment project is approximately 2.5 miles long and extends from existing CR 46A to the interchange with the Wekiva Parkway (Section 4B) project, which is located along existing SR 46 as shown on the Location Map (**Figure 1**) in **Appendix A**.

The proposed CR 46A realignment project is planned as an ultimate rural, 4-lane, divided typical section. An interim phase consisting of a rural, 2-lane, undivided typical section will be constructed. The proposed right-of-way and stormwater ponds will be designed for the ultimate 4-lane section; therefore, this report will refer to the ultimate roadway geometry for purposes of sizing the proposed stormwater ponds. The ultimate phase typical sections are included in **Appendix B**.

The project also includes a portion of the Wekiva Trail, which is a proposed 12-foot wide paved multi-use path. The Wekiva Trail will be located along the north side of existing SR 46, west of the proposed intersection with CR 46A, and along the south side of the alignment from the intersection to the interchange with the Wekiva Parkway. The proposed ponds are designed to accommodate the stormwater requirements for the Wekiva Trail within the limits of this project.

The roadway alignment used for this study was established based on coordination with project stakeholders including FDOT D5, Lake County, the Lake-Sumter Metropolitan Planning Organization (MPO), and affected landowners.

3.0 Previous Drainage Studies

Previous drainage studies prepared for this project and adjacent developments that were referenced for this study include the following:

- *Pond Siting Report for the Wekiva Parkway (SR 429)/SR 46 Realignment PD&E Study (FPN 238275-1-22-01 & 240200-1-22-01)*, dated July 2010 and prepared under the Project Development & Environment (PD&E) design phase. This study provided alternative pond sites and pond sizing estimates for each of the alternative alignments that were under consideration.

- *Drainage Design Report: Section 5 – CR 46 and CR 46A (FPN 431081-2-32-01)* dated May 10, 2012 and prepared under the Line & Grade design phase. This study provided detailed designs of stormwater retention ponds and floodplain compensation ponds for the preferred alignment that was identified during the PD&E design phase.
- *Hojin Garden MSSW Permit Application (Permit No. 40-069-0192A)* dated September 1995 and prepared for SJRWMD for Environmental Resource Permitting of the proposed Hojin Garden Development.
- *Heathrow Country Estates (aka, Red Tail Subdivision) Stormwater Design Calculation (Permit No. 82093)* dated January 2002 and prepared for the St. Johns River Water Management District (SJRWMD) for Environmental Resource Permitting of the Red Tail Subdivision.

4.0 Coordination

The following meetings have been conducted to coordinate elements of the pond siting study:

- FDOT Drainage Kickoff Meeting (February 22, 2013)
- FDOT Right-of-way Kickoff Meeting (March 6, 2013)
- On-site Meeting with Mr. Scott Taylor, Property Owner (June 25, 2013)
- Lake County Engineering Meeting (July 8, 2013)
- Coordination Meeting with Mr. Scott Taylor, Property Owner (September 12, 2013)

Minutes of these meetings are included in **Appendix L**.

5.0 Existing Conditions

5.1 Land Use

The existing land uses within and adjacent to the project alignment include agricultural, low density residential and State-owned lands. Refer to **Figure 5** in Appendix A for an aerial layout of the project alignment and pond sites.

5.2 Soils

The existing soils are generally characterized as well-drained sandy soils throughout the majority of the project alignment. The estimated seasonal high groundwater levels provided by Geotechnical and Environmental Consultants, Inc. (GEC) at the alternative pond sites range between +50 to +60 feet NAVD. The geotechnical information provided by GEC for this study is included in **Appendix J**. The limits of the soil types identified by the U.S. Department of Agriculture Natural Resource Conservation Services (NRCS) are shown on **Figure 4** in **Appendix A**.

5.3 Floodplains

The project alignment traverses two FEMA 100-year designated floodplains which include the Mount Plymouth Lake and Bear Pond floodplains that have 100-year flood elevations of +64 and +59 feet NAVD, respectively. Additionally, the project alignment crosses several local depressions, which provide historical basin storage but are not designated FEMA floodplains. The FEMA floodplains are shown on the FEMA maps on **Figure 3** in **Appendix A**. The local depressions are shown on the drainage maps included in **Appendix C**.

5.4 Existing Drainage Patterns

The existing drainage basins are shown on the Pre-Development Drainage Maps in **Appendix C**. Below is a summary of the existing drainage patterns for each of the three basins located within the project alignment:

5.4.1 Basin 5-1

Basin 5-1 is located within the Mount Plymouth Lake basin, which is considered a closed basin by the Florida Department of Environmental Protection (FDEP). Basin 5-1 is located at the south end of the project and extends within the project limits from Station 365+00 (SR 46 Base Line (BL) of Survey) to Station 407+71 (SR 46 BL of Survey) at the tie-in with Section 4B. Basin 5-1 also extends north to Station 253+70 (CR 46A BL of Survey). Basin 5-1 includes four sub-basins described as follows:

- Sub-Basin 5-1-1 (43.50 ac) drains to an existing ditch located along the north side of SR 46. The limits of the area draining to this wetland are outlined on the Pre-Development Drainage Maps in **Appendix C**. Generally, the north side of SR 46 throughout the project sheet flows into this existing ditch where it is then conveyed to a low point at approximately Station 394+00 (SR 46 BL of Survey). At the low point is an existing 24-inch cross-drain which conveys the ditch flow to the south into Mount Plymouth Lake and serves as a floodplain equalizer at higher elevations. The ditch basin is hydraulically connected at Elevation +63.5 feet NAVD to an existing wetland to the north located from approximately Station 395+00 to Station 400+00 (SR 46 BL of Survey). The hydraulic connection between the ditch and wetland are just below the 100-year FEMA flood elevation of +64 feet NAVD.
- Sub-Basin 5-1-2 (25.72 ac) drains to an existing wetland located north of SR 46 from Station 395+00 to 400+00 (SR 46 BL of Survey). The limits of the area draining to this wetland are outlined on the Pre-Development Drainage Maps in **Appendix C**. As mentioned in the discussion for Sub-Basin 5-1-1, this wetland has a high level connection with the existing ditch located along the north side of SR 46. This wetland is included in the FEMA 100-year floodplain limits for Mount Plymouth Lake. The 100-year FEMA flood elevation for this system is +64 feet NAVD.
- Sub-Basin 5-1-3 (19.09 ac) drains to an existing surface water feature located on the north side of SR 46 from Station 389+00 to 391+00 (SR 46 BL of Survey). This feature is a land-locked surface water that is not hydraulically connected with the adjacent sub-basins at elevations below the 100-year FEMA flood elevation of +64 feet NAVD. This surface water feature has a designated FEMA 100-year flood elevation of +64 feet NAVD. The limits of Sub-Basin 5-1-3 are shown on the Pre-Development Drainage Maps in **Appendix C**.
- Sub-Basin 5-1-4 (5.81 ac) is the area of proposed Pond Site 5-1A located on the south side of SR 46 between Stations 370+00 and 377+00 (SR 46 BL of Survey). The runoff in this sub-basin sheet flows east and west into the Mount Plymouth Lake floodplain. The other alternative pond sites (Ponds 5-1B and 5-1C) are included within Sub-Basins 5-1-1, 5-1-2 and 5-1-3. The limits of Sub-Basin 5-1-4 are shown on the Pre-Development Drainage Maps in **Appendix C**.
- Sub-Basin 5-1-5 (5.58 ac) is the area south of the crown line on SR 46 which sheet flows directly into Mount Plymouth Lake. This basin extends along the portion of the project alignment where the proposed CR 46A will be constructed south of the existing crown line of SR 46. The limits of Sub-Basin 5-1-5 are shown on the Pre-Development Drainage Maps in **Appendix C**.

5.4.2 Basin 5-2

Basin 5-2 is located within the Bear Pond Outlet basin which is considered a closed basin by the FDEP. Basin 5-2 is located within the central portion of the project and extends within the project limits from Station 204+00 (CR 46A BL of Survey) to Station 253+70 (CR 46A BL of Survey). Basin 5-2 includes three sub-basins described as follows:

- Sub-Basin 5-2-1 (49.43 ac) extends from Station 226+00 to Station 253+70 (CR 46A BL of survey) at the south end of Basin 5-2. Runoff from this sub-basin sheet flows to the west discharging into Bear Pond. The limits of Sub-Basin 5-2-1 are shown on the Pre-Development Drainage Maps in **Appendix C**.
- Sub-Basin 5-2-2 (70.74 ac) is the area at the north end of Basin 5-2 which extends from Station 204+00 to Station 222+00 (CR 46A BL of Survey). The runoff within this sub-basin sheet flows to four local depressions that are hydraulically connected to the Bear Pond floodplain. The 100-year elevation of the Bear Pond floodplain is +59 feet NAVD. The limits of Sub-Basin 5-2-2 are shown on the Pre-Development Drainage Maps in **Appendix C**.
- Sub-Basin 5-2-3 (7.51 ac) extends from Station 222+00 to Station 226+00 (CR 46A BL of survey). The runoff from this sub-basin sheet flows to an existing depression located between Stations 223+00 to Station 225+00 (CR 46A BL of survey), right. This local depression is not hydraulically connected to the Bear Pond floodplain and has been identified as a land-locked depression. The limits of Sub-Basin 5-2-3 are shown on the Pre-Development Drainage Maps in **Appendix C**.

5.4.3 Basin 5-3

Basin 5-3 is located within the Seminole Creek basin which is considered an open basin and Outstanding Florida Waterway by the FDEP. Basin 5-3 is located at the north end of the project and extends within the project limits from the begin project location at Station 168+50 to Station 204+00 (CR 46A BL of Survey), which is about 300 feet south of the proposed CR 46A and old CR 46A intersection. The three sub-basins located within Basin 5-3 are described as follows:

- Sub-Basin 5-3-1 (30.78 ac) extends from Station 190+00 to Station 204+00 (CR 46A BL of survey). The runoff from this basin sheet flows to an existing depression located to the south of existing CR 46A from Station 198+00 to Station 200+00 (CR 46A BL of survey). This depression is not considered a FEMA floodplain; however, it provides historical basin storage. To be conservative, the runoff rate from this sub-basin was not considered in the overall pre-development runoff rate for Basin 5-3. The limits of Sub-Basin 5-3-1 are shown on the Pre-Development Drainage Maps in **Appendix C**.
- Sub-Basin 5-3-2 (1.12 ac) is a relatively small area located from Station 186+00 to Station 190+00 as shown on the Pre-Development Drainage Maps in **Appendix C**. The runoff from this sub-basin sheet flows to the northeast and ultimately discharges to Seminole Creek, a designated Outstanding Florida Waterway (OFW). To be conservative, the runoff rate from this sub-basin was not considered in the overall pre-development runoff rate for Basin 5-3.
- Sub-Basin 5-3-3 (12.85 ac) extends from the begin project at Station 168+50 (CR 46A BL of Survey) to Station 190+00 (CR 46A BL of Survey). The runoff from this basin sheet flows to two local depressions located north of the project alignment at Stations 176+00 and 184+00 (CR 46A BL of Survey). To be conservative, the runoff rate from this sub-basin was not considered in

the overall pre-development runoff rate for Basin 5-3. The basin limits for Sub-Basin 5-3-3 are shown on the Pre-Development Drainage Maps in **Appendix C**.

6.0 Proposed Conditions

This section of the report will provide information regarding the project's proposed conditions including the roadway geometry, design criteria and pond designs.

6.1 Proposed Roadway Characteristics

The proposed roadway is a rural 4-lane divided highway from the begin project at the tie-in with existing CR 46A to just west of Section 4B where an urban 4-lane divided section will be constructed. The proposed section for the CR 46A portion includes four 12-foot travel lanes and a 40-foot depressed median. The rural and urban sections along old SR 46 include four 12-foot travel lanes and a 22-foot median which will be depressed for the rural section and raised for the urban section. The proposed CR 46A along the old SR 46 alignment includes a 12-foot mixed-use path on the south side of the roadway. This path will be located within the FDOT right-of-way and will be sloped to drain to a proposed roadside conveyance ditch located between the roadway and the path. The proposed roadway typical sections are included in **Appendix B**.

6.2 Pond Design Criteria

The following regulatory agencies and associated criteria have been considered for the purpose of designing the proposed pond alternatives for this project. In the case of conflicting criteria, the proposed design has adopted the most restrictive criteria.

Florida Department of Environmental Protection

- **Wekiva River Hydrologic Basin:** The project is located within the protected Wekiva River Hydrologic Basin and is, therefore, subject to additional permit submittal requirements.
- **Attenuation:** For closed basins the post-development discharge volume for the 25-year / 96-hour storm event must be less than or equal to the pre-development discharge volume. For open basins the peak runoff rate for the post development 25-year / 24-hour storm event must be less than or equal to the pre-development peak discharge rate.
- **Water Quality:** For off-line dry retention systems the water quality volume is the greater of the first one-half inch of runoff over the basin area or 1.25 inches of runoff over the impervious area; plus an additional one-half inch of runoff from the basin. For Outstanding Florida Waterways (OFW), an additional 50% of the water quality volume calculated is required. Seminole Creek, the outfall for Basin 5-3, is considered an OFW.
- **Volume Recovery:** Dry retention systems must provide the capacity for the treatment volume to recover within 72 hours following a storm event assuming average antecedent moisture conditions.
- **Most Effective Recharge Areas:** This project is located within a designated Most Effective Recharge Area and is required to retain at least three inches of runoff from the directly connected impervious area or must demonstrate that the post-development recharge will be equal to or greater than the pre-development recharge.

- ***Floodplains:*** Cup for cup compensation, or in-kind replacement of the volume impacts between the seasonal high groundwater level and the floodplain elevation, shall be provided for impacts to the 100-year FEMA floodplain.

Florida Department of Transportation

- ***Attenuation:*** For closed basins, the post-development discharge volume must not exceed the pre-development discharge volume for the critical duration storm events. The critical storm for estimating runoff volume differences is the 100-year / 240-hour storm event. For open basins, the FDOT critical storm analysis is not required.
- ***Volume Recovery:*** One-half of the provided retention volume must be recovered within 7 days and all of the provided retention volume must be recovered within 15 days. A factor of safety of 2 shall be applied to either the hydraulic conductivity or the required recovery time.
- The following pond geometry criteria were utilized for conservatively sizing the pond alternatives for this project:
 - 20' maintenance berms with slopes ranging from 1:10 (V:H) to 1:20.
 - Maximum 1:4 side slopes between the inside top of berm to the pond bottom.
 - Maximum 1:2 side slopes for tying down to existing grade outside the maintenance berms.
 - Minimum 30-foot radii for the inside corners of maintenance berms.
 - At least one foot of freeboard will be provided between the peak stage and the inside top of berm.

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- Retention ponds which are contributory to land-locked areas with no positive outlet shall be designed to retain the difference in runoff between the pre- and post-development discharge volumes for the 25-year / 96-hour storm event.

6.3 Proposed Drainage Approach

The following sections describe the proposed drainage approach for each of the three basins located within the project limits.

6.3.1 Basin 5-1

A proposed dry retention pond is proposed for Basin 5-1 to provide water quality treatment and attenuation. Three alternative pond sites, referred to as Ponds 5-1A, 5-1B and 5-1C, were evaluated. A summary of the alternatives pond sites considered is as follows:

- ***Pond 5-1A:*** This site is approximately 7.9 acres of undeveloped and wooded land that was planned for residential development. The site is located on the south side of SR 46 between Station 369+00 to Station 378+00 (BL Survey of SR 46). The existing elevation of the site ranges from +60 to +69 feet NAVD and the preliminary estimated seasonal high groundwater level is +57.6 feet NAVD. The pond was laid out to maximize its size on this parcel while allowing sufficient distance for tie-in slopes within the limits of the proposed pond right-of-way.
- ***Pond 5-1B:*** This site is located between the east boundary of the existing Hojin Garden residential parcels and the proposed CR 46A alignment from Station 246+00 to Station 255+00

(BL Survey CR 46A). The existing ground elevations on the site range from +65 feet NAVD to +85 feet NAVD and the preliminary estimated seasonal high groundwater level is +52.4 feet NAVD. The size of the pond and required pond right-of-way for this site was configured to minimize the impact to the Hojin Garden parcels.

- **Pond 5-1C:** This site is located in undeveloped pasture land between an existing surface water feature and wetland on the north side of SR 46 from Station 390+00 to Station 395+00 (BL Survey SR 46). The existing ground elevations on the site range from +65 to +72 feet NAVD and the preliminary estimated seasonal high groundwater level is +56.6 feet NAVD. The size of the pond and required pond right-of-way for this site was configured to minimize the impact to the existing parcel.

The methodology for establishing the required pond sizes in Basin 5-1 is summarized as follows:

- **Step 1:** Evaluate the pre-/post-development runoff volume difference for the 100-year/240-hour storm. The portions of the pre-development sub-basins which do not currently drain to the Mount Plymouth Lake floodplain were not considered in the pre-development runoff volume calculation.
- **Step 2:** The maximum inside top of berm elevation was established as Elevation +65 feet NAVD, which allows for a peak stage of +64 feet NAVD assuming a minimum of 1 foot of freeboard. One-half foot was assumed for additional attenuation depth above the retention stage which establishes the 100-year/240-hour pre-/post-development runoff volume difference maximum retention stage as +63.5 feet NAVD.
- **Step 3:** Establish the proposed pond bottom by providing a minimum of 4 feet of clearance above the estimated seasonal high groundwater level.
- **Step 4:** Establish the maintenance berm width as 20 feet with a slope of 1:20. Internal pond slopes were set at 1:4 (V:H) and outside tie-in slopes at a maximum of 1:2 (V:H).
- **Step 5:** Determine the pond area required to store the required retention volume as constrained by the maximum berm and pond bottom elevations. It's noted that the seasonal high groundwater level varies per site as well the runoff volume difference varies by site; therefore the required pond area varied for each alternative considered.

The Basin 5-1 design results are summarized in **Table 1**, below:

Table 1
Basin 5-1 Pond Design Summary

Pond Alternative	Maximum Retention Stage (ft NAVD)	Required Retention Volume ¹ (AF)	Required Water Quality (WQ) Volume (AF)	Provided Retention and WQ Volume ² (AF)	SHWL Clearance (feet) ³
5-1A	63.5	6.63	2.08	6.63	>4
5-1B	63.5	7.89	2.01	8.21	>5
5-1C	63.5	8.28	2.09	9.18	>4

- 1) 100-yr/240-hr pre-/post- volume difference
- 2) Storage provided at the maximum retention stage
- 3) Clearance between the SHWL and the pond bottom elevation

Please refer to the Pond Alternative Matrix in the Executive Summary, the pond detail sheets in **Appendix D** and the Basin 5-1 calculations in **Appendix E** for additional information.

6.3.2 Basin 5-2

Wet and dry retention systems were considered for Basin 5-2 to provide water quality treatment and attenuation. Four alternative pond configurations, referred to as Ponds 5-2A, 5-2B, 5-2C and 5-2D were evaluated. A summary of the alternative pond sites considered is as follows:

- ***Pond 5-2A (Wet Retention)***: This site is located in an undeveloped pasture on the west side of the project alignment from Station 213+00 to Station 218+00 (CR 46A BL of Survey). The existing ground elevation on this site ranges from +60 to +78 feet NAVD and the preliminary estimated seasonal high groundwater level is +53.7 feet NAVD. The pond layout was established by locating the northern berm of the pond adjacent to the edge of the 100-year floodplain elevation of +59 feet NAVD and extending the pond west to the parcel line at the edge of the Red Tail Subdivision. The pond width was then varied to provide the required retention storage.
- ***Pond 5-2B (Wet Retention)***: This pond location and layout is similar to Pond 5-2A, with the exception that a 50-foot wide strip was left between the proposed pond site and the western property line to allow for private driveway access between the parcels located north and south of the pond. This pond is slightly wider than Pond 5-2A to allow for the 50-foot strip on the west side.
- ***Pond 5-2C (Wet and Dry Retention)***: This alternative includes two pond sites to provide the water quality treatment and attenuation for Basin 5-2. Proposed Pond 5-2C-1 is a wet retention system and proposed Pond 5-2C-2 is a dry retention system. The northern pond site (Pond 5-2C-2) is located in the southeast quadrant of the proposed CR 46A / Old CR 46A intersection as shown on the Pond Detail Sheets in **Appendix D**. The existing ground elevation on the Pond 5-2C-2 site ranges from +65 to +72 feet NAVD. The location and layout of the other pond site (Pond 5-2C-1) was established similar to Pond 5-2A, with the exception that the storage requirement and subsequent pond size were reduced by the amount of storage provided in Pond 5-2C-2.
- ***Pond 5-2D (Wet and Dry Retention)***: This alternative includes two pond sites (Ponds 5-2D-1 and 5-2D-2) with the locations, pond types and layouts being similar to those described for Pond 5-2C. The exception is that Pond 5-2D-1 was laid out to provide a 50 foot buffer between the western pond right-of-way and the parcel line at the Red Tail Subdivision.

The methodology for establishing the required pond sizes in Basin 5-2 is summarized as follows:

- ***Step 1***: Evaluate the pre-/post-development runoff volume difference for the 100-year/240-hour storm. The portion of Sub-Basin 5-2-3 which is routed to the proposed ponds was not considered in the pre-development runoff volume calculation because it currently drains to an existing land-locked depression located on the west side of the proposed CR 46A alignment from Station 223+00 to Station 225+00 (CR 46A BL of Survey).
- ***Step 2A***: For the ponds located on the west side of the proposed CR 46A alignment (Ponds 5-2A, 5-2B, 5-2C-1 and 5-2D-1) the maximum inside top of berm elevation was established at +59 feet NAVD. Floodplain compensation storage for impacts to the 100-year FEMA floodplain is to be provided in these ponds from +57 to +59 feet NAVD which allows a peak stage of +57 feet NAVD for storing the required retention volume. Considering the depth to the estimated seasonal high

groundwater level and the presence of shallow clay layers these ponds were designed as wet retention systems; therefore, since the required pond volume recovery is not possible the ponds were conservatively sized to retain back to back 100-year/240-hour pre-/post-development runoff volume differences up to +57 feet NAVD. The starting water elevation was established at the preliminary estimated seasonal high groundwater level of +53.7 feet NAVD.

- Step 2B: Dry retention ponds 5-2C-2 and 5-2D-2 are identical in layout and design. The maximum inside top of berm elevation was established as +64 feet NAVD which allows a peak stage of +63 feet NAVD assuming one foot of freeboard. One half foot of peak discharge attenuation to the peak stage was used which results in Elevation +62.5 feet as the maximum retention storage stage elevation for the 100-year/240-hour pre-/post-development runoff volume difference. The pond bottom elevation was established at four feet above the preliminary estimated seasonal high groundwater level.
- Step 3: The maintenance berm width for all ponds was established as 20 feet with a slope of 1:20 (V:H) for Ponds 5-2C-1 and 5-2D-2 and a slope of 1:10 for Ponds 5-2A, 5-2B, 5-2C-1 and 5-2D-1. Internal pond slopes were set at 1:4 and outside tie-in slopes at a maximum of 1:2.
- Step 4: The sizes of Ponds 5-2C-2 and 5-2D-2 were maximized to utilize the entire parcel. The resulting storage provided in Ponds 5-2C-2 and 5-2D-2 was then subtracted from the required storage for Ponds 5-2A, 5-2B, 5-2C-1 and 5-2D-1 and the geometry of these ponds was then varied in order to provide the remaining storage and floodplain compensation volumes for Basin 5-2.

Please refer to the Pond Alternative Matrix in the Executive Summary, the pond details sheets in **Appendix D** and the Basin 5-2 calculations in **Appendix F** for additional information. The Basin 5-2 design results are summarized in **Table 2** on the following page.

6.3.3 Basin 5-3

Proposed dry retention systems are proposed for Basin 5-3 to provide water quality treatment and attenuation. Three alternative pond sites, referred to as Ponds 5-3A, 5-3B and 5-3C, were evaluated. A summary of the alternatives pond sites considered is as follows:

- Pond 5-3A: This site is a remnant parcel of undeveloped pasture land that is located between existing CR 46A and proposed CR 46A from Station 175+00 to Station 192+00 (CR 46A BL of Survey). The site will be split into two equalized ponds which will be separated by a driveway at Station 181+00 (CR 46A BL of Survey). The existing ground elevations across the site ranges from +62 to +75 feet NAVD and the preliminary estimated seasonal high groundwater level is +55.7 feet NAVD. This design approach for this pond site was to maximize the available land within this remnant parcel to provide as much retention storage within the available area.
- Pond 5-3B: This pond alternative includes the remnant right-of-way parcel located in the northeast quadrant of the intersection of proposed CR 46A and old CR 46A at Station 100+00 (old CR 46A BL of Survey) and the undeveloped wooded parcel located in the southeast quadrant of the same intersection and bounded by the eastern parcel line of SEDA Properties, LLC to the east and the proposed CR 46A alignment to the west. The two ponds were considered as one equalized pond. The existing ground elevations on the site range from +55 to +77 feet NAVD and the preliminary estimated seasonal high groundwater level is +55.0 feet NAVD. The design approach for this pond site was to maximize the available land within these two parcels to provide as much retention storage within the available area.

Table 2
Basin 5-2 Pond Design Summary

Pond Alternative	Pond Names	Maximum Retention Stage (ft NAVD)	Required Retention Volume ¹ (AF)	Required Water Quality (WQ) Volume (AF)	Provided Retention and WQ Volume ² (AF)	Required Floodplain Compensation (AF)	Provided Floodplain Compensation (AF)	SHWL Clearance (feet) ³
5-2A	5-2A	57.0	16.0	2.95	16.1	9.3	10.9	N/A
5-2B	5-2B	57.0	15.8	2.95	16.6	9.3	11.3	N/A
5-2C	5-2C-1	57.0	13.6	3.10	13.8	9.3	9.6	N/A
	5-2C-2	62.5	N/A		2.2	N/A	N/A	>4
	Total	N/A	15.8	3.10	16.0	9.3	9.6	N/A
5-2D	5-2D-1	57.0	13.6	3.10	13.8	9.3	9.5	N/A
	5-2D-2	62.5	N/A		2.2	N/A	N/A	>4
	Total	N/A	15.89	3.10	16.0	9.3	9.5	N/A

- 1) 2 x 100-yr/240-hr pre-/post- volume difference
- 2) Storage provided at the maximum retention stage
- 3) Clearance between the SHWL and the pond bottom elevation. N/A is reported for wet retention ponds.

- **Pond 5-3C:** This site is located in the northeast quadrant of the intersection of proposed CR 46A and old CR 46A. The pond location includes a portion of the old CR 46A right-of-way and existing undeveloped offsite pasture land to the north. The existing ground elevations on the site range from +55 to +76 feet NAVD and the preliminary estimated seasonal high groundwater level is +55.0 feet NAVD. The size of the pond and required pond right-of-way for this site was minimized to limit the impact to the existing parcel.

The methodology for establishing the required pond sizes in Basin 5-3, an open basin, is summarized as follows:

- **Step 1:** Considering that none of the existing sub-basins currently drain to the outfall location, the ponds were sized to retain the 25-year/24-hour post-development runoff volume for the pond drainage basin.
- **Step 2:** The maximum inside top of berm elevation was established as Elevation +64 feet NAVD which allows for a peak stage of +63 feet NAVD assuming a minimum of 1 foot of freeboard. One-half foot was assumed for additional attenuation depth above the retention stage which establishes the maximum retention stage as +62.5 feet NAVD.
- **Step 3:** Establish the proposed pond bottom by providing a minimum of 4 feet of clearance above the seasonal high groundwater level.
- **Step 4:** Establish the maintenance berm width as 20 feet with a slope of 1:20. Internal pond slopes were set at 1:4 and outside tie-in slopes at a maximum of 1:2.
- **Step 5:** Determine the pond area required to store the required retention volume as constrained by the maximum berm and pond bottom elevations. It's noted that the estimated seasonal high groundwater levels vary per site; therefore the required pond areas vary per site.
- **Step 6:** Impacts to the existing land-locked depression were checked by flood routing the pre- and post-development drainage areas and basin storage capacity.

The Basin 3 design results are summarized in **Table 3** below:

Table 3
Basin 5-3 Pond Design Summary

Pond Alternative	Maximum Retention Stage (ft NAVD)	Required Water Quality (WQ) Volume ⁵ (AF)	Required Retention Volume ¹ (AF)	Provided Retention and WQ Volume ² (AF)	SHWL Clearance (feet) ³
5-3A	62.5	2.89	6.75	8.39	>4
5-3B ⁴	62.5	2.68	6.88	3.17	>4
5-3C	62.5	2.37	6.80	6.89	4

- 1) 25-yr/24-hr post-development runoff volume
- 2) Storage provided at the maximum retention stage
- 3) Clearance between the SHWL and the pond bottom elevation
- 4) Pond 5-3B does not provide the minimum storage volume
- 5) The required water quality volume includes an additional 50% for OFW criteria.

Please refer to the Pond Alternative Matrix in the Executive Summary, the pond detail sheets in **Appendix D** and the Basin 5-3 calculations in **Appendix G** for additional information.

6.4 Tailwater Considerations

The effect of tailwater is an importation consideration in evaluating the feasibility of a pond site. In general, the proposed ponds in Basins 5-1 and 5-2 will discharge to floodplain systems associated with Mount Plymouth Lake and Bear Pond, respectively. The design overflow elevation for the Basin 5-1 ponds was established as +63.5 feet NAVD which is slightly below the 10-, 50- and 100-year floodplain elevations for the Mount Plymouth Lake floodplain elevations of +63.8, +64.0 and +64.1 feet NAVD, respectively. However, considering the inside top of berm for all of the proposed ponds in Basin 5-1 was established as +65 feet NAVD it is acceptable for the floodplain stages to backflow into the ponds as it will be contained below the pond berm elevations and the pond will return to its normal function as the floodplain stages recede.

The Bear Pond floodplain will backflow into the proposed Basin 5-2 ponds as designed. The Basin 2 ponds will provide floodplain compensation for impacts to the existing 100-year floodplain. The inside top of berm elevation for the Basin 2 ponds located adjacent to the Bear Pond floodplain is +59.0 feet NAVD which is at the 100-year floodplain elevation and which will ensure that these ponds will not overtop for the 100-year flood event.

In Basin 5-3, the proposed outfall is located approximately one-thousand feet east of the project alignment on the north side of old CR 46A. This outfall location is an existing low area and drainage way that provides discharge for runoff from the north and south roadside ditches on old CR 46A. There is an existing cross drain under old CR 46A at this location. This existing ditch conveyance drains to the north to Seminole Creek. The existing ground elevation at the outfall location is approximately +50 feet NAVD. During our field reconnaissance we did not observe any standing water at this location; therefore, we anticipate the tailwater elevation to be a minimal distance above the existing ground elevation. The proposed overflow elevations for Basin 5-3 have been established as Elevation +62.5 feet NAVD which provides more than 10 feet of clearance above the approximate tailwater elevation. Further detailed evaluation of the tailwater elevations will be conducted for the final design phase; however, our preliminary evaluation indicates that the existing tailwater conditions do not adversely affect the proposed ponds as designed.

6.5 Floodplain Compensation

The proposed CR 46A alignment will result in FEMA floodplain impacts in Basins 5-1 and 5-2. The following paragraphs summarize the proposed impacts and compensation methods for this project:

The proposed floodplain impact in Basin 5-1 is 7.4 acre-feet. To compensate for these impacts the portion of existing SR 46 from approximately Station 379+00 to Station 391+00 (SR 46 BL of Survey) will be graded down to an average ground elevation of +62.5 feet NAVD to provide 1.6 acre-feet of compensation. The remaining compensation in Basin 5-1 will be provided in floodplain compensation pond FPC 5-1 which is located in the triangular parcel north of SR 46 and south of the intersection of proposed SR 46 and CR 46A between Stations 380+00 and 390+00 (SR 46 BL of Survey). Refer to the Post-Development Drainage Maps in **Appendix C** for the layout of Pond FPC 5-1. Pond FPC 5-1 provides 6.6 acre-feet of compensation which is more than the 5.8 acre-feet that is required after considering the compensation provided by grading down a portion of old SR 46. Refer to **Appendix I** for the Basin 5-1 floodplain calculations.

The proposed floodplain impact in Basin 5-2 is 9.3 acre-feet. To compensate for these impacts the required floodplain storage will be provided in the stormwater management pond located on the west side of the proposed CR 46A alignment from approximately Station 212+00 to Station 218+00 (CR 46A BL of Survey). The proposed floodplain compensation in the stormwater pond is being provided within the pond (below the inside top of berm) and atop the required retention volume. Refer to **Appendix I** for Basin 5-2 floodplain calculations.

There are no FEMA floodplain impacts in Basin 5-3.

6.6 Volume Recovery Considerations

A preliminary volume recovery analysis was conducted for the pond alternatives. The subsurface parameters used in the analysis were based on information provided by GEC and included in **Appendix J**. The results indicate that Ponds 5-1A, 5-1C and 5-3C do not meet the minimum FDOT recovery criteria and will require improvements such as underdrains or a revised pond layout. A detailed evaluation of volume recovery will be conducted for the final design stage. The preliminary volume recovery calculations and a summary of the results are included in **Appendix H**.

7.0 Environmental Considerations

A Preliminary Ecological Assessment of the alternative pond sites was conducted for purposes of this pond siting update and is included in **Appendix K**. A summary of this preliminary environmental assessment is provided in **Table 4** on the following page:

Table 4
Ecological Assessment Summary

Pond Alternative	Wetland Habitat	Potential Impacts for Listed Species Habitat	
	(Y/N)	Level	Comments
5-1A	NO	Low	Suboptimal habitat: dense shade and invasive plants
5-1B	NO	High	Gopher Tortoise burrows observed, sand skink cover board surveys and management required
5-1C	NO	Medium	Gopher Tortoise burrows observed
5-2A	NO	Medium	Suitable habitat but no burrows observed
5-2B	NO	Medium	Suitable habitat but no burrows observed
5-2C-1/ 5-2C-2	NO	Medium	Suitable habitat but no burrows observed on Pond 5-2C-1. Gopher tortoise burrows observed on Pond 5-2C-2
5-2C-2 / 5-2D-2	NO	Medium	Suitable habitat but no burrows observed on Pond 5-2C-1. Gopher tortoise burrows observed on Pond 5-2C-2
5-3A	NO	Medium	Gopher Tortoise burrows observed
5-3B	NO	Low	No burrows observed
5-3C	NO	Low	No burrows observed

8.0 Preferred Pond Alternatives

Table 5, below, summarizes the pond alternatives and identifies the preferred pond alternatives based on our evaluation of hydraulic, environmental and cost considerations:

**Table 5
Summary of Preferred Pond Alternatives**

Basin	Pond Alternative	Provides Minimum Hydraulic Requirements	Wetland Impacts (Y/N)	Habitat Impact Potential	Relative Cost	Comments
5-1	5-1A	YES	NO	LOW	HIGH	
	5-1B	YES	NO	HIGH	LOW	PREFERRED
	5-1C	YES	NO	MEDIUM	HIGH	
5-2	5-2A	YES	NO	MEDIUM	MEDIUM	
	5-2B	YES	NO	MEDIUM	MEDIUM	PREFERRED
	5-2C	YES	NO	MEDIUM	MEDIUM	
	5-2D	YES	NO	MEDIUM	MEDIUM	
5-3	5-3A	YES	NO	MEDIUM	LOW	PREFERRED
	5-3B	NO	NO	LOW	LOW	
	5-3C	YES	NO	LOW	HIGH	

In Basin 5-1, the preferred alternative is Pond 5-1B. This pond site is preferred primarily because of the relatively low cost of this option as compared to the other ponds. Additionally, Mr. Scott Taylor, who owns the properties for all of the alternatives in Basin 5-1, recommended the general location of Pond 5-1B as his preference.

In Basin 5-2, the preferred alternative is Pond 5-2B. In our evaluation it was determined that all four alternatives ranked similarly for the categories that were investigated. Beyond the criteria reviewed for this report, Pond 5-1B was selected because it will result in lower maintenance costs because it is just one pond site as opposed to two pond sites for Ponds 5-2C and 5-2D; also, Pond 5-1B provides a 50-foot access strip between the adjacent parcels which allows greater flexibility for future development. However, further investigation of the preferred pond alternative for Basin 5-2 is warranted during final design.

In Basin 5-3, the preferred alternative is Pond 5-3A. This pond is located fully within a remnant parcel whereas the other pond alternatives require right-of-way acquisition.